Mass Emergencies 3 (1978) 1–22
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TOWARDS A COMMUNITY DISASTER MODEL FOR POLICY ANALYSIS*

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INTRODUCTION

The community disaster model is an interactive computer-based system whose principal purpose is to provide guidance to decision-makers in the United States on the relative benefits and costs of alternative mitigation and recovery policies for natural hazards. As a basic part of the system the user is able to design a community by describing the socio-economic and financial characteristics of the homeowners and the physical attributes of their structures. This approach thus complements earlier hazard simulation models which have been designed for the purpose of analyzing the impact of different disaster programs on a regional or national level (See James, 1964; Day, 1970; Friedman, 1975; Wiggins, 1976; and especially Cochrane, 1976 for a summary of the state of the art).

The unit of analysis upon which the model operates is the individual homeowner. Each homeowner has specific socio-economic traits (e.g., age, income, education); and financial characteristics (e.g., assets and debts); and resides in a particular type of structure (e.g., one-story, wood-frame house with a basement). Such attributes can be obtained through field survey data or by sampling from statistical distributions that the user specifies. In this manner the user constructs a community of his or her choice and is able to analyze the effects of different mitigation policies (e.g., specific building regulations) and relief policies (e.g., type of federal loans and grants) for disasters of different degrees of severity.

This project has been devoted exclusively to studying the flood hazard. In this paper we will show how the decision-maker can determine how sensitive different policies are to two key variables: (1) the socio-economic and physical characteristics of the hazard-prone area, and (2) the severity of flooding. In this sense the community disaster model for the United States offers the possibility of providing a rich array of descriptive data. These results have normative implications only to the extent that the decision-maker is able to conclude, after analyzing a number of different scenarios, that one set of policies is preferred to another.

The community disaster model is designed with the user in mind. It is extremely flexible so that it is relatively easy to extend or modify existing routines. Furthermore, it has a modular structure so that the decision-maker can suggest adding new policies or behavioral models of choice without forcing the programmer to redesign its entire structure. (See

* Financial support for this effort has been provided by NSF-RANN grant ENV76-12370. Opinions, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of NSF.

TABLE I

Purposes of Disaster Model for Different User Groups

Purpose \ User Group	FIA, SBA, FDAA	Community	Insurance Industry	USGS CE	Financial Sector
Evaluate mitigation measures: Land-use regulations, building codes, flood proofing, warning and emergency preparedness, control and protection works.	Given a certain community and a type of flood, what is the comparative cost-effectiveness of alternative mitigation measures?	Are certain mitigation measures more effective than others in terms of reducing losses?	What are the cost-benefits of tying insurance to various mitigation measures?	What are the cost-benefits of a particular control work?	To what extent do different mitigation measures change the pre-flood and post-flood financial characteristics of individuals?
Evaluate extent of flood damage:	To what extent will various flood heights, velocities, or durations affect damage? Given a certain flood, how will different communities be affected?	Can evaluate the extent of damage given a certain flood – for determing effectiveness of preparedness plans. Can evaluate losses for different types of floods.	Can evaluate expected losses for different types of floods.	Can evaluate extent of damage if a work is exceeded (for cost-benefit analysis).	Can evaluate financial losses for different types of floods.
Evaluate flood recovery program: Losses Grants Insurance Other aids	Will certain types of communities need more post-disaster aid than others? What affect will varying the interest rate, or size of available loans or grants have on overall cost of federal aid in a particular disaster? To what extent will insurance reduce the need for federal aid? To what extent will tax writeoffs aid flood victims?	How will different recovery policies reduce economic disruption?	What affect will mandatory insurance have in terms of cost after a disaster? Given a certain amount of damage, how does insurance aid in recovery? What are the cost-benefits of marketing insurance in a particular location or to a particular group of people? How will insurance in force change if insurance is required for SBA loans?	How will a particular control work reduce the need for relief after a flood of a certain magnitude?	How will different recovery policies minimize the financial disruption of victims? Can a particular policy or combination of policies be developed to minimize financial impact on all elements of the community?
Evaluate status of post-recovery community:	Will certain communities recover easier than others? How do post-recovery communities compare to pre-flood communities? To what extent do SBA loans aid recovery process?	What will be the economic status of the post-recovery community? How will the post-recovery community compare to the pre-flood community?	To what extent does insurance aid the recovery process? How will insurance in force change after a flood and how will this change affect future recovery?		Determine the change in the financial characteristics of post-recovery victims from pre-flood homeowners.

Katz and Miller, 1977 for a detailed description of the structure of the model). The model is also designed in such a way that the decision-maker can utilize it in an interactive manner at a computer terminal with only minimal knowledge of the technical details of the simulation. In undertaking this project our principal interest has been to develop a tool that decision-makers will want to use for policy analysis. This paper is designed to facilitate an understanding of what the flood model can do and to stimulate an interest on the part of decision-makers to construct communities, generate specific floods, and specify alternative mitigation and relief measures.

Table I outlines some of the questions decision-makers can examine through the use of the flood model. The columns of the table consist of different user groups that are impacted by the flood hazard. They are: governmental agencies concerned with flood recovery problems (e.g., the Federal Insurance Administration (FIA), the Small Business Administration (SBA), and the Federal Disaster Assistance Administration (FDAA)); the individual flood-prone community; the insurance industry; governmental agencies concerned with engineering aspects of flood control (e.g., the Army Corps of Engineers (CE) and the United States Geological Survey (USGS)); and the financial sector (e.g., banks, savings and loan associations).

The rows of the table represent various reasons for using the model. They are: to evaluate alternative mitigation measures, to evaluate the extent of flood damage, to evaluate alternative flood recovery programs, and to evaluate the status of the post-flood community. It is important to note that the specific questions posed in each of the cells could have been asked by other user groups or had an impact on other evaluation levels. In fact, the relative merits of a specific mitigation policy (e.g., flood proofing) could be of interest to many sectors (e.g., FIA, CE, insurance industry) and could be evaluated in terms of its effect on flood damage and recovery.

UTILIZING FIELD SURVEY DATA

The development of the community disaster model is a natural outgrowth of a recently completed NSF-RANN supported study (Kunreuther et al., 1977) in which a field survey was undertaken through face-to-face interviews with 2055 homeowners in 43 areas throughout the United States subject to coastal and riverine flooding and 1006 homeowners living in earthquake prone areas of California. Half of the respondents had purchased flood or earthquake insurance. Controlled laboratory experiments were also undertaken to determine how specific variables influenced the decision to buy coverage. The field survey provides insight into the decision processes and socio-economic characteristics of homeowners in the pre and post-disaster periods. The community disaster model enables the user to analyze the merits of alternative disaster programs based on these findings. Hence the data collection and policy analysis phases are inextricably interwoven.

Specifically, the field survey was designed to provide insight into the decision processes utilized by homeowners in determining whether to purchase insurance. The questionnaire elicited subjective estimates by homeowners of the probability of a severe flood or earthquake and the estimated loss if a disaster should cause damage to property. Data were also obtained on individuals' awareness of the hazard and insurance, past disaster experience, and the role that friends and neighbors play in information dissemination and decision-making. Multivariate statistical analyses have been utilized to estimate the relative importance of different factors on the probability that an individual would have

flood or earthquake coverage (Kunreuther et al., 1977, Chapter 6).

The field survey also provides quantitative data on the impact of alternative disaster programs on the recovery process of disaster victims. For example, since 1953 the federal government has provided low interest loans to those suffering losses from severe natural disasters. The data indicate to what extent insured and uninsured victims with varying amounts of loss have utilized this source of relief.

Finally, the field survey data base offers a profile of the socio-economic attributes of homeowners in hazard-prone areas and the physical characteristics of their structures. The existing data base contains information on the age, income, education, marital status, family size, and occupation of all individuals interviewed. Data ara also available on the year and type of construction of the structure, number of stories, purchase price, estimated current value, and mortgage history. Hence, it is possible for us to construct a flood-prone community with actual data rather than having to synthesize relevant attributes. Furthermore, we are able to incorporate the results of the field survey analysis into the community disaster model. This has been done by utilizing behavioral models of choice on whether to purchase insurance and if so how much coverage to take out, and a model detailing the nature of the recovery process for disaster victims.

EVALUATING ALTERNATIVE INSURANCE PROGRAMS

A principal purpose of the community disaster model is to evaluate the relative performance of different adjustments to the hazard. In this paper we will be analyzing one such adjustment – the financial impact of alternative insurance programs on homeowners in a hypothetical flood-prone community. Specifically, we will be studying the following programs:

Program 1: Flood insurance is *mandatory* for all homeowners.

Program 2: Flood insurance can be purchased *voluntarily* by homeowners.

Program 3: Flood insurance is *not available* to homeowners because the community is not part of the National Flood Insurance Program.

We have chosen to study the insurance adjustment for detailed analysis for three reasons: (1) There is considerable information from the Kunreuther et al. (1977) field survey and laboratory experiments on the factors influencing the decision of homeowners to purchase insurance, and the role insurance plays in disaster recovery. (2) Flood insurance has been the focal point of recent reports and legislation (U.S. Water Resources Council, 1976) and a subject for critical analyses and discussion in the natural hazards literature (Kunreuther, 1973; Anderson, 1974; Brown and Lind, 1976; Platt, 1976). (3) Insurance can be utilized as a mechanism for coordinating other hazard mitigation adjustments as has been clearly pointed out by the Task Force on Federal Control Policy (U.S. Congress (1966), White (1966)). The community disaster model offers an opportunity to serve as an interactive mechanism for evaluating the costs and benefits of such coordination.

In evaluating the above three programs we will pay careful attention to the impact that they are likely to have on the different socio-economic groups in a community. In particular, we will want to determine how homeowners in specific income and age strata will be affected financially should they suffer damage from a flood and be forced to rely on different sources of relief in order to recover.

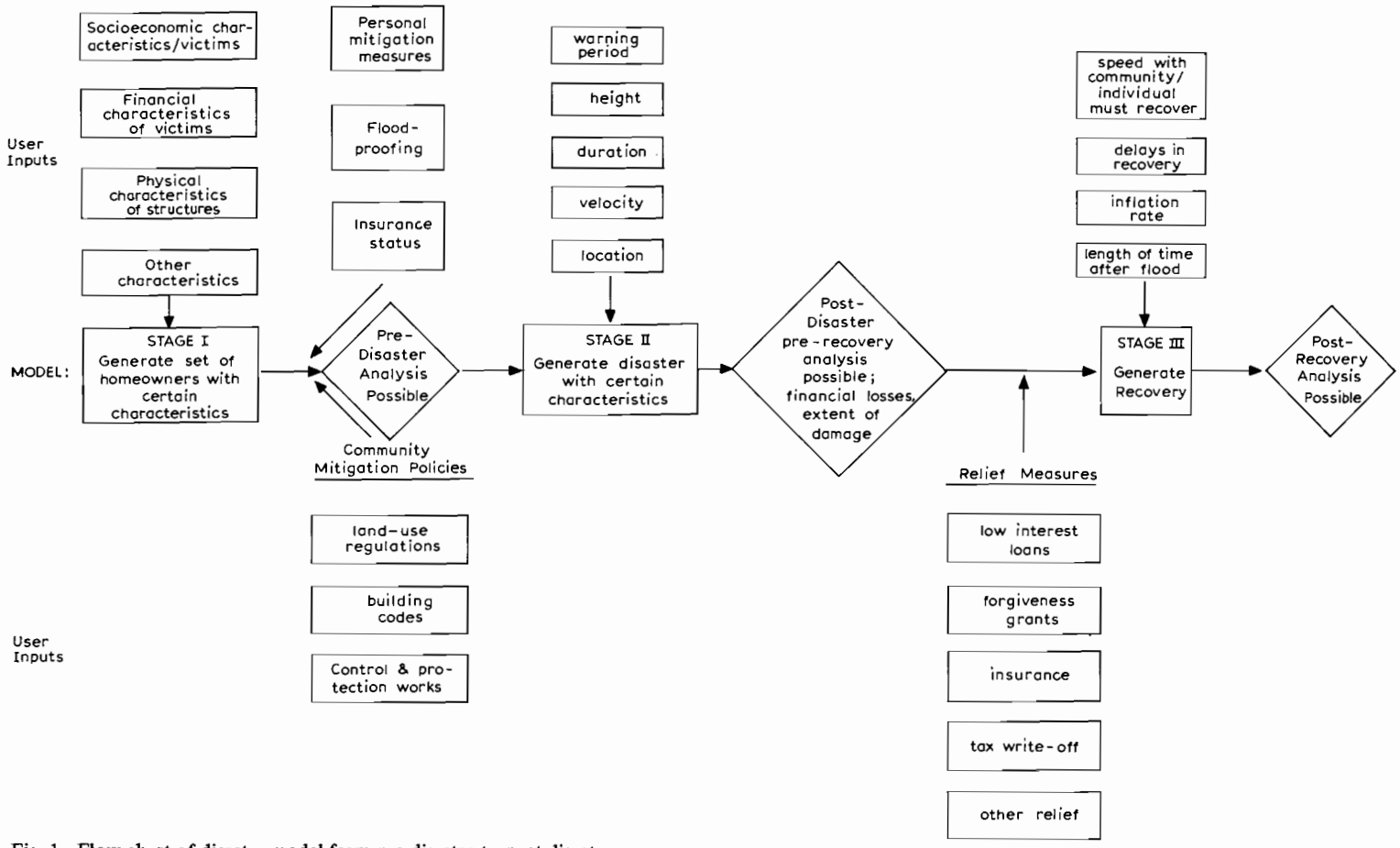


Fig. 1. Flow chart of disaster model from pre-disaster to post-disaster recovery.

STAGES OF ANALYSIS

For convenience and ease of exposition, we have divided the model into three stages corresponding to the pre-disaster period, the immediate post-disaster period, and the post-recovery period. The user has the option of determining the impact of alternative disaster programs on residents of the community after each of these stages. Figure 1 delineates these time periods and indicates a set of illustrative user inputs associated with each one. To facilitate an understanding of this figure we have assembled data in Table II on the Glenn Family, long-time residents of River City, Pennsylvania – a simulated flood-prone community which will be the subject of detailed analysis in this article.

Stage I is concerned with generating a set of homeowners with prescribed pre-disaster attributes. As can be seen from Table II we have listed certain attributes of the household head (Mr. Glenn) such as his age and educational level as well as socio-economic characteristics of the family (income and family size). Detailed balance sheet data on assets and liabilities including estimated house and contents value provide a picture of the financial status of the Glenn family in the pre-disaster period (See Vinso, 1977b). The user may also want to input data on the insurance status of the household if this in-

TABLE II

Selected Attributes of an Individual Homeowner

Pre-Disaster Attributes (Stage I)	
Socioeconomic	
Age of household head	50 years
Income (annual)	US $ 10,000
Education level	12 = high school graduate
Family size	4
Financial	
Total financial assets	$ 14,000
Total real assets	$ 40,000
Total current liabilities	$ 400
Total fixed liabilities	$ 4,600
Structure value	$ 24,000
Contents value	$ 12,000
Insurance Status	
Structure coverage	$ 10,000
Contents coverage	$ 5,000
Flood Proofing Measures Adopted	none
Physical (House)	
Date of construction	1948
Number of stories	2
Basement (with/without)	with
Type of construction	wood frame
Height of first floor above ground level	3 ft
Zone	100 year flood plain
Generate Flood (Stage II)	
Issuance of Offical Warnings	Yes
Time prior to flood	4 hours
Actions taken by homeowner	Move furniture upstairs
Height of Water Above Ground Level	12 ft
Damage Incurred	
Structural	$ 12,000
Contents	$ 6,000
Total damages:	$ 18,000
Estimated Savings from Heeding Warning	$ 1,000
Financial Attributes (Post-Flood, Pre-Recovery)	
Total financial assets	$ 14,000
Total real assets	$ 22,000
Total current liabilities	$ 400
Total fixed liabilities	$ 4,600
Structure value	$ 12,000
Contents value	$ 6,000
Generate Recovery (Stage III)	
Insurance Claim	
Structure	$ 10,000
Contents	$ 5,000
SBA Disaster Loan	$ 3,000
Insurance + Loan =	$ 18,000
Financial Attributes (Post-Recovery)	
Total financial assets	$ 14,000
Total real assets	$ 40,000
Total current liabilities	$ 400
Total fixed liabilities	$ 7,600
Structure value	$ 24,000
Contents value	$ 12,000

formation were readily available. Alternatively, one could develop a behavioral model of choice to predict whether a particular family is likely to purchase insurance coverage given their socio-economic characteristics and their interaction with the environment, such as whether they have experienced damage from previous flooding. We have followed this latter course of action in this paper.

Another important set of attributes associated with Stage I relates to the physical characteristics of the property in the community. In the case of the Glenn family we see from Table II that they reside in a 30-year-old, two-story, wood-frame house with a basement. The structure is located in the 100 year flood plain with the first story raised so it is three feet above ground level. These data enable the user to determine the potential damage to the structure from floods of different levels. By characterizing different families and their property in the same manner, the user can generate an entire flood-prone community.

Once the community has been constructed the user can undertake a set of pre-disaster analyses. For example, in this paper we will determine the proportions of homeowners in different income and age classes residing in River City. We will also provide a profile of the different types of structures and their location in relation to the river. The pre-disaster analysis can also provide information to users on the adoption patterns of different socio-economic groups with respect to such measures as the purchase of insurance or use of flood-proofing measures. In this paper we will determine the proportion of low, medium, and high income residents in River City who would have purchased flood coverage voluntarily if it was available to them.

Stage II of the model generates a flood with prescribed characteristics. These might include the height of the water above ground level, the velocity of the water, and the duration of the flood. One could also specify whether official warnings were issued by appropriate governmental agencies, and, if so, how they were disseminated to the community prior to the onset of flooding. The illustrative example in Table II assumes that the local radio stations broadcast warnings four hours prior to the onset of flooding. The Glenn family heeded these warnings by moving some of their living room furniture upstairs. The particular flood rose twelve feet above ground level causing $ 18,000 damage to the structure and its contents. The family estimates that the preventive steps taken prior to the flood saved them approximately $ 1000 in contents damage.

Once these damage figures have been determined for each specific structure one can update the financial balance sheets to reflect the change in assets and liabilities caused by the flood. In the case of the Glenn family the flood reduced the value of their house from $ 24,000 to $ 12,000, and the value of their contents from $ 12,000 to $ 6000. The other components of their balance sheet did not change, since this financial snapshot was taken prior to the injection of any recovery funds into the community.

After Stage II data have been generated, the model can provide summary statistics on the physical damage to different types of structures in each of the flood zones in River City (e.g., one-story wood-frame homes with a basement in the 100 year flood plain) from floods of different heights. To do this one has to translate flood stage to monetary losses through certain prescribed relationships; (See Wilson, Lepore and Duffy, 1977 for a discussion of such a damage model). The user can also determine the financial effects that different levels of flooding will have on specific classes of residents (e.g., homeowners with an annual income below $ 10,000 who are over 65 years old). Such analyses comprise the post-disaster pre-recovery analysis phase depicted in Fig. 1.

Finally the community disaster model enables one to evaluate the impact of different

relief measures on the recovery process. We have listed the most obvious ones in Fig. 1: low interest disaster loans, insurance, and tax write-offs. The user has the option of generating the specific terms of these policies or creating other recovery measures. For example, he can specify the interest rate on SBA disaster loans and the maximum amount available to any disaster victim. The model can then determine how changes in the terms of a particular relief program financially affects disaster victims and the federal government.

Stage III generates data on the recovery of homeowners once they have taken advantage of the different relief measures available to them. In the case of the Glenn Family their losses exceeded the value of their insurance policy on both house and contents. As shown in Table II we have assumed that they took advantage of a low interest SBA loan to cover the uninsured portion of their $ 18,000 property damage. The dollar flows from these two sources of funds changed the composition of their balance sheet from what it was in immediate post-flood period. The value of their real assets increased by $ 18,000 to reflect the checks they received from both the Federal Insurance Administration and the Small Business Administration. On the other hand, the $ 3000 loan increased the level of their fixed liabilities to $ 7600. The actual costs to the Glenn family, the federal government, and the insurance sector from these transactions depend on the SBA loan interest rate and the type of sharing arrangement between the federal government and the private sector on insured losses [1].

Similar analyses at Stage III can be undertaken for all disaster victims in the community; however, it may be difficult to generate the precise sources of recovery for each household. The strategy followed in this paper is to utilize field survey data to develop a behavioral model of choice which determines the size of SBA loans as a function of the insurance status and magnitude of damage. The user can then compare the pre-flood, immediate post-flood, and post-recovery financial characteristics of different classes of victims under the alternative disaster programs described in the previous section.

DESCRIPTION OF THE COMMUNITY (STAGE I)

River City is composed of 427 households from the riverine portion of the Kunreuther et al. (1977) field survey. The 427 households were chosen from the 642 riverine households interviewed in the field survey because each respondent had answered all the survey questions related to the set of attributes which we have noted in Table III. (The remaining 215 homeowners either responded "don't know" or "no answer" to some of the questions.) These data describe the socio-economic characteristics of each household head, the physical characteristics of the property, the financial characteristics of the household, as well as certain behavioral traits which influence the household's decision to purchase

TABLE III

Attributes of Homeowners for Illustrative Example from Field Survey Data

Socioeconomic Characteristics
Age of household head
Income of household head
Education of household head
Marital status of household head
Physical Characteristics of Property
Basement or no basement
Number of stories
Height of first floor relative to ground
Financial Characteristics
Current value of house
Current value of the land only
Amount of first mortgage
Other Factors influencing Insurance Purchase Decision
Perception of severity of flood problems
Knowing anyone with flood insurance
Estimate of probability of severe flood in neighborhood
Estimate of damage to property from severe flood
Years lived in house
Degree of aversion to risk

insurance. Table IV provides the reader with an indication of the diversity of the actual sample, by summarizing the actual locations of the respondents who comprise the hypothetical community of River City.

TABLE IV

Number and Percentage of River City Respondents from Each State

	Absolute Count	Frequency (%)
California	28	6.6
Maryland	11	2.6
New Jersey	220	51.6
North Dakota	56	13.1
Oregon	26	6.0
Texas	40	9.3
Virginia	46	10.8
	427	100.0

In this illustrative example we are particularly interested in the impact of alternative disaster programs on different age and income classes. Figure 2 depicts the proportion of homeowners in the high, medium, and low income and age classes. The relevant ranges were arbitrarily specified so that between 20 and 30 percent of the households fall in the extreme categories. Thus we see that 30 percent of the residents of River City have

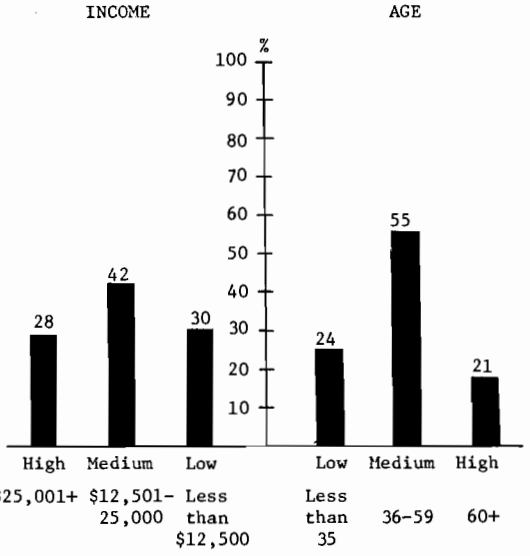
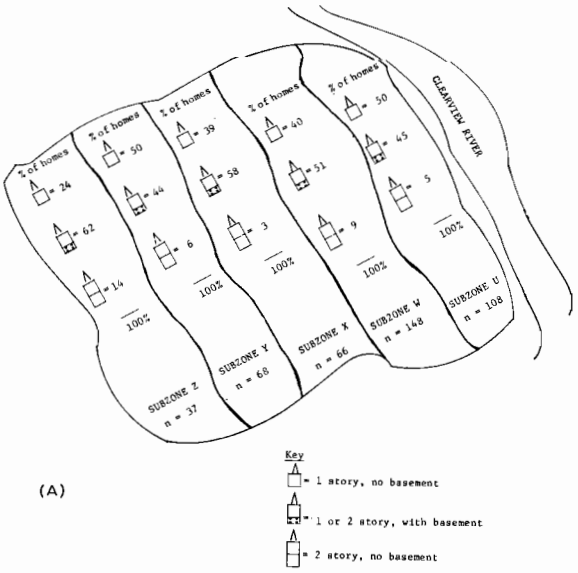


Fig. 2. Percentage of River City residents in income and age classes. (n = 427).



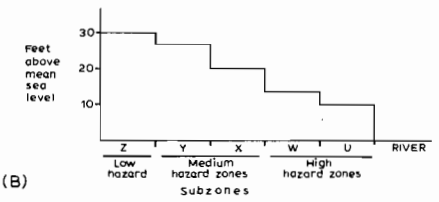


Fig. 3A. House types by subzones for River City.
Fig. 3B. Cross-sectional view of River City's elevations.

annual incomes below $ 12,500; 28 percent have incomes above $ 25,000; the remaining percentage earn between these two amounts.

Land elevations in River City are assumed to range from 10–30 feet above mean sea level. Since water depth at particular sites within the community depends on elevations as well as flood height, logical groupings of elevation contours are specified by the user. As shown in Fig. 3A, we have assumed for this particular example that five different contours or subzones have been selected. Fig. 3B, which provides a cross-sectional view of River City's elevations, indicates that subzones U and W can be considered high hazard

areas. We assume no flood protection works have been constructed in the community.

Households were assigned to the subzones according to certain field survey criteria. Of the 642 riverine households surveyed, 400 of them were located in the 100 year flood plain. Hence we assigned approximately 60 percent of the 427 River City households to subzones U (42%) and W (58%). The remaining 40 percent of the River City households were assigned to the other three subzones in the following arbitrary proportions: 15 percent to subzone X, 15 percent to subzone Y, and 10 percent to subzone Z.

The actual assignment of the four types of structures in each subzone shown in Fig. 3A was based on an analysis of the physical attributes of the 642 riverine homes comprising the field survey. For example, in riverine communities 7 percent of all the homes in high hazard areas were two-story wood-frame homes without a basement. Hence there was a 7 percent chance that each structure in zone U or W would be of this type.

FACTORS INFLUENCING VOLUNTARY PURCHASE OF INSURANCE (STAGE I)

In order to evaluate the performance of a voluntary insurance program (Program 2) it is necessary to determine which homeowners in the community are likely to purchase flood insurance by choice. Considerable statistical analyses were undertaken, as part of the Kunreuther et al. (1977) project, to isolate those factors which impacted on this decision. These results were utilized in the development of a subroutine for the "insurance purchase decision".

Table V presents a regression equation indicating the relative importance of different factors in influencing the insurance purchase decision. By far the most important variables in the analysis are whether the person considers the problem to be serious and whether he knows someone who has purchased the insurance. These two factors interact with each other. Someone who thinks the hazard is a problem and who also knows a policyholder, is more likely to purchase coverage than these variables would imply separately. As shown in Table V there is a 0.549 difference in the probability of having insurance between people who know someone with a policy and think the hazard is a serious threat and those residing in the same hazard zone who do *not* know someone and think there is *no* problem.

Another significant variable is whether the person expects any future damage from a catastrophic flood. The data in Table V show that a person who expects no damage is 15.9 percent less likely to have insurance than one who expects some damage. For every $ 10,000 increase in anticipated future damage, the likelihood that the homeowner has coverage increases by 1.5 percent.

All the coefficients in the model represent the effects of a given variable when all other factors are held at the same level. The socio-economic variables are statistically significant but do not have much effect on the probability of having insurance. Homeowners most likely to have insurance are older residents who are married, have at least a high-school education, and have incomes above $ 25,000. A person more averse to risk is more likely to have purchased coverage.

Finally, we see from Table V that those who have lived in their house for some length of time are less likely to have purchased insurance than are those who are relatively new to the area. The coefficient associated with this variable is so small (−.00039), however, that it does not change the overall probability of having insurance by very much (less than a 1 percent decrease in probability between one who just moved to his house and a homeowner residing there for 25 years).

We utilized the above regression equation to determine whether homeowners were insured or uninsured. Specifically if a resident

TABLE V

Insurance Purchase Regression for Flood Sample

Probability of homeowner purchasing insurance = 0.045[a] +

{ .0 if not high school graduate
  .051 if at least high school graduate } +

{ .0 if low income
  −.029 if medium income
  −.055 if high income } +

{ .0 if not married
  .030 if married } +

{ .0 if mildly risk averse
  .069 if some risk aversion
  .131 if highly risk averse } +

{ .549 if thinks hazard serious problem and knows someone with insurance
  .434 if thinks hazard minor problem and knows someone with insurance
  .245 if thinks hazard not a problem and knows someone with insurance
  .198 if thinks hazard serious problem and doesn't know anyone with insurance
  .142 if thinks hazard minor problem and doesn't know anyone with insurance
  .0 if thinks hazard not a problem and doesn't know anyone with insurance } +

{ 0.17 × log (subjective probability of disaster) } +

{ .0032 × age (in years) } +

{ −.00039 × years lived in house } +

{ .015 if can't estimate future damage
  −.159 if thinks will suffer no future damage
  .0015 × estimate of future damage (in $ 1000) if thinks will suffer some } +

{ −.026 if lives in coastal zone A
  −.010 if lives in coastal zone B
  −.068 if lives in riverine zone A
  −.0 if lives in riverine zone B }

$R^2 = .307$

[a]Estimated probability of homeowner purchasing insurance who:
(a) is not a high school graduate,
(b) has low income,
(c) is not married,
(d) is not risk averse,
(e) thinks there is no hazard problem while not knowing anyone with insurance,
(f) expects $1 future damage,
(g) lives in riverine zone B.

of River City had a set of characteristics which resulted in a likelihood of having coverage which was greater than a certain prescribed value [2], the family was classified as being insured. Otherwise we assumed that he did not have coverage. This type of procedure is meaningful to the extent that the variables in Table V capture the decision process with respect to the insurance purchase decision.

Figure 4 presents a graphical picture of the percentage of homeowners in each income and age class that were assumed to have purchased coverage. The regression equation implies that other things being equal a larger proportion of high income residents will buy

insurance than low income homeowners. The data in Fig. 4 reveals that more than 30 percent of the high income residents have coverage while only 18 percent of low income residents are insured. A comment from an uninsured homeowner interviewed as part of the field survey study provides some insight into why low income residents may not buy coverage even if they reside in a flood-prone area:

> A blue collar worker doesn't just run up there with $ 200 (the insurance premium) and buy a policy. The world knows that ninety percent of us live from pay-day to pay-day... He can't come up with that much cash all of a sudden and turn around and meet all his other obligations.

Figure 4 also shows that older residents in River City are more likely to be insured than the younger homeowners in the community.

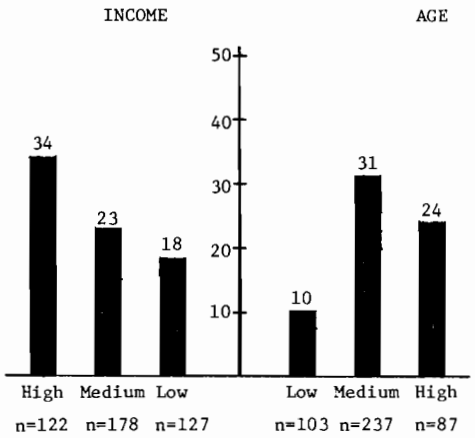


Fig. 4. Percentage of River City residents in each income and age group with flood coverage.

A similar statistical analysis was undertaken to determine the amount of structural and contents coverage purchased by each insured homeowner. Figure 5 summarizes the ratio of house and contents coverage to the value of the property for insured homeowners in the different income and age groups. The data suggest that residents in the community have coverage considerably below the value of their structure and contents. For example, in the low income group one out of every four insured households is covered against less than

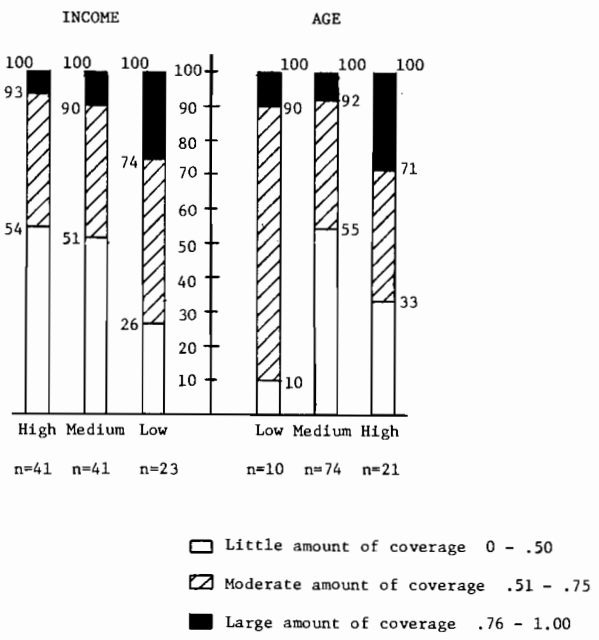


Fig. 5. Ratio of house and contents coverage to house and contents value, broken down by income and age classes. (For those who had coverage)

50 percent of its property value. Over half of the high income residents are in the same boat. For families with expensive homes, the decision to buy less than full coverage is partially impacted by the maximum amounts of coverage that they can purchase on their property [3]. Looking at the distribution of coverage by age groupings we see from Fig. 5 that young and senior citizens are better protected than the middle-age class of homeowners.

The community disaster model has thus provided the user with a picture of River City prior to the onset of any flooding. For this example we have chosen to focus on the insurance status of residents, classifying homeowners by age and income as well as location in the flood plain. Should the user be interested, he can enrich this descriptive analysis by developing other subroutines such as the adoption of hazard mitigation measures like flood proofing as a function of socio-economic characteristics and variables such as past flood experience. The field survey data base serves as a useful starting point in the construction of such behavioral models.

IMPACT OF SPECIFIC FLOODS ON RIVER CITY (STAGE II)

Once the community is constructed, it is possible to analyze the effect of floods of different heights on physical damage. To begin our analysis we have assumed that the Clearview River will rise to a height 22 feet above mean sea level, so that the first three subzones will be partially inundated (see Fig. 3B). The actual damage to each residence in the flood plain is determined by two factors: the elevation of the first floor in relation to the water level and a damage probability matrix. Given water height, the damage probability matrix indicates the proportion of damage to the structure and contents. It is thus conceivable that some houses in the more hazardous zones (U and W) will receive less damage than the same type of structures in zones generally subject to less flooding (Y and Z) either because they are higher above the ground and/or the water of a given height in relation to the structure causes less damage.

We will specifically examine the impact that flooding will have on different socio-economic groups in River City. Figure 6 focuses on the low income group and specifies the extent of the damage to their property from a 22-foot flood. For this particular configuration of houses, the dotted lines in the figure indicate that approximately 6 out of every 10 low income families would suffer damage to their property that equalled or exceeded 45 percent of its current dollar value. These homeowners would be severely hurt financially if they were uninsured. The graph also reveals that 22 percent of this class would have no damage; no family would suffer losses that exceeded 78 percent of its property's pre-disaster value. The reader is again cautioned that these percentages should be viewed as illustrative; if we had constructed the community in a different way or utilized different relationships between the height of the water and structural damage, the results may have been quite different than those depicted here. Such modifications can easily be incorporated in the model should the user desire to do so.

One way of illustrating the financial impact of a flood on disaster victims is to deter-

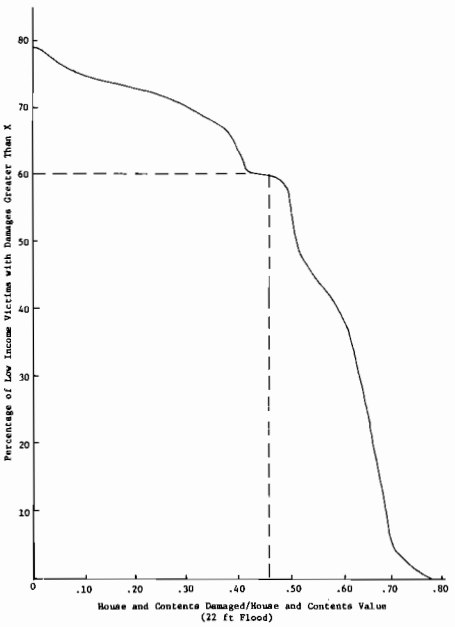


Fig. 6. Percentage of low income victims with ratios of house and contents damaged to house and contents value greater than values on x-axis.

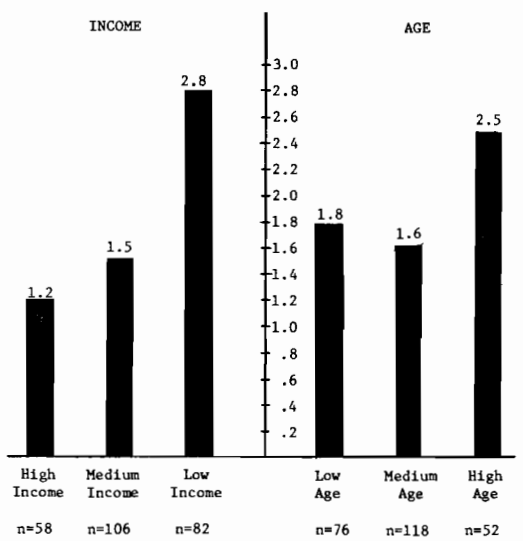


Fig. 7. Average damage/income ratio for uninsured residents suffering damage from a 22-foot flood.

mine the ratio of damage/income for different socio-economic groups. Uninsured homeowners who have high damage/income ratios may not be eligible for disaster relief because of their inability to repay a loan. Figure 7 portrays this ratio for uninsured victims in different age and income groups affected by a 22-foot flood. The data indicate that individuals in the low income class and those in the highest age bracket have substantially higher ratios than their respective counterparts. For example, uninsured homeowners with incomes below U.S. $ 12,500 had, on the average, damage which was 2.80 times their annual income. The high income uninsured group, on the other hand, suffered losses which were approximately equal to their annual income. If this phenomenon is typical following disasters then individuals most in need of disaster relief will be the ones least likely to get it, because they will not meet the repayment standards imposed by the Small Business Administration as a condition for eligibility.

The damage/income ratio taken by itself has no causal significance since we are not able to predict whether individuals who have high incomes will also have high damage. On the other hand, this descriptive statistic can be used in combination with other financial ratios discussed by Vinso (1977b) to determine the impact that a disaster is likely to have on different socio-economic groups.

Figure 8 indicates how the damage/income ratio changes as the severity of flooding varies. Low income uninsured victims have much higher values than either of the other two groups whether there is minor flooding (14–18 feet), medium amounts of flooding (20–24 feet), or very severe flooding (26–30 feet). For relatively minor floods none of the income groups have unusually high ratios. As the magnitude of flooding increases, the ratio for the low income groups increases much faster than for the medium and high income homeowners. In fact at a flood height of

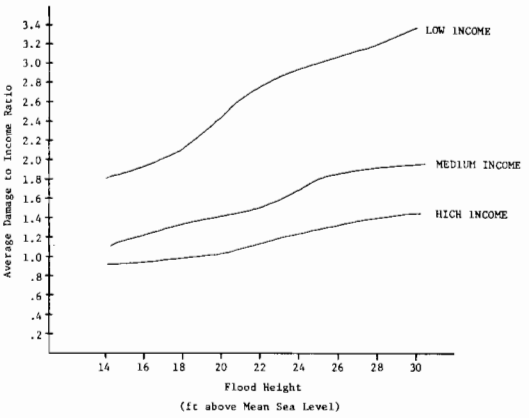


Fig. 8. Average damage/income ratios for River City income classes as a function of flood height (for uninsured residents suffering some damage).

30 feet the average ratio for those with incomes under US $ 12,500 is over 3.4 compared to 1.9 (medium income group) and 1.4 (high income group). This type of analysis provides the user with a picture of the impact that changes in the magnitude of flooding have on the homeowner's financial status.

SPECIFYING A RECOVERY MODEL (STAGE III)

Immediately after the flood, the balance sheet figures of homeowners are altered by the dollar damage to house value and contents value. The financial recovery of homeowners in the area is determined by the amount of insurance coverage by victims, the type of recovery funds available, and the behavior of different victims with respect to different sources of relief.

In this illustrative example, SBA loans are assumed to be available at 3 percent to cover any uninsured damage sustained by victims. The field survey data revealed that many homeowners eligible for low interest loans did not take advantage of this opportunity particularly if their losses were below US $ 10,000. Table VI details the percentage of insured and uninsured victims in the field survey who availed themselves of such relief as a function of their property damage.

Each victim in River City had a probability of obtaining an SBA loan based on the relevant percentages in Table VI. For those who qualified for SBA relief, an "amount received" subroutine specified the dollar amount by first determining the ratio of SBA loan/total damage and then multiplying this value by the amount of damage incurred by the victim. The distribution of the loan/damage ratios were obtained for each of the eleven cells in Table VI in which some victims used SBA loans for recovery purposes. In other words we assumed that the victims of River City utilized SBA funding in approximately the same manner as did homeowners interviewed in the field survey.

TABLE VI

Percentage of Uninsured and Insured Victims in each Damage Class Using SBA Loans for Recovery

Damage	Insured(%)	Uninsured(%)
1– 500	0	6
501– 1,000	0	13
1,001– 2,500	0	17
2,501– 5,000	27	34
5,001–10,000	19	55
10,001–20,000	29	69
20,000+	22	72

COMPARISON OF ALTERNATIVE PROGRAMS

Loans and insurance will have different effects on the financial status of the victim in the post-disaster period. At one extreme, if a homeowner is able to utilize insurance to finance his entire recovery then the value of his house and contents are restored to their pre-disaster condition and his net worth is also augmented by the amount of the insurance payment. At the other end of the spectrum if debt in the form of an SBA loan is used to finance recovery then total assets, as represented by the value of the house and contents, will be increased by virtue of the funds used to restore it; however, the level of debt will also increase. For this reason the type of insurance program in effect will have a significant impact on the financial recovery of homeowners in the community.

To illustrate the impact of different programs on the financial recovery of socio-economic groups in River City, we have compared in Table VII the ratio of total debt to total assets at three points of time: (1) the pre-flood period (Stage I); (2) the immediate post-flood period (Stage II); and (3) the period after recovery funds have been provided (Stage III). Table VII considers differences between the three insurance programs (i.e.,

TABLE VII

Comparison of Average Debt/Asset Ratio for Residents in River City under Alternative Insurance Programs

	Pre-Flood	Immediate Post-Flood	After Recovery Funds Provided
Income			
Low (n=127)			
Program 1	.20	.30	.21
Program 2	.20	.30	.33
Program 3	.20	.30	.36
Medium (n=178)			
Program 1	.24	.36	.26
Program 2	.24	.36	.38
Program 3	.24	.36	.41
High (n=122)			
Program 1	.25	.33	.26
Program 2	.25	.33	.36
Program 3	.25	.33	.38
Age			
Low (n=103)			
Program 1	.35	.55	.37
Program 2	.35	.55	.58
Program 3	.35	.55	.59
Medium (n=237)			
Program 1	.22	.30	.23
Program 2	.22	.30	.32
Program 3	.22	.30	.36
High (n=87)			
Program 1	.12	.15	.13
Program 2	.12	.15	.20
Program 3	.12	.15	.21

mandatory, voluntary, and no insurance) by income and age class.

The comparisons are interesting. When insurance is required for all homeowners in River City (Program 1), the debt/asset ratio significantly decreases between the period immediately following the flood to when recovery funds were provided for all income and age groups (e.g., for the low income group the ratio dropped from .30 to .21). Furthermore, in all income and age groups the value of this ratio after recovery funds were provided under Program 1 is approximately the same as it was prior to the disaster. At the other extreme one finds that if no insurance is available (Program 3), then the debt/asset ratio rises during this interval because victims are forced to rely on loans to finance their recovery (e.g., for the low income group the ratio rose from .30 to .36) [4]. As one would expect a voluntary program produces debt/asset ratios which are between those resulting from Programs 1 and 3 in the period after recovery funds have been provided (e.g., for the low income group the ratio rose slightly from .30 to .33).

A more detailed comparison of the recovery process for River City residents under the three programs is provided in Table VIII. The first portion of the table shows that 76 percent of the homeowners in the community suffered some damage from a 22 foot flood with the per capita total loss for these victims averaging approximately $ 28,200. As one would expect the nature of recovery differs greatly among the three programs. Only one-fourth of the victims are assumed to have insurance when it was voluntary so that many of them relied on the SBA (56%) for relief with an average loan of approximately $ 14,700. More than two thirds of the victims took advantage of the SBA when flood insurance was not available in River City; the average loan under this program also increased to US $ 14,800. (For comparable data in the Wilkes Barre flood, see Vinso, 1977a). When insurance was mandatory then insurance claims naturally dominated the recovery picture. Only 25 percent of the victims supplemented their insurance coverage with SBA funds; under this program the average loan amounted to less than US $ 9,000.

Table VIII also depicts the magnitude of recovery by indicating the ratio of recovery

TABLE VIII

Comparison of Recovery Process for River City Residents under Alternative Insurance Arrangements

	Effect of Disaster Damage due to 22 ft flood		Sources of Recovery (for those Suffering Damage) Insurance Claims		SBA loans	
	Per capita damage for victims (US $)	Percentage of houses damaged	Per capita* (US $)	Percentage using source	Per capita* (US $)	Percentage using source
Program I	28,200	76	24,300	100	8,600	25
Program II	28,200	76	22,300	24	14,700	56
Program III	28,200	76	0	0	14,800	70

Effect of Recovery

Recovery Funds/Total Damage (for those Suffering Damage) (Percentage in Each Class)

	0	.01–.25	.26–.50	.51–.75	.76–1.00	1.00+
Program I	0	0	0	6	71	23
Program II	26	15	15	15	16	13
Program III	30	21	20	13	4	12

*Based on those using specific source

TABLE IX

Comparison of Recovery Process for *Low Income* River City Residents under Alternative Insurance Arrangements

	Effect of Disaster Damage due to 22 ft flood		Sources of Recovery (for those Suffering Damage) Insurance Claims		SBA loans	
	Per capita damage for victims (US $)	Percentage of houses damaged	Per capita* (US $)	Percentage using source	Per capita* (US $)	Percentage using source
Program I	21,500	79	19,200	100	8,400	17
Program II	21,500	79	16,300	18	13,400	56
Program III	21,500	79	0	0	12,300	65

Effect of Recovery

Recovery Funds/Total Damage (for those Suffering Damage) (Percentage in Each Class)

	0	.01–.25	.26–.50	.51–.75	.76–1.00	1.00+
Program I	0	0	0	2	81	17
Program II	30	14	14	13	14	15
Program III	35	20	16	12	3	14

*Based on those using specific source.

funds to total damage under each of the three programs. Whenever this ratio is below 1.0, homeowners will not have received enough funds to restore their property to its pre-disaster condition. When insurance is required only 6 percent of the victims did not obtain enough funds from their coverage and SBA loans to restore their property to at least 75 percent of its pre-disaster value. On the other side of the ledger, one finds that if no insurance was available 30 percent of the disaster victims did not utilize the SBA for any disaster relief and hence have a ratio of recovery funds/total damage equalling zero. These families would have had to turn to other sources such as personal savings, bank loans, or Red Cross aid to restore their property.

An analogous comparison is presented in Table IX for low income residents of River City to illustrate the types of analyses which can be generated using the community disaster model. The per capita damage figures for this group are lower than for the community as a whole as are the average amount of insurance claims and SBA loans for those who utilized each of these sources. When insurance is mandatory practically every low income family recovers to at least 75 percent of its pre-disaster value. Under a program of no insurance more than 1/3 do not utilize the SBA for any relief, a higher percentage than for the community as a whole.

EVALUATING PRIVATE AND SOCIAL RISKS

The community disaster model enables one to determine the impact of different programs on private and social risks. *Private risks* refer to actions taken by an individual that affect himself but not society. An example would be a decision by a person to construct a house near a river knowing full well that he would have to bear the entire financial burden should the structure suffer damage from a flood. *Social risks* arise if the general public bears the costs of negative outcomes associated with a particular action. The above location decision would be classified as a social risk if the federal government were to pay for all flood losses to private property.

Most actions involve both types of risks (Lave, 1971). The relative magnitude of the

private and social costs will depend upon the nature of the public policies in force and the time horizon under consideration. For example, should a flood occur tomorrow the physical destruction will be identical whether homeowners expect to be compensated by insurance or by federal relief. Their decision to locate in these hazard-prone areas has an element of social risk to the extent that other taxpayers bear some of the recovery costs through either federally subsidized insurance or generous federal relief. Any difference in the social risks between these two programs will also be reflected in the resulting income distributions of victims and non-victims following a disaster.

Let us now consider the impact of the programs discussed above on private and social costs. To begin with let us consider Mr. Glenn who has suffered US $ 12,000 damage to his house and US $ 6000 to the contents from a 22-foot flood in River City. If the Glenn family had purchased sufficient flood insurance to cover their entire loss (except for the deductible) then the social costs associated with the claim will be determined by the proportion of insurance subsidized by the federal government [5]. Suppose that at the time of the River City flood 55 cents out of every dollar in insurance claims was paid by the federal government through the Federal Insurance Administration. Then the social cost would be .55 multiplied by the insurance claim payment. Since the private sector would pay the remaining 45 percent through insurance premiums this portion of the payment to the Glenn family would be treated as a private cost.

The same analysis could be applied to all victims in River City who have insurance coverage. For any given flood the social cost of the flood insurance program will increase as the percentage of the government subsidy in creases and as the amount of coverage in force within the community increases. If victims do not have insurance coverage then they may want to rely on other disaster relief programs to aid their recovery. For example, in Program 3 the only source of relief was SBA disaster loans. The social cost of each dollar in SBA relief will be directly related to the difference between the subsidized interest rate and the market rate of interest. If, as in the illustrative example, the interest rate were 3 percent on loans of any size and the market rate of interest were 9 percent then the general taxpayer would be subsidizing the recovery by 6 percent for every dollar loaned to disaster victims. Naturally if the SBA disaster relief program included forgiveness grants, then the social costs of this recovery measure would be increased.

The community disaster model is *not* intended to provide direct answers as to which set of adjustments are the most desirable from the viewpoint of private and social costs. What it can do is provide information to policy-makers which will help them understand the positive and negative aspects of any policy. For example, in the above discussion on the recovery problems in River City, Program 1 (required insurance) and Program 3 (no insurance available) will have very different impacts on the distribution of wealth in River City after the flood. On the basis of the behavioral models utilized to describe the recovery pattern, we have seen that if no insurance were available in River City, many victims would choose not to utilize any governmental funds to aid in their recovery efforts. The social costs of Program 3 would thus be relatively small but many of the victims, particularly those in the low income class, would be financially crippled for many years after the disaster [6]. These stark figures produced by the community disaster model highlight critical problems and choices facing federal, state and local governments as well as the insurance industry in designing disaster programs.

EXTENSIONS OF THE MODEL

The illustrative example and the discussion of private and social costs are designed to stimulate further suggestions by users and decision-makers in the United States as to ways in which this tool could be improved for policy purposes. Extensions of the model include: (1) the construction of alternative scenarios; and (2) analysis of alternative adjustments; these areas are discussed below.

(1) Construction of Alternative Scenarios

By constructing different communities using either field survey data or by having users generate characteristics through the use of statistical distributions, one can determine the effect that alternative adjustments will have on different groups in the flood-prone area as a function of their socio-economic characteristics, the types of physical structures and their location in relation to the river. Depending upon how runs of the model are constructed, a user can vary different inputs (e.g., income levels or age distributions of the community), or enter new mitigation or recovery policies (e.g., requiring all homes in the 100 year flood plain to be flood proofed) to determine the effects such changes will have on physical damage and the financial status of different socio-economic groups; (for a detailed description of how to use the model see Katz and Miller (1977)).

For example, one could determine the impact that flood proofing homes to different protective levels would have on the actual damage and financial status of classes of disaster victims in a community such as River City. One could also examine the impact of changes in the interest rate of SBA loans on the financial recovery. Another question that could be addressed is what effect a mandatory flood insurance program would have on the recovery process should a community suffer losses from disasters of differing degrees of severity. The computer model has been designed so that the user can undertake these types of sensitivity analyses with relative ease.

(2) Analysis of Alternative Adjustments

The community disaster model can serve as a vehicle for analyzing alternative adjustments to the flood hazard taken individually or as part of a coordinated disaster program. Specifically, it should be possible to examine the impacts on different user groups should several adjustments be successfully coordinated. White's (1973) critical assessment of the flood hazard provides a meaningful point of departure for this analysis by indicating which adjustments are closely linked, which ones have only weak interrelationships, and others where there is no solid evidence for estimating the relation. Future analysis of the types of hazard mitigation and recovery measures outlined below should be undertaken by recognizing the limits of our understanding as to how these adjustments relate to each other.

In developing such interactions the user should recognize that some of the adjustments are linked in a dynamic fashion and may change over time. For example, White and Haas (1975) point out that testimony from flood insurance hearings indicated that once land-use regulations are enacted in communities participating in the National Flood Insurance Program, they either lead to a reduction in the development of the flood plain or cause action on the part of the developers to either "modify the insurance provisions or eliminate land-use planning and accompanying insurance guarantees in the community" (p. 67). Thus land-use regulation and insurance may complement each other in certain localities by reducing the physical and financial consequences of the hazard while they may exacerbate problems in other areas.

In the discussion that follows we will outline specific hazard mitigation and recovery measures which users may want to incorporate into the community disaster model. The

reader is cautioned that the evaluation of these adjustments will be dependent on the quality of data and accuracy of the behavioral models of choice in the pre- and post-disaster periods. Future research and data collection efforts should improve our understanding of these decision processes and will increase the quality of the data analysis.

Flood Proofing

Preliminary analyses of the cost and potential benefits of flood proofing have been undertaken by Wilson, Lepore and Duffy (1977) in presenting their findings on the damage sector. Their analysis has concentrated on the impact that specific flood proofing requirements will have on reducing losses to residential structures from floods of different magnitudes. A user could also incorporate the flood proofing adjustment into a more extensive disaster program. For example, he could analyze the costs of adopting specific flood proofing measures and the potential benefits in the form of lower insurance premiums reflecting a reduction in the expected annual flood losses to the property. In the same manner one could evaluate the pre- and post-disaster financial effects of utilizing flood proofing techniques. For example, the community disaster model could analyze balance sheet effects following specific floods, should specific groups of homeowners choose to adopt or not utilize available flood proofing techniques.

Warnings

Mileti (1975) has pointed out that an integrated warning system actively incorporates three processes: (1) the *evaluation* of data on which to base a warning (2) the *dissemination* of the information to the threatened population and (3) the *response* by those who receive the warnings. The community disaster model would enable the user to evaluate the effectiveness of different warning systems if data is available on the impact of such messages on behavior of selected groups in population. Anderson (1970) has provided considerable insight into the subject in his study of the response to warnings by residents of Crescent City, California and Hilo, Hawaii. A limited amount of data on response to warnings in past disasters has been collected from the field survey of 2000 homeowners in flood-prone areas. Considerably more information should be forthcoming in a current research project study on the subject at the University of Minnesota.

To evaluate the relative merits of a warning system one would need to have cost data associated with the installation and implementation of a warning system for different communities threatened by floods. One might also be able to determine what impact this adjustment would have in combination with flood insurance. If homeowners have advanced warning of a flood they may decide to either protect some of their possessions or not to take any action should they prefer to replace used items by a claim. Their action will undoubtedly be influenced by the size of the deductible on the flood policy.

Flood-Prone Land Acquisition

The National Flood Insurance Act includes a section (1362) that enables the federal government to acquire flood-prone lands subject to the following restrictions:

(a) the property must be located in a flood-risk area;
(b) the property must be covered by flood insurance;
(c) the property must have been damaged "substantially beyond repair" by flooding while covered by flood insurance.

The community disaster model may be a useful tool for analyzing the impact that the implementation of Section 1362 is likely to have on individual residents of different flood-prone areas, the community as a whole, as

well as state and federal governmental agencies responsible for providing mitigation and recovery funds for natural hazards.

In order to determine the relative performance of 1362 when compared to other relief programs one should have data on the socio-economic characteristics of the community under study, the types of damage that can be expected from floods of different magnitudes, as well as the insurance status of the population and alternative relief measures that they are likely to utilize if the government were not to reimburse them for substantially damaged property. This type of analysis thus suggests that one has to integrate other adjustments (e.g., insurance purchasing decisions, degree of flood proofing, decisions to obtain loans) explicitly into the analysis.

SBA Loan Programs

Consider the changes in the SBA disaster loan program in the past six years. Following Tropical Storm Agnes in June 1972 disaster victims were able to receive forgiveness grants of up to US $ 5000 and loans to cover the remaining portion of their loss at an annual interest rate of one percent. In April 1973 legislation was passed (PL 93-24) rescinding the US $ 5000 forgiveness grants authorized after Tropical Storm Agnes and increasing the annual interest rate from one to five percent. The interest rate was raised even further to 6 5/8 percent in August 1975 (PL 94-68). The severe drought in the West and spring flooding in Appalachia during 1977 led Congress to liberalize the disaster relief provisions once again. Legislation passed in August 1977 (PL 95-89) permits individuals to obtain one percent interest loans on the first US $ 10,000 of uninsured damage, three percent loans on the next US $ 30,000, and 6 5/8 percent loans for that portion of a loan covering uninsured losses exceeding US $ 40,000. Any victim who has received an SBA loan related to a disaster that has occurred since July 1, 1976, can take advantage retroactively of the above provisions.

The community disaster model can examine how changes in the terms of this program will impact the recovery process under different assumptions about victims' behavior following a disaster. What impact will different interest rates and forgiveness grant features have on the decision as to how large a loan, if any, will be requested and approved? What are the private and social costs associated with these programs?

CONCLUSION

If the community disaster model is to be considered a successful tool for policy purposes then it must meet the needs of users who are interested in investigating the effects of different mitigation and recovery policies. Katz and Miller (1977) have provided extensive documentation on how to use the interactive computer model. As they point out, a major design objective is to provide a high degree of flexibility so that it is possible to make substantial modifications without having to incur large amounts of time, skill, and confusion in reprogramming. The next step in the process is for users to be willing to make the initial commitment to experiment with the model. Only then will we be able to determine whether the community disaster model is a useful tool for policy analysis.

ACKNOWLEDGEMENT

The community disaster model was developed by an interdisciplinary team at the University of Pennsylvania consisting of Bradley Borkan, Norman Katz, Howard Kunreuther and Louis Miller (Decision Sciences), Joseph Vinso (Finance), and Brogan Duffy, John Lepore and John Wilson (Civil and Urban Engineering). The overall design and implementation of the model is due to Katz and Miller. A more detailed description of the capabilities of the community disaster modeling system appears in Kunreuther et al. (1978).

NOTES

1 Currently flood insurance is offered on a nationwide basis at subsidized rates through the cooperation of the federal government and the private insurance industry. For a detailed discussion of the National Flood Insurance Program, see Kunreuther et al. (1977), Chapter 2.

2 For this illustrative example we arbitrarily chose a critical value of .88. This cutoff point resulted in approximately 28 percent of the homeowners in River City having coverage.

3 The limits on coverage were set at US $ 70,000 for the structure and US $ 20,000 for contents

4 Analyzing the low income, high age group showed an even more dramatic increase. The pre-flood debt/asset ratio was .10, immediately after the flood it was .13, and following the recovery it was .19. This is consistent with the finding of Vinso (1977a) in a study of a flood-prone community (Wilkes Barre, Pa.) characterized by low income, high age residents where virtually no one had purchased flood insurance prior to Tropical Storm Agnes. The actual ratios in River City are slightly lower than those found by Vinso due to the lesser damage incurred by River City. However, the relative magnitudes of the ratios are similar.

5 In recent years this percentage subsidy borne by taxpayers has been reduced from 90 percent to slightly above 50 percent so that the social cost of flood insurance has decreased.

6 Vinso (1977a) has shown that many uninsured victims in Wilkes Barre were saddled with severe debts following Tropical Storm Agnes. They have thus been financially crippled despite the generous SBA loan policy provided them after the disaster.

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Mass Emergencies 3 (1978) 23–40
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POST-DISASTER RECONSTRUCTION PLANNING: THE CASES OF NICARAGUA AND GUATEMALA*

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Earthquakes may seriously disrupt the human and ecological equilibrium of entire countries. But in many cases, especially when they strike deprived areas, another important phenomenon occurs: they bring to light a vast number of problems already existent in each country, but which were not normally visible. Thus, massive poverty, growing disparities between the rich and the poor, congested cities, shortage of housing, malnutrition, and illiteracy in countries affected by natural disasters surface and become public knowledge. These deficient conditions are usually kept out of sight by certain institionalized devices, such as slums or squatter settlements segregated in areas where the better-off do not go (Merton, 1969).

In this study two cases in Central America are analyzed in which the effects of an earthquake were compounded with deficient situations which were the result of many years of underdevelopment. The two cases are: Nicaragua after the 1972 earthquake and Guatemala after the 1976 earthquake. The quake in Nicaragua almost completely destroyed Managua, the capital of the country. Its effects were centralized in one area, and it did not have primary effects over the rest of the country. In Guatemala, the quake affected primarily rural areas, it had extensive impacts in different regions of the country, and only some sections of Guatemala City were affected. The subsequent response was as dissimilar as the effects of the two earthquakes. In Nicaragua the processes of relief and reconstruction were shaped by a vertical decision-making structure which led to a highly centralized operation. Maybe the evident failures of the Nicaraguan approach plus structural conditions internal to the particular context led the Guatemalan government to respond to the earthquake in the opposite way. There, decision-making was decentralized, the government almost avoided taking responsibility in the reconstruction process, and the different impacted areas were "allocated" to the relief groups. Thus, the strategies adopted by the agencies in each case varied as well as the results of the policies undertaken (Kreimer, 1977).

*A modified version of this paper was presented at the Conference on Disaster Area Housing, Turkey, September 1977.

BACKGROUND

Throughout the years Central America has been struck by a number of natural and man-made disasters which had serious consequences. One of the major disasters was caused by the influence of foreign culture, patterns, and plagues brought by the Conquest itself. The Indians had been isolated from the diseases

which struck them after 1492, and as a consequence they had no immunological defenses. Furthermore, the new culture was a major factor in the disruption of the human ecology (McLeod, 1973).

Natural disasters, a frequent event in geologically unstable Central America, were also the cause of serious disruptions. Severe earthquakes, volcanic eruptions, droughts and floods bringing about heavy destruction were factors beyond control which inhibited growth even before the time of the Conquest. In this century, Central America has suffered a large number of earthquakes. It is not the vulnerability to earthquakes that is surprising. What is remarkable is the fact that systematically these quakes had differential impacts according to social stratification; namely, there was a negative redistribution of resources within the population. This phenomenon also occurred in the last two earthquakes which struck Nicaragua and Guatemala.

Two days before Christmas, on the night of December 23/24, 1972, at 12.30 a.m. Managua, Nicaragua, was struck by an earthquake of a 6.25 (Richter) magnitude, followed by two aftershocks of 5 and 5.25 (Richter). Managua was a heavily concentrated city, and the quake killed some 10,000 people and injured 20,000. The earthquake and subsequent fires almost completely destroyed the center of the city, where the government offices, the financial and the commercial centers were located. It also destroyed the residential section of downtown Managua.

On February 4, 1976, a major earthquake – 7.5 on the Richter scale – struck Guatemala. It left about 23,000 dead and 77,000 injured. From February 4 to February 24, there was intense seismic activity with a number of secondary movements, some of which reached an intensity of between 4 and 5 on the Richter scale. The major movement activated a vast series of secondary faults, and as a result the effects of the quake were extensive and affected 16 out of 22 provinces in the country.

SOCIOECONOMIC CONTEXT

Nicaragua

Nicaragua is a small country which in 1974 had a 2.2 million population, with a 49/51 percent urban/rural ratio. The main exports of the country are from extensive mechanized agricultural production: cotton, coffee, meat, sugar.

The income distribution shows a significant disparity among different population sectors. According to a 1975 Vice-Ministry of Urban Planning Census in Managua, 5 percent of the population receives 16 percent of the income while 50 percent obtain 30 percent of it. The pattern of land ownership confirms this disparity: 43.2 percent of farms with less than 7 hectares each take up 2.2 percent of the farmland, 1.9 percent of farms with more than 350 hectares each takes up 47.6 percent of farmland. There are four main groups: (a) a reduced group with economic power who also have political power; (b) a middle class of professionals, merchants, and public employees; (c) a small modern urban and rural working class; and (d) a large proportion of underemployed and unemployed people living at subsistence levels.

Prior to the earthquake Managua was a concentrated city, following a pattern typical of most Latin American cities. Most of the activities and services – governmental, cultural, commercial – were located in the downtown area, which was a center of continuous movement. It was also extremely crowded. The urban development pattern was radial-concentric and the center was the focal point of all trips to the city. Thus, the urban pattern was one of congestion and slow traffic movement.

Managua has experienced ten earthquakes of a magnitude sizeable enough to merit recording since 1900. Over and over again, the city has been rebuilt on the same site, which according to studies is prone to suffer further earthquakes in the future.

It is estimated that a quarter of a million people lost their homes in the earthquake and subsequent fires. This dramatically aggravated the housing shortage which was a serious problem in Managua before the earthquake. To a large extent, the importance of the damages and the almost complete destruction of buildings in the central area was due to the complete lack of anti-earthquake techniques in the construction and the bad detailing prevailing in the pre-earthquake construction. Houses made of "taquezal" suffered heavy damage. "Taquezal" is a wood frame construction with rocks and mud filling the interstices. It does not have cross bracings and it is extremely heavy. Concrete structures also suffered due to lack of or inadequate reinforcement and to the widespread use of pumice as sand and vesicular basalt as aggregate.

Before the earthquake over 60 percent of Nicaragua's commerce was concentrated in Managua, mostly in the downtown area. After the earthquake this acitivity was paralyzed and about 50,000 workers found themselves unemployed as a result (AID, 1974). At the time Nicaragua was already facing a serious unemployment problem – especially in the rural sector – due to the drought of 1972. Thus, the earthquake sharply increased the number of unemployed people from the urban sector, raising dramatically the number of unemployed people in the whole country.

Although the Managua earthquake was not the most intense in recent history, it had particularly damaging effects because it destroyed a highly dense urban area. Given the macrocephalic structure of Nicaragua, with a heavy concentration of productive, social and political activities in the capital, the earthquake disrupted not only life in Managua but in the whole country.

Now, five years after the last earthquake, the central city is a huge, empty, vacant lot with only a few isolated buildings left, dramatic remnants of the once-crowded city. An overgrown vegetation is already falling over the old city, transforming the once busy and super-concentrated capital, into abandoned lands. The widespread idea rooted in the public's opinion is that the process of reconstruction of Managua has not started, that after five years Managua has still not been rebuilt. Contrary to this opinion, however, the new Managua is there. It is a shapeless, overextended, imageless and amorphous entity. The city that was destroyed by an earthquake on December 23, 1972, has been replaced by a number of disconnected, fragmented developments, expensive shopping centers in the periphery of the old city, clusters of housing segregated according to social and economic strata, and a series of rapid traffic roads which systematically ignore the needs of the poor and marginal neighborhoods.

Guatemala

Guatemala is 42,042 square miles, half of which is mountainous. In 1976 the estimated population was 6.3 million. The population is largely rural: 75/25 percent ratio in 1964. Five percent of the population receives 34.5 percent of the national income, and 70 percent receives an average annual income of $ 42; 2.1 percent of landowners own 62 percent of the arable land, 87 percent of landowners own 19 percent of the arable land. The housing situation was very bad before the earthquake: 60 percent of all urban homes had no sewage service, 88 percent of all homes had no electricity, and there was a deficit of 800,000 housing units.

Agriculture is the basis of the economy. Guatemala's major exports are coffee and cotton. These crops are grown in large latifundios, which use the most fertile lands. 87.4 percent are subsistence farmers, many of them Indians crowded in the Altiplano, the mountainous area of the country. On steeply inclined plots or minifundios they grow corn which does not provide them enough income to survive. Thus, in addition to working on

their own plots, the Indians work seasonally on the coffee and cotton plantations.

A very important aspect in the socioeconomic organization in Guatemala is the difference between Indian and ladino, who are the product of racial mixture, dating from the time of the Conquest and still prevalent today. It is primarily a cultural distinction: dress, language and customs set the indigeneous population apart from the others. Today Indian populations have a certain degree of isolation and cultural integrity (Olson and Olson, 1977).

Guatemala's history is marked by major disasters: Ciudad Vieja, the first capital established by the Spaniards, was destroyed by a flood in 1541; Antigua, the second capital, was destroyed by an earthquake in 1773. As a consequence of this quake, the capital was moved to its present site at Guatemala City, also a geologically unsafe location. It has been subjected to frequent earthquakes, the most serious of which was in 1917.

In the February 1976 earthquake, the major cause of death was the collapse of "adobe" wall construction and tile roofs. This construction, like "taquezal" in Nicaragua, is very heavy and not adapted to stand shock. Again, as in the Nicaragua case, the population who uses adobe are the poor, those who cannot afford anti-seismic construction with safe materials and good foundations. Furthermore, this group is the sector which lives in the hazard-prone areas. In Guatemala City the low-income population is located in ravines on the fringes of the city which are geologically highly unstable. Thus, construction methods plus location contributed to stronger effects of the earthquake for some population sectors while others were not affected. And thus, the major impact of the earthquake was on the urban and rural poor, the Indians, and squatter areas where the population lives in substandard housing conditions, and on farmers who live on subsistence agriculture. In general, the middle and upper-middle classes, the export agricultural sector and big industry were not seriously affected. The destruction in Guatemala was clearly a class-based phenomenon.

RECONSTRUCTION PLANNING IN MANAGUA

Deconcentration as a spontaneous development

After the earthquake, early location decisions helped to promote the notions of decentralization, later formally adopted, as well as provided the basis for subsequent urban development guidelines. In a way, the early spontaneous development became later the blueprint for the reconstruction. Early decisions also set a pattern of urban segregation based on socio-economic differentiation. This residential segregation entails a division according to social class as well as differential access to scarce resources such as transportation, education and infrastructure.

The evacuation and relocation of population did not follow any coordinate plan, but took place on an ad hoc basis. The lack of an early planning framework compounded with the lack of organization in guiding the response to the emergency situation. After the earthquake, the tendency of the population abandoning Managua was to locate either in other cities (Masaya, Leon, Granada) or on the periphery of the destroyed city. People who moved to other cities tended to go back to Managua after the first few weeks, but people who moved to the periphery of the old city tended to transform into a permanent location what had been temporary at the outset (Kates et al., 1973; Kessler, 1976).

After the emergency period was over, ad hoc, uncoordinated and fragmentary decisions were made which clearly influenced subsequent stages in the process and which in many cases began to build new shopping centers in the periphery of the old city. Most of these shopping centers were for the upper-income sectors, no market analysis guided these decisions, and the consequence now is an over-

supply of this type of commerce. Concurrent with the commercial development, new traffic arteries were built connecting the shopping centers with the emerging upper-income residential sectors. These roads followed a radial concentric pattern which later became the urban development mode adopted by the Immediate Reconstruction Action Program, thus ruling out any possibilities for a linear development. Las Americas, a "temporary" housing development built by AID, which was transformed into "permanent" low-cost housing for 50,000 people acted as a magnet and attracted low-income housing development in the southeast section of the city. Meanwhile, expensive housing was being built in secluded spots (e.g., Las Colinas), following a decentralized scheme and reinforcing the pattern of residential segregation.

Deconcentration/decentralization as planning concepts

A number of plans and reports have been produced where different international and national organizations discuss the effects of the earthquake and possible strategies for the reconstruction of Managua. The following can be mentioned as the most influential throughout the process:

1. A Master Plan for the Reconstruction and Development of Managua, prepared by a Mexican team, DEPLAN, and consisting of two different proposals, the first one based on a concept of urban concentration but limited urban growth, and the second one on the idea of urban deconcentration.

2. Report by the International Advisory Panel on Reconstruction and Redevelopment, supported by the World Bank and the Organization of American States. The International Advisory Panel, criticized the first Mexican proposal and strongly advocated the idea of a decentralized Managua.

3. Report on a Process of Planning and Urban Design, prepared by Lawrence Mann and Whilo Von Moltke, supported the deconcentration concept and provided guidelines for the urban design of downtown Managua.

4. Program of Urban Relocation and Industrial and Commercial Decentralization, prepared by the Ministry of Economics in Nicaragua, provided guidelines and proposed policies for a strategy of decentralization concerning industry and commerce.

5. The USGS Seismological and Building Code Work. The United States Geological Survey identified alternatives for relocation of the capital; the National Geographic Institute worked on the identificaiton of major and secondary faults, and the U.S. Department of Commerce's Bureau of Standards evaluated the conditions of buildings to determine causes of building failures, and developed recommendations for the new Nicaraguan Building Code.

6. Agenda for Reconstruction and Development Targets and Objectives 1974–1978, prepared by the Centro-American Institute of Business Administration (INCAE), a graduate school and research institute. INCAE had as a task the formulation of a strategy for development, the definition of the external assistance required and the development of reconstruction programs and projects.

7. Managua Periphery Development to 1985, prepared by George Nez, analyzed the feasibility to immediate peripheral expansion up to about 1985, while also preparing for later development of a metropolitan satellite town system.

8. Plan for Immediate Reconstruction and Action (PRAI) of the Vice Ministry of Urban Planning (VMPU). VMPU was created after the earthquake in September 1973 as the organization in charge of planning and development of Managua and its metropolitan system. The PRAI focused on short term strategies for the development of Managua.

9. Master Plan for Development (PGDU), Vice Ministry of Urban Planning, integrated the short-term policies of the PRAI into a long-term master plan.

With the exception of the first Mexican Plan, which proposed concentration of population in high-rise buildings with high-speed roadways following the lines of the faults, all the other plans listed supported the strategy of deconcentration/decentralization. This was also the official policy adopted by the Government.

The reports and plans analyzed base the decision to deconcentrate/decentralize on at least one of the following four objectives: environmental protection, reduced social cost of concentration, regional balance, and nonmetropolitan development (Burton, 1974). In every case, environmental protection has been singled out as either the *most important* or as the *only* objective of the plan.

Although the strategies proposed by the different plans to achieve deconcentration in Managua vary, certain common denominators can be found. Two notions of urban development are proposed: a linear pattern and a radial concentric pattern. Most of the reports propose (1) to reduce the density of buildings, and to drastically reduce public occupancy in the old center; (2) to create a civic center in the old center; and (3) to establish the periphery as a priority for residential location.

The notions of deconcentration/decentralization became words to be found in every report and plan published and in every public speech given. However, words do not have the power to change reality and to guide the course of events by themselves. They have to be complemented by adequate decisions, by a set of regulations, incentives and disincentives. Furthermore, in order to propose a successful policy, prevalent social and economic characteristics in the country have to be considered, otherwise the planning concept may lack the necessary conditions that could support its implementation.

According to the Advisory Panel, the city resulting from a deconcentration strategy would be a more "modern" city with no loss of accessibility. In their words,

> The resulting reconstructed city will be more modern in that it will reflect the tendency observable in all parts of the world toward greater expansion of urban area than in urban population. There should, however, be no loss of accessibility, specifically as good surface transportation is made a top priority and as vehicular ownership continues to grow – which is to be expected (International Advisory Panel Report, 1973).

However, this vision of a "modern" city, another Los Angeles, relying on freeways to provide access and dependent not only upon individual automobile ownership but also upon a good and efficient public transportation system is, in the case of Managua, almost a utopia. This idea in fact applies to and is feasible for the very reduced group within the higher income bracket of the population. According to the 1975 Census (International Advisory Panel Report, 1973), in Managua 53 percent of the population receives 16 percent of the income while 5 percent receives 30 percent. In Managua only 12 percent of the families own an automobile (9 percent according to another source). Given the disparity in income and the low proportion of people who own a car, the expectation that vehicular ownership will grow enough to reach a reasonable level to justify the decision to build a decentralized city with a rapid transit system, is far from being grounded in reality. This inconsistent view of Managua's reality which guided the proposal by the Advisory Panel is again evident when they state that the most potent force working for decentralization in Managua is:

> .... the rising standard of living of the population, which makes possible longer journeys to work, both through the transportation supply effects of higher income and through the rising ability of the population to pay higher travel costs out of wages (1973).

Figures in the 1971 Census contradict the notion of a "rising standard of living" (no up-to-date statistics could be obtained). The bottom 50 percent of the population has a median income of $ 90 a year (15 percent of

the GNP); the top 5 percent of the population has a median income of $ 1800 a year (30 percent of the GNP); 47 percent of the urban homes and 81 percent of those in the countryside have no sanitary facilities; 80 percent have no running water in Managua; 99 percent have no drinking water in the countryside.

It seems doubtful that the bulk of the population living under such conditions would be able to afford higher travel costs out of wages. In terms of transportation supply, the public transportation system in Managua is highly deficient. According to a report by INCAE (September 1973), a deconcentration towards the periphery was not accompanied by a systematic reorganization of the transportation system. Vast low income areas – and most of the squatter and marginal settlements in the city – are not serviced by public transportation. In the areas which do receive the benefit of public transport, routes overlap and there is not a good transfer system. Thus, in many cases the users have to pay more than one fare to reach their destination. Furthermore there are high operation costs in some routes due to lack of paving in substantial sections of the route.

An additional problem which makes the image of the "modern" city more inconsistent is the fact that prevalent risky and aggressive driving in Managua has produced a number of automobile accidents that has reached alarming proportions. In the first semester of 1974, there were 2,833 accidents with 697 persons injured and 49 deaths in Managua (Covian, 1976).

Even though some of the notions underlying the theory of deconcentration have proven inconsistent with the social and economic reality of Managua, it has been implemented to a certain extent. We have mentioned above the fact that early unplanned decisions guided the development of the city. The construction of a system of highways following a radial concentric pattern is one of those decisions. Although this radial concentric pattern is criticized in some of the planning reports in the sense that the natural tendency developed by this pattern would be to concentrate again population and activities in the center, this is the urban scheme adopted by the Vice Ministry of Planning in its Immediate Reconstruction Program.

In other instances, the stated goals of the decentralization policy are contradicted, either by specific steps taken by the government or by the lack of necessary regulations for the private enterprise. For instance, activities related to the Finance sector, which had a 66 percent concentration in Managua before the earthquake, decreased to 21 percent immediately after the earthquake to reach again in 1974 the pre-earthquake proportions (INCAE, September 1973). A large number of industrial activities are located in Managua. In 1974 out of 24 industrial activities existent in Nicaragua, 13 had more than 50 percent of their production located in Managua, and only in 3 activities was the participation in production of Managua less than 25 percent (Arguello and Velasco Arboleda, 1975). Thus, according to Arguello and Velasco, the tendency for all industrial activities in 1973 and 1974 has been to concentrate in Managua. This behavior contradicts the policy of decentralization promoted by the government. However, in order to control this tendency, incentives or disincentives should be implemented, and that has not happened. Comparing the economic base of Managua with six intermediate cities – Granada, Masaya, Diriamba, Jinotepe, Leon and Chinandega – the importance of Managua is evident. Even the deconcentration that took place immediately after the earthquake in 1973 was not enough to increase the participation of other cities in the GNP more than 10 percent for some activities. Unless a firm policy of decentralization of public investment and of control of private investment is implemented, the concentration of economic activity in Managua will not only continue, but it will accelerate in time.

Growth in one area of economic activity entails growth and concentration in other areas as well. The same trend we noted for industry takes place for commerce and services. The peak for the concentration in these activities takes place in the area of the Mercado Oriental and Ciudad Jardin, where the pattern of density and congestion has already reached pre-earthquake proportions. Given that the majority of the population does not have a car and that the mass transportation system is so deficient, a large number of the population tends to concentrate in a chaotic way around Mercado Oriental and Ciudad Jardin and to generate a system of commerce for the low-income sector. Thus in Managua now, there is a dual market formed on the one hand by the shopping centers in the periphery with goods and prices for the upper-income levels and the stores in the Mercado Oriental and in the Ciudad Jardin area, on the other, addressed to the low-income sector.

In spite of the destruction of the old commercial and financial center, the central ring in Managua continues to be the most important net generator of employment per inhabitant. The other rings, as they get farther from the center, become more residential. According to Carvajal and Velasco (1975), this indicates that in Managua, in spite of the urban impact caused by the earthquake, the patterns of economic urban structure common to most Latin American cities are reproduced. That is, heavy concentration of employment and activities in the center and location of residential areas in the periphery. And these activities clearly contradict the postulates of the deconcentration/decentralization policy.

LOW-INCOME HOUSING AND MARGINAL POPULATION

Prior to the earthquake the housing conditions in Managua were extremely deficient. A World Bank survey reports that according to the 1971 Census over a quarter of the housing units in the city were makeshift houses or rooms in cuarterias (Davis, 1973). The latter are old houses containing many rooms, each of which are rented as housing units but sharing toilets and wash basins. As a result of the lack of adequate housing, most of the new migrants either doubled up with relatives or friends in the cuarterias or moved into make-shift and very crowded houses (4.8 people per room) in the southeastern and western fringes of the city. Streets were generally unpaved, there were no sidewalks and, in some areas, water was sold only by the barrel.

This already deficient housing situation worsened considerably after the earthquake. Thus, low-income housing and marginal populations became a basic concern for a number of the planning proposals and reports.

According to the Advisory Panel Report, this area would be given first priority. They state:

> First social priority should be given to the problems of the marginal populations... Without a program for housing this population and without steps to secure the employment of sizeable numbers from its midst, the entire reconstruction program would be subjected to social pressure and the threat of disruption (1973).

Reality again contradicts the proposed strategy. In contrast to the affluent suburbs where the rich live in isolated clusters, the majority of the population – the poor – live either in "temporary" shelters turned into permanent housing or in squatter and marginal settlements. The latter, which have acquired fantastic proportions have no paved roads, no water or electricity, no adequate public transportation and are totally disconnected from the emerging automobile-oriented infrastructure and services of the new Managua.

Acccording to a study by INCAE (June 1974) on the situation of low-income housing, the typical house is poorly built and basic services (water, electricity, sewage system) are seldom available. Alternatives to provide these

services are equally deficient and water has to be bought in barrels.

Given the housing conditions of the low income population in Managua and the importance attached to it by the planning proposals, it is ironic that a large number of low and middle income housing sits vacant because of the prohibitive prices of the housing units which the population cannot afford. The government who rejected the sites and services proposal of the World Bank because they would not meet the expectations of the population in terms of housing, refers to the phenomenon of unoccupied housing as a situation of "surplus" housing. However, the projects, funded by loans from international organizations and built by Nicaraguan organizations in conjunction with private corporations, remain vacant due to their exhorbitant prices determined by the ambitious profit expectations of the construction companies, the obstacles for getting credit mentioned above, plus the accelerated increase in land values and construction costs, both financial and selling costs, after the earthquake. According to *La Prensa* (August 1976), the Housing Bank (Banco de la Vivienda) has not been a good arbiter to control the speculation of the finance corporations and the urban development. According to a special study done by a group of consultants for *La Prensa,* the prices being asked for low-income housing were at least 20 percent higher than the real construction costs. Due to the increase in costs, these houses cannot be afforded by the low-income sector for whom they were originally built. However, for the middle-income group who eventually could be able to buy them, these houses have characteristics of "houses for the poor" they do not want to accept – minimal dimensions, organized in endless repetitive rows, and located in fringe areas.

Several of the proposals and plans for the reconstruction of Managua propose the development of either self-help or training programs. In terms of a service of guidance for construction it should be mentioned that no construction training programs have been implemented. Given the fact that most projects for housing lay outside the economic possibilities of the poor and that the Government is not regulating speculation, the solution to the housing needs of the poor can only be achieved on an individual basis. Thus, organized self-help programs and training programs could in fact be of great value. However, none of the implemented housing projects included training or participation of the users. Thus, it is possible to predict that pre-earthquake building methods have not changed substantially for a large sector of the population who are still building their shacks with the same methods as before.

PLANNING TO DATE: THE VICE MINISTRY OF URBAN PLANNING

The Vice Ministry of Urban Planning (VMPU) has a task to carry out urban planning duties and to administer the new building code. This organization was in charge of the preparation of an Immediate Reconstruction Action Program (PRAI) which was to be the first stage of a General Plan of Urban Development (PGDU). The PRAI contemplated development during the 1975–1978 period and the final version was approved by President Somoza on May 20, 1975; that is, two and one-half years after the earthquake. The idea underlying the generation of the PRAI was that of a document geared to action, without providing global diagnoses on critical socio-economic and physico-institutional aspects (PRAI, 1975). The latter would be the task of the PGDU which was considered more of a master plan for development.

The dominant strategy of the PRAI as in the other plans described above is the deconcentration of urban development. The policies proposed by the PRAI and to be included in

the long term strategies of the PGDU are:

(1) Reconstruction of Managua in the same site with strict seismic and zoning regulations.
(2) Deconcentrated development on the basis of lower densities to increase the safety in case of new earthquakes.
(3) Development of Managua in concentric rings from the destroyed area to the Pista de Circumvalacion with an emphasis on the east–west axis.
(4) Development of Managua as a multi-center city.
(5) Development will occur in the form of urban cells, with housing and services.
(6) Special attention will be given to the needs of the low-income sector.
(7) The urban center of Managua will be rebuilt as a non-residential area, with public buildings, parks and open spaces.
(8) Participation of the private sector will be stimulated during the planning and implementation process.

Given the need of making decisions in a first moment that would certainly affect future development, the idea of a transitory plan to improve the efficiency seems to be very valuable. However, the PRAI was superseded by a myriad of private decisions, and at most, only in a few cases could it provide guidelines for action.

The General Plan for Urban Development (PGDU) (VMPU, 1975) is a long term reconstruction plan elaborated by the Vice Ministry of Urban Planning. The main aspects of the PGDU were identified in February 1974 by representatives from the UN, AID, OAS, and VMPU. The PGDU is conceived as a process of continuous evolution, with the PRAI defining the short term strategies which will define the orientation of the middle and long term policies to be adopted.

The main objectives of the PGDU are the following:

(1) Definition of criteria to satisfy the habitational requirements of Managua's population.
(2) Definition of criteria to satisfy the functional requirements of different urban activities.
(3) Definition of norms of land use, occupation and subdivision.
(4) Definition of infrastructure and equipment necessary to materialize the urban structure.

It is too early to evaluate the effectiveness of the PGDU in guiding development. However, considering the forces and tendencies resulting in ad hoc, uncoordinated decisions, and the delay and virtual impossibility of putting into operation the PRAI, it is not difficult to predict the fate of the PGDU.

The fact that all these plans have only been implemented in a minimal and partial way does not mean that Managua has not been reconstructed. The result is indeed congruent with the process. According to the public opinion, which needs the symbol of the still missing new civic center to perceive the reconstruction as a completed process, the rebuilding of the new city has not started. However, the new Managua has already been built, a new disjointed and fragmented city.

In sum, the process of planning and implementation adopted in the reconstruction of Managua can be characterized as follows:

(1) As an ad hoc process guided by individual profit and by vested interests. This process resulted in uncoordinated investments and fragmentary urban schemes which pose heavy demands upon public infrastructure investments.

(2) A process which reinforces patterns of residential segregation, increasing the marginalization of the poor, and promoting a model of class differentiation which favors the elites in terms of public investment.

(3) A system relying on the transfer of both foreign technology and conceptual models which are not adapted to the concrete situation and context of the country.

(4) A process characterized by a hierarchical structure of decision-making and lack of horizontal connections among the involved agencies.

(5) An effort lacking coordination among the different international teams and experts working on the reconstruction.

The final result of the reconstruction process is (1) a deterioration of services for the majority of the urban population, this population growing as a result of rural migration to the city pushed by the agricultural mecha-

nization in latifundia; (2) an increase in land values in the city and in the periphery as a result of the new decentralization infrastructure financed by external aid and of speculation; and (3) an improvement in the services for the small middle and upper class sectors, which tend to resemble more and more those of suburban areas in American cities.

THE PROCESS OF RECONSTRUCTION IN GUATEMALA

In contrast to what happened in Nicaragua, in the operation of reconstruction, in Guatemala the government adopted a policy of hands-off the problem. The task was left either to individual decisions by the relief agencies or to the communities themselves, with no global guidelines or controls, and with subsequent conflicts and problems arising as a result of this lack of coordination. Some communities were left without aid at the emergency and reconstruction stages. A large number of the rural population had to migrate in search of food and medicine, resulting in a shortage of labor for the harvest, disruption of established markets and exchange patterns, and interruption of life organization. Eventually not only did they have to bear the dislocations brought about by the earthquake, but they also had to rebuild their own houses. In other communities the aid tended to discriminate in favor of certain groups, for instance, those who owned the land (e.g., CARE in Chimaltenango) or those who belonged to a given church (e.g. Mormons). In other areas the aid was given without a unified set of criteria: some groups required full payment of the total cost of the house, others required partial repayment, some gave the materials to the recipient but required a contribution of work, and still others provided financing through BANVI or BANDESA (Thompson and Thompson, 1976).

The process of reconstruction can be characterized as a decentralized operation. On March 18, 1976, the National Reconstruction Committee was formed by President Langerud and headed by General Ricardo Peralta Mendez. In its reconstruction policy the government promised to take advantage of the earthquake to implement housing programs and to benefit the popular sector. Through the Banco de la Vivienda, the Government announced ten programs to build individual and collective housing units, of which only three have been implemented (Marroquin, 1976). The National Reconstruction Committee allocated the affected areas to donor agencies by means of an "auction", that is, portions of the disaster areas were assigned to the different agencies and groups, and the government adopted a policy of hands-off in those areas. This resulted in fragmentary knowledge about the situation in different areas, the programs implemented, and the extent to which donor agencies who had promised to work in given areas were doing so.

Decentralized Reconstruction or Laissez-faire?

The process of reconstruction in Guatemala was handled by the government following a "decentralized" approach. Three weeks after the earthquake, and after the emergency situation, an "auction" took place which allocated the affected areas to the different relief agencies. The following is a list of some of the agencies working on the problem:

> CARE (USA), OXFAM, AID, CARITAS, Red Cross, Central American Mission, Mexican Government, Italian Government, EXIMBAL, Salvation Army, International Disaster Emergency Service (IDES), City of Philadelphia, Spanish Government, Dutch Government, Masonic Lodge, Canadian Government, Wings of Mercy (Calif.), Oxfam/ World Neighbors, Association of Protestant Churches (CEMEC), Adventist Church, Rotary Club, Comite Central Menonita, Bricks for Guatemala, Jewish Central Committee, Committee of Permanent Help (CEPA), Comite Fratelli d'Italia, FEDECOAG (National Agricultural Cooperatives), Fundacion El Centavo, Church of Jesus Christ Latter Day Saints (Mormons), Save the Children Alliance, and Scouts of Guatemala.

Each agency developed their own definition of goals for the reconstruction program, their own approach to the operation, and their own schedule. Charlotte Thompson and Paul Thompson, in a survey of the programs proposed by each relief group, list the different approaches taken by each agency (Thompson and Thompson, 1976). The results of this decentralized operation were varied. In some cases, the objectives were to establish training programs in earthquake resistant construction (Oxfam); in others, to provide one house for every family in a village (Canadian Government in San Andres Itzapa). In some cases, several agencies were working in the same town without coordinating efforts; in other cases, seriously affected populations were left without any aid. Agencies which at the beginning promised to work in given areas never delivered the promised help.

Meanwhile, the government, relying on the external aid, was not undertaking a coordinated and controlled approach to the provision of relief and to the reconstruction effort. Several reports about the situation mention the fact that approaches which tend to generate dependencies between the relief agencies and the population should be avoided, as well as "paternalistic" responses to the reconstruction needs. However, in this case the real problem is not the dependency created between, for instance, the Indian population in a rural town and a relief agency, but between the government towards external aid and towards the myriad of relief agencies operating in the country. Robert McCormack is right when he states in a report written for AID that "most outside groups working in the communities have established highly paternalistic ties with local officials and people. These outsiders are imposing their ideas on the people, however benignly, and usurping local authority from local officials, thus they may use these officials as tokens". However, this thought should be taken one step further and applied to the attitude of the national government of not assuming control of the situation and adopting the "auction" approach. This established a pattern of uncontrolled outside intervention, which should be analyzed under the framework of disequilibriums in the access to resources by different countries and unequal exchanges among countries. The decentralized approach led to a lack of control on the progress of the different groups working in the affected areas.

The Implemented Programs

On their own initiative, some groups implemented very active programs (e.g. Oxfam, Canadian Government, Mexican Government). These programs were based on completely different assumptions, and pursued varied goals, therefore the outcomes of each also differed. For instance, Oxfam's goal was not to build houses but to train the population in safe construction techniques using local materials. With this program in mind, they established demonstration programs where they built model houses in the villages where they were working – San Martin, Jilotepeque, Tecpan, San Jose Poaquil. As an educational device, they have prepared a construction manual following the format of a comic book which was distributed free to the population. As a part of the program, Oxfam also distributed lamina imported from El Salvador for roof construction, which they subsidized and sold at low prices. The Oxfam program was quite influential, and other agencies have adopted the basic principles developed by this group.

The Canadian Government in San Andres Itzapa and in San Jose Poaquil has implemented a program which had as a goal to build a house for each family who wanted to participate in the program. The houses were built of wood panels, imported from Canada, and corrugated zinc. The participants in the town were organized by Canadian technicians into teams of about eight persons each whose

task was to build the houses in one block. Other members of the community worked in assembling the construction elements and the panels in a factory. The results of this program were quite impressive. In San Andres Itzapa, where the destruction had been almost total and where practically everyone in town participated in the Canadian program, the construction was nearly completed in July. The program achieved an overwhelming support from the population in terms of participation and sense of self-esteem. All over town, there were banners praising the work of the Canadians and the expressions of satisfaction with the operation were unanimous. By July, the people of the town had already started to paint and to modify the otherwise homogeneous houses in order to give them their personal touch.

This approach is completely different from the one taken by Oxfam, in that the Canadians based their help on the provisions of imported materials, then closely controlled and organized the reconstruction of the whole town, thus establishing a more "dependent" pattern towards the donor agency, while Oxfam relied on local materials (except for the lamina imported from El Salvador) and training of the population and the organization was left to local groups and cooperatives.

The programs described above are only two among the diversity of approaches implemented in the different areas. Thompson and Thompson, in their study, provide a perspective of the myriad of approaches and objectives that guided the selection of methods and also of the differences in the outcomes. As a result of the overall decentralized approach to reconstruction, no control was established over the different programs. Some areas then received a disproportionate amount of aid (e.g., Chimaltenango, San Martin, Patzuc) when compared to other areas which did not receive enough according to their needs. Similarly, there was not a single criterion followed for allocating housing. The government did not provide guidelines or regulations in that sense and each agency interpreted the concept of need in a different way. Some agencies identified recipients by giving priority to those who were low-income – the definition of this category was unclear – or to those who had no resources to build a house or to those who cared to participate (Thompson and Thompson, 1976). Some programs required a minimum monthly payment, in others every family in the town received a house, and in others only members of a given church qualified. Thus, the decentralized approach, with a large number of agencies operating with *carte blanche* to test their ideas, in no way solved the housing needs of the earthquake victims, but provided solutions for some while leaving many without aid.

Some positive aspects of the reconstruction operation were the following:

1. Emphasis on the utilization of recycled and recovered materials. As opposed to Nicaragua where neither the Reconstruction Committee nor the agencies tried to base their programs on the re-use of materials salvaged from the earhtquake, in Guatemala this was an approach used not only by the affected population but also promoted by some of the involved agencies (e.g., Oxfam). The population was already familiar with building using waste materials, in fact in many cases the destroyed houses had been built originally out of recycled materials. Thus, whatever materials could be re-used from the rubble were salvaged. After the earthquake, the population tended to attack immediately the problem of temporary shelter. In rural areas, in many instances the shacks usually utilized to store tools and seed became temporary shelters. As it was mentioned above, in many instances the population preferred this solution to the temporary shelters provided by the relief agencies.

2. Attemps by several agencies to implement self-help and training programs, and to promote the organization of cooperatives. This is a significant departure from the approach taken in Nicaragua, while there was no attempt at training the population in safe construction techniques.

In Guatemala, there were several programs attempting to involve the local residents in the building programs and in the decision-making process (e.g., Oxfam/World Neighbors working with the cooperative El Quetzal/Katoki). There was a generalized acceptance of the fact that the process of reconstruction should be understood as a complex experience for the affected population and that approaches based on the provision of a final product – a house – undertaken in other disaster situations were not the best possible answer to the problem.

Two problems associated with the decentralized approach undertaken in the reconstruction were:

1. Emphasis in the reconstruction of rural areas rather than urban areas. In Guatemala City, very little has been done to improve the living conditions of the earthquake victims. After the earthquake, the people who were living in hazard-prone areas, on steep ravine slopes, moved to private and publicly owned flat land. These squatter settlements grew at an accelerated rate (the number of improved houses is approximately 20,000), with precarious characteristics and not even adequate to resist weather conditions. Mass migration and land invasions generated conflicts between the invaders and the government and between the invaders and the landowners which resulted in serious repression by the armed forces.

After the earthquake, the Banco Nacional de la Vivienda defined a policy of housing based on ten programs to build temporary houses, to remodel and rehabilitate houses, and to acquire land for future housing development. Three out of these ten programs have been implemented to relocate a sector of the squatter population (Marroquin, 1976). However, most of the squatters in the capital cannot afford either the housing programs promoted by the government nor the land offered at market prices. It is calculated that a total of 30,000 families who were left houseless by the earthquake or who did not have a house before are in this situation. Thus, it is in the capital where the most serious problems of housing and lack of service appear that is the area which has been almost completely deprived of help for the reconstruction.

2. Lack of provision of comprehensive plans for development of infrastructure and social facilities for the communities. Very few of the programs contemplate the provision of services or proceed in response to comprehensive urban plans. Most of the plans only consider the provision of housing without sanitary services, electricity, water, or roads, thus posing a number of problems in terms of providing these essential services. Another aspect which is not contemplated in most of the programs implemented is the provision of facilities for communal life. Therefore, most of the programs do not deal with community needs in a wholistic way.

In sum, the earthquake in Guatemala made manifest the extreme differences and inequalities that existed among the social groups. These disparities are not a new phenomenon in Guatemalan society; their origins date from the Conquest when land was divided into latifundia controlled by the Conquerors and small plots for subsistence farming cultivated by the Indians.

In Guatemala City, in spite of the programs announced for the uprooted, the government failed to provide real alternatives. Thus, living conditions of these groups, which were extremely deficient before the earthquake, have deteriorated since then. The crisis situation also brought to light the lack of a policy for low-cost housing in the country. In spite of the dramatic situation of the victims in Guatemala City, the efforts of the relief agencies

were mainly concentrated in the rural areas. Both during the emergency and reconstruction stages, a centralized control of the operation was lacking. The government adopted a policy of hands-off the relief operation, and agencies defined their own objectives and guidelines for the operation. Thus, programs had different assumptions, pursued varied goals, and had different outcomes.

The policy adopted by the government in the earthquake has been described as a decentralized approach. However, given the systematic neglect to which large groups of the affected population were subjected, it is necessary to question whether it is a decentralized approach, or strategic laissez-faire. The result is a fragmentary approach to the reconstruction and a systematic lack of comprehensive short and middle range policies to solve the housing problems of the poor, both by the bilateral assistance and by the government.

COMMENTARY

Natural disasters are testimonies. They are breaks in the on-going life of a given society, and as such they discover in the affected country aspects which are not normally considered emergencies, although they share some of the characteristics of emergency situations. Housing shortages, lack of essential services, unemployment, health problems, and illiteracy are some of the difficulties common to the dispossessed of the world. One of the impacts of natural disasters in poor countries is that they suddenly reveal these deficiencies. In normal life, these problems are known to those who suffer them. In the event of disaster there is a telescopic effect and they become reported by the international press and widely diffused.

The crises in Nicaragua and Guatemala analyzed in this study can be characterized according to a series of traumatic events which affected each system. Among others, the following can be mentioned:

1. Total or partial paralysis in the functioning of the system. The impact of the earthquake in Nicaragua, although concentrated in Managua had consequences which affected the functioning of the country. Given the macrocephelic structure of Nicaragua, with a heavy concentration of productive, social and political activities in the capital, the earthquake disrupted not only life in Managua but in the whole country. In Guatemala it affected a subsystem: urban poor living in substandard conditions in marginal areas, and rural populations, many of them living on subsistence farming. In general middle and upper-middle groups, the export agricultural sector and the big industry were not seriously affected. Thus the paralysis was only partial and it included the struck area plus communication linkages among areas.

2. General, partial or local lift of organizational inhibitions which permitted hidden capabilities to surface. In Guatemala, the affected populations were in many cases able to react immediately without outside help and to organize the situation in order to consider priorities for action. For instance, the necessity of preserving the harvest after the earthquake in some cases prevailed over the necessity of reconstructing the houses. Thus, the population resorted to any structures they had available such as tool shacks or chicken houses as shelter in order to devote manpower to the sector where it was most needed.

In Nicaragua, the extended family proved to be one of the most important institutions able to immediately organize networks of material and effective relief. In many aspects it provided the aid that the government and official institutions were not able to provide at the emergency stage.

3. Reinforcement of social differences. The impact of the two earthquakes were not homogeneously distributed among the population. They affected primarily the poor. But

also the inefficiencies in the relief systems affected those whose needs were more pressing. In Nicaragua, the reconstruction specially stressed social differences. This was done by spatially segregating groups in the new Managua, and increasing the marginalization of the poor by adopting a pattern of decentralization which favors the elites in terms of public investment and by increasing land values as a result of speculation.

In Guatemala the quake has been defined as class-based in that it impacted the urban and rural poor, Indians, and farmers who live on subsistence farming. These groups not only had to bear the dislocations brought by the quake but also in most cases the costs of rebuilding their own houses. In Guatemala City, where the most serious problems of housing, people without land, and lack of services appeared, land invasions became a phenomenon which created conflicts with the government and with the owners of the land and which generated severe repression from the armed forces.

4. Disruption of locational patterns and generation of both voluntary and involuntary migrations. These processes are in general chaotic and tend to disrupt the organization of life of the population. In the two cases studied migration occurred. The sudden uprooting of large masses in both cases was a serious problem which was not dealt with by the authorities in a coherent way. In Nicaragua the evacuation of the city caused a massive migration to other cities and to the periphery. This relocation took place without a coherent plan and the massive influx of people without housing or employment disrupted the economy of secondary cities.

In Guatemala, although in many cases the harvest became a fundamental concern, in some areas the conditions of deprivation were such that migrations took place with considerable losses in the labor available for the harvest, thus seriously affecting the agriculture sector. Furthermore, large numbers migrated to the capital, increasing the already serious situation of the squatter settlements.

5. Transfer of technology and cultural patterns. Technology and cultural pattern transfer is pervasive in the case of countries whose economies are conditioned by the development of other economies. In the two cases analyzed this phenomenon occurred at different stages in the process. In Nicaragua, this happened not only in the emergency process – polyurethane igloos brought into the country as emergency shelter are one example – but also in the reconstruction process, with the transfer of urban development concepts from other contexts. There, the pattern of a deconcentrated city and the decisions followed to implement it were not congruent with the concrete characteristics and reality in Nicaragua. Thus the necessary resources and infrastructure to support such a system are missing.

In Guatemala, the lack of government responsibility over the reconstruction task resulted in lack of controls over the way in which reconstruction operations proceeded. Thus, some relief agencies showed more concern in avoiding the transfer of technology and in following local traditions, while others evidenced less concern with these issues and proceeded with the traditional pattern of "developed societies provide the best models".

If the consequences of disasters are to be mitigated in the future, then much more thought devoted to the issues of relief and reconstruction will be necessary. An effective interface of international organizations and of governments of the countries involved is essential. In this respect, as the details of each relief operation are exposed, one question is of paramount importance. It recognizes the disparity that exists between the traditional ideas about relief and reconstruction planning and the actual process by which policies are chosen. From a perspective broader than the particular case, the Nicaragua and Guatemala cases illustrate the failures of the local governments concerned.

In Nicaragua the reconstruction process was a conjuncture of influential people making decisions plus a failure on the part of the government to set the necessary regulations to control development. Some of the decisions which affected the pattern of reconstruction were location of major circulation routes, location of shopping centers, construction of temporary housing which subsequently became permanent, and construction of housing for the middle and upper income sectors. This process resulted in uncoordinated investments and fragmentary urban schemes which posed heavy demands upon public infrastructure investments. The consequences of this operation are that benefits of the development are distributed in an unequal manner and those who benefit the most are the elites, those who are politically and economically powerful, and those who are affected are the ones who have the greatest need for government assistance.

In Guatemala, the government did not play the role it should have in overseeing the validity and appropriateness of the approaches taken by the different agencies. The National Reconstruction Committee presumably in charge of monitoring the reconstruction process did not control the diversity of technical judgments made by the relief agencies.

At the same time, in the two cases there was no organization with the necessary resources – expertise, money, power – to examine alternative ways of dealing with the situation or to vocally object to or oppose the adopted strategies and solutions. This raises an important question for the future which is how can international, bilateral agencies participate and organize post-disaster situations with an orientation toward human service, understanding the limitations that sociopolitical contexts impose over relief and reconstruction efforts.

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Mass Emergencies 3 (1978) 41–48
©Elsevier Scientific Publishing Company, Amsterdam – Printed in The Netherlands

MASS EMERGENCY PROBLEMS AND PLANNING IN THE UNITED KINGDOM FROM THE PERSPECTIVE OF THE POLICE

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"YE KNOW NOT THE DAY NOR THE HOUR"

This extract from the Bible really sums up the need for contingency planning if we are to effectively deal with the unexpected emergency when it occurs.

Disasters do not generally occur as the result of a single malfunction. There are generally a number of contributory factors which, had they happened on their own, would not produce an emergency situation, but, because they sometimes occur simultaneously produce an emergency situation of disaster proportions. Not least amongst these factors is the human failure to correctly react or respond to circumstances when the occasion demands. It therefore follows that disasters can to some degree be obviated by the training of staff in their emergency action procedures and the efficient supervision of staff and processes. However confident one might be regarding the effectiveness of such training, one must still be prepared to meet the disaster when it occurs. Natural disasters cannot be prevented, but contingency planning can reduce the consequences of such disasters by enabling an advance warning of the pending situation, such as flood, hurricane, etc., to be given and for the rapid intervention of evacuation plans designed to protect the individual and lessen the effects of the disaster.

My research has shown that in the United Kingdom some 60 different situations can produce a disaster scene. These situations invariably occur when a combination of events happens simultaneously. One such example occurred in England in 1975. A light aircraft lost engine power on take-off from an airport because of the chance presence of a flock of birds. The pilot decided on an emergency landing in nearby fields and this would probably have been completed successfully without loss of life and with little damage to the aircraft. However, the emergency landing path did involve the pilot crossing a road. At the precise second that the aircraft crossed the road at almost ground level a car was driven across it's path. The aircraft struck the car, killing all the occupants and, whilst the pilot still managed to land his aircraft without further loss of life, considerably more damage was occasioned to the aircraft than would have been the case had the car not been present.

TYPICAL DISASTER INCIDENTS

Let us look at some typical situations which in the past have produced a major disaster:

1. A Building Collapse in a Shopping Centre

Usually some advance warning might be expected from a surveyor or architect, but occasionally a building will collapse without warn-

ing. Had it collapsed in the middle of the night when shops were closed there would have been few, if any, pedestrians about and the incident would not be classified as major. What though, would be the case when the incident occurs on a Saturday afternoon in a shopping precinct busy with pedestrian shoppers? We are faced with a situation where the number of persons involved is unknown and therefore a complete clearance of the debris becomes necessary before the emergency services can assure themselves that no casualties remain. In this instance only five persons were killed and ten injured – a small number considering the surrounding circumstances. Had the shop been displaying television sets showing an important sporting event there would probably have been many more pedestrians watching the display and thus a much higher casualty figure would have resulted.

2. A Main Line Train Crash

The essential ingredient to such an incident is the fact that there is a railway line running through an area. Where there is a railway then a plan for dealing with such an incident should be required. Emergency services can survey the route of the track during planning and record the best access points to various sections, thus ensuring a rapid mobilisation. Should such planning not have been undertaken one can imagine the services arriving at the scene only to find their access made difficult by the presence of a high embankment or deep cutting. Planning might have revealed access by a level crossing some distance away as being more suitable for an approach. Like the collapsed building, this type of accident must be fully searched before the services can be confident that nobody remains in the debris.

3. An Air Crash in Open Country

Unlike the train crash, nobody can predict where an aircraft will crash. Whilst statistics show that the majority of crashes and incidents occur at or in the vicinity of airports one must plan for a crash taking place anywhere in the country or in the coastal waters surrounding the country. A crash in the country often presents the rescuers with few access roads but, being isolated from the densely populated areas, the ever present band of sightseers will not be immediately on the scene, thus giving the emergency services reasonable access to the site and affording sufficient time for large scale area closures to be instituted. Crashes in the country generally only involve the aircraft and thus the number of persons involved can be accurately known from the information provided by the operating airline.

4. An Air Crash Close to a Town or City

This kind of situation presents similar problems to the previous case. However with the generally better network of road communication and proximity to a populated area, sightseers often reach the scene before the emergency services and thus not only create a problem of their control but also effectively delay the arrival of the urgently needed help at the scene.

5. An Air Crash on a Town or City

Such a situation presents problems of sightseers, access by emergency services and the many possibilities of persons on the ground being involved. There is no fixed number of casualties or victims, the services are faced with unknown figures of shoppers in stores, residents in houses and passing vehicles involved. All action has to be geared to the complete search of the affected area and will undoubtedly result in numerous enquiries being received by the police from anxious relatives and friends of persons possibly involved. One can envisage all manner of combinations in relation to an aircraft, but the

following description is one that might well occur.

6. A Large Passenger-Carrying Aircraft Crash on a City

In March, 1974, a large capacity aircraft crashed in France north of Paris with a death role of 346 persons. Had that aircraft remained in the air for another twelve minutes and then crashed, the experts tell us that it would probably have landed on London. Even before this incident the Police Force had conducted a study on the results of such a crash in the City of London.The study was based on data provided by a major aircraft manufacturer obtained from an actual crash in open country. The damage data was divided by four as it was thought that a heavily built up area like the City would have effectively reduced the spread of wreckage. Even then the area involved remained too large for a practical study, so it was decided to restrict the study to a triangular area of about 150 yard sides with its apex at the point of impact. The study showed that during a working day there are upwards of 5,000 persons working in offices within the triangle thus presenting a very high casualty figure. It takes little imagination to consider the numerous problems which would be involved in such a situation. Looking at the casualty situation alone, local hospitals would be unable to cope with the casualties and it is anticipated that, if we are ever to be confronted with such a situation, we would be obliged to send the lightly injured casualties to hospitals up to 30 miles away, keeping the local hospitals available to deal with the serious injuries.

7. The Bombing Incident

This kind of event presents yet another planning consideration. There is a need for an instantly operational evacuation and protection plan and, should the bomb detonate, then a crime investigation plan coupled with a search plan to ensure that even remote casualties unable to help themselves are rapidly located and given emergency aid treatment.

8. The High Rise Building Fire

Whilst it is acknowledged that the United Kingdom has the most rigorous fire safety regulations and escape procedures, one cannot overlook the natural human tendency to move upwards away from fire and smoke if one finds oneself confronted with a situation that effectively prevents the logical movement downwards through the building. On reaching the rooftop a person would find no further means of escape and thus it becomes the task of the emergency services to effect rescue of such individuals. The modern building is sometimes of such a height that conventional fire ladders will not reach rooftop level. Where no buildings abut the affected building there are no means of escaping sideways and thus an alternative means of escape and rescue must be forthcoming. Such means will usually come from a helicopter which, if uncontrolled, can result in a number of machines flying round the building like bees round a honeypot. Planning must therefore be considered for controlling the use of helicopters in such circumstances.

9. The Industrial Explosion

The devastating explosion at Flixborough in June, 1974, presented the emergency services with hitherto unprecedented problems. A very large area was devastated, initially an unknown number of persons were on the site at the time and all records relating to them had been destroyed in the blast. Added to this was the need to evacuate persons from damaged residential property and later further evacuation considerations were necessary due to the possible effects of chemical laden smoke clouds.

10. The Overturned Chemical Tanker

Such an incident can present equally serious problems to those of an industrial explosion, especially if the incident occurs in a densely populated and built-up area. There is a need in such incidents to rapidly identify the danger, to organize a quick evacuation of the immediate area, if necessary, and furthermore, to treat those casualties that have been exposed to the effects of the chemical. If further casualties and damage are to be avoided there is a need for clear planning and training of personnel on their intervention and identification procedures.

11. The Mutli-Vehicle Road Crash

Once again this presents the situation of an unknown number of persons involved and the need for complete search and assessment of the incident. Vehicles concerned could be carrying a variety of different chemical products which, if allowed to mix together, could produce noxious fumes and potential explosion. The nature of the road layout often dictates the means of access by the services. Where motorways or isolated country roads are involved this can often present a considerable tail-back problem with the consequent obstruction to the arrival of emergency services at the scene. By pre-planning and establishing flexible but workable access plans the services can be given the ready intervention access that they require.

12. The Flooding Menace

This is an example of a natural disaster. Planning can provide for a warning to be given to the public whereby action can be taken to minimise the effects of the pending flood. Such incidents usually persist in their effect long after the flood waters have subsided, presenting a residue of silt, health hazards and long term disruption to public services. It is often many weeks, sometimes months, before normal life can be resumed in such areas.

13. The Large Public Demonstration

One can be excused for not immediately considering such an event to be a form of major incident. However, each demonstration contains the essential ingredients for a disaster. Whilst organisers and police in the United Kingdom invariably plan such events amicably there is always the possibility of uncontrolled movements, possibly toward a series of pedestrian stairways. Such a movement need only involve a single person tripping on the stairways and falling to the ground thereby effectively presenting another "Ibrox Park" type of disaster where the oncoming crowd, oblivious of the obstruction ahead of it, continues its onward movement, causing more persons to fall over the initial obstruction and causing numerous, sometimes fatal, injuries.

14. The Complete Unforeseen Incident

The Moorgate Underground Disaster of February, 1975, is an example of such an incident. It presented all the emergency services with hitherto unprecedented problems of access, control and public demand for information. Perhaps this incident clearly illustrates the need for contingency plans to be kept simple in order to afford flexibility and the use of initiative by the intervention services.

THE IMMEDIATE AFTERMATH OF AN INCIDENT

It is inevitable that there will be initial chaos following any incident. This is encouraged by the everyday training of the police officer in the United Kingdom, who, right from the day of joining the service, is taught to act on his or her own and make his or her own decisions. Naturally, every officer will initially continue such a policy and afford

such assistance as is immediately necessary in his or her own eyes. No amount of planning can overcome such reaction but the plan will contain a policy of police officers working as groups instead of individuals on such occasions. Where this type of plan is in existence, a progressive establishment of control and co-ordination can be achieved in a comparatively short time.

The foregoing gives some idea of the range of activity that disaster can present to the various emergency services. There is no doubt that the initial activity at the scene can affect the long term intervention at the outset. A plan which ensures a rapid response by police to an incident, especially one that ensures a police presence within ten to fifteen minutes will considerably help to both reduce the number of casualties and also the amount of damage to property. It will, furthermore, ensure the future success of the operation with its rapid establishment of essential control and co-ordination.

In the United Kingdom such an early response is often the sole presence of police officers at the scene before the arrival of the other services. This is not because the police are more efficient, but because the other services are not normally operational on the ground throughout the 24 hours of a day, but waiting in their respective stations for notification of an emergency. Quite often the police officer is considerably nearer the scene when the initial message is received.

Before the arrival of the other services, apart from the general responsibility of the police, the primary duties are:

Protection of Life and Property;
Rendering First Aid to the Victims;
Initiating Evacuation when Necessary;
Searching for and Rescuing the Injured;
Cordoning off the Affected Area;
Establishing Emergency Services Approach Routes;
Preventing Looting in the Area;
Ensuring that the Other Services are Informed;
Controlling Panic at the Scene;
Controlling and Utilising Sightseers;
Classifying Casualties According to Their Injuries;
Activating a Mutual Aid Plan for Assistance, Organising and Directing Volunteers;
Determining the Scope of the Disaster;

and meanwhile continuing police cover elsewhere in the Force area.

Amongst the primary duties are those of first aid to victims, searching for and rescuing casualties, and classifying casualties according to their degree of injury. These are not normally police tasks in a disaster situation, but, in the absence of other services, the police will naturally undertake them. If later confusion is to be avoided the police must be trained in the operating principles of other services thereby enabling them to establish a procedure that will not be subsequently changed when the specialist service arrives and takes over the tasks.

Once the remaining full time emergency services arrive at the scene the primary police tasks tend to change in character and the secondary and long term duties are undertaken as follows:

Recovery and Protection of the Dead;
Maintaining a Log of Events;
Completing Damage Reports;
Recovery and Safeguarding Property;
Identification of the Casualties and Victims;
Notification to the Next of Kin of Dead and Injured;
Controlling Entry into the Affected Area;
Recording the Scene by Photography and Documentation;
Keeping in Touch with the Press to Ensure Accurate News Coverage;
Recording Details of Persons Reported Missing.

By this time the first aid responsibility has been assumed by the ambulance service; search and rescue by the fire service and classification of casualties by the hospital service.

PLANNING FOR DISASTERS

It is therefore apparent that there must be a strong liaison between the various emergency services and this becomes one of the biggest tasks of the planners. Whilst the police must ensure that their own personnel have a working knowledge of the operational schemes of the other services, so the other services must have an operational knowledge of police methods of intervention. Plans must not therefore be made in isolation by any one service. There must, during the planning stage, be frequent discussions between all services and organisations likely to become involved in a joint intervention at a disaster. Such discussions will avoid the duplication of effort by the different services and will establish an agreed division of responsibility.

Planning can best be achieved by the establishment of a Joint Services Planning Committee on which the fire, police, ambulance, hospital and local authority organisations are represented. Naturally there are many more organisations who have a part to play at disasters, but it is my view that these should be co-opted or invited to attend particular meetings of the Committee when the Agenda contains items of interest to a specific body. By establishing the small committee with its members being those persons who have a definite role in an emergency, decisions can be made rapidly and the need to adjourn for discussion by individual services is overcome.

Not only must a particular geographical area have joint planning, but its plans must also link in with the plans of surrounding areas especially in the field of casualty documentation and press liaison procedures. It must be remembered that an incident will not acknowledge boundaries and might well occur straddling two or more authority areas. It is on such occasions that a fully integrated inter-service plan will prove its value.

Whilst incidents can cover a vast field it is important that there should be only one overall general plan which must be kept simple, short and concise. Such a plan will provide the essential backbone to any operation whilst additional appendices regarding a particular type of incident should be available to elaborate where necessary on the overall plan.

A major incident is a comparative rarity, probably only occurring once in the service of an individual. Therefore personnel, in general, will not have the opportunity, other than through training and exercises, to gain skills and develop expertise on disaster management. In so far as it is practicable, the major incident plan should be based on everyday working methods and procedures but employing them on a larger scale to deal with the disaster.

Plans must be kept flexible, thereby permitting a supervisory officer to readily adapt the basic procedures to suit the incident at hand. The plan will enable the detailing of personnel for a task without the need for explicit briefing because they will have been trained on the specific duties required under that plan. For example, if an incident produces casualties, then the police, through traditional acceptance, require details of those casualties. Where a formal plan exists the supervisor can quickly instruct an officer to go to a hospital and document the casualties. The officer needs no further instructions, he knows that on arrival at the hospital he must obtain documentation forms from a police storage cupboard, complete them and then ensure that the information is sent to the Police Casualty Bureau, either by telephone or motor cyclist. Where no plan exists the supervising officer would have to devise a procedure on the spot, fully brief officers in how to deal with the situation, and still leave the officer in doubt as to what is sup-

posed to be done and why he is doing it.

Having produced a plan, it cannot be supposed that it can be locked away until it is needed. Planning is a continuous process. Policies of an organisation can change, the experience of others might reveal shortcomings in plans, the topography of an area might change by the introduction of new industry, roads, services, etc., and above all telephone numbers have a habit of being changed overnight. On this last item there is a need to make a regular check. This means not just a check against a telephone directory but physical contact with the subscriber, thus ensuring that the person is still on the receiving end. Apart from verification of the number such a policy ensures that the organisation or service being contacted (and it might be simply a manufacturer or supplier of special equipment) is reminded that they are on the list of emergency agencies with whom the police have made a call-out arrangement or facility for the supply of specialist equipment.

Another simple, yet important point to be remembered is the danger of allocating certain tasks in the plan to named officers. The personal name of an officer should not be mentioned in the plan, the official appointment, the position involved, should be used instead. This avoids the ever necessary amendments to the plan because officers have been transferred to different everyday tasks.

From the foregoing it will have been gathered that there is a considerable amount of contingency planning that must be undertaken by the police, not only to ensure a full and adequate command of personnel, but also to ensure that plans exist which will rapidly ensure that the following tasks are taken care of without delay:

Effectively closing the area around the incident;
Controlling sightseers and diverted traffic;
Policing every junction on the essential ambulance routes to and from hospitals so as to ensure a smooth and uninterrupted journey for the casualties;
Establishing a working liaison with the press and news media to ensure that they receive positive and reliable information;
Documenting the casualties, victims and survivors at the hospitals, mortuaries and the scene and informing their next of kin;
Maintaining a list of agencies that are able to provide specialist manpower and equipment which is not stockpiled by the various emergency services;
Establishing a full co-ordination plan whereby all services tender their ideal operational requirements to the police who decide which facilities are best suited to each service without unduly affecting the work of another service and avoiding duplication of effort.

"Should the United Kingdom have a National Disaster Organisation? " The question has been posed many times in Parliament and elsewhere and after consideration the same answer "No" has been given. The various services in this country have shown that, when an incident occurs, they are able to effectively deal with it from local resources backed up by mutual aid arrangements with their adjoining organisations. To consider having a national service will involve establishing, amongst other things, regional or other designated intervention centres. If the country was to rely on such centres, albeit that they would presumably be well equipped, it is likely that a considerably longer delay would result before the "experts" attended the scene of the incident.

Having said this, there are certain avenues of standardisation that could be adopted, for example on the format and detail contained in casualty and enquiry record cards. Standardisation in this one respect would undoubtedly result in a more efficient service to the public and more especially the relatives and

close friends of persons believed to be involved in an incident. It would also ensure that, where more than one force was involved in an incident, one force could establish the central casualty bureau with the knowledge that neighbouring forces would be feeding into the bureau identical cards, not only in format but, more importantly in size, thus enabling them to be inserted directly into all index systems.

There are always lessons to be learned from both disasters and training exercises. Currently debriefing reports and papers on the lessons learned are invariably only distributed on a local basis. In this sphere of operations the experience of others could be made available to all forces by the establishment of a central index of reports on incidents and exercises. The index could be geared to ensure extraction from reports of the details of lessons and experiences useful to others and circulated by a digest to all forces for their information. The inherent concern that others would mock the mistakes of their colleagues could be removed by the simple use of reference numbers, which would be unrelated to the originating force and, would encourage originators to really set out in detail in their papers the full lessons learned from an incident or exercise.

There is nothing new in the concept of contingency planning. The earliest reference that can be found appears in the Bible:
Genesis, Chapter 6 Verse 14:

> "Make for yourself an ark out of wood of a resinous tree. You will make compartments in the ark and you must cover it inside and outside with tar".

An attitude of "it could not happen to us" must be avoided at all costs. All too often following an incident occurring somewhere in the world others become concerned for their own area, shake the dust off their old, stored-away plans and consider updating them – sometimes this happens too late and the disaster strikes an area when it is least prepared.

Mass Emergencies 3 (1978) 49–53
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THE AMERICAN RED CROSS RESPONSE TO DISASTERS

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Thirty-seven thousand times a year, on the average, trained American Red Cross volunteers and staff respond to a disaster scene somewhere in the fifty states and U.S. territories.

On May 21, 1976, for example, Red Cross workers were on the job in the midst of the devastating winds brought to Guam by Typhoon Pamela; assisting flood victims along the remote Kuskokwim River in Alaska; winding up an extended tornado relief operation in Mississippi, and aiding families in Martinez, California, after a bus accident killed 28 school children and injured many more. Within weeks, they were also assisting victims of major floods in Tulsa, Oklahoma, along the banks of the Snake and Teton Rivers in Idaho after the Teton Dam collapse, and in Houston, Texas.

Within the past fiscal year, Red Cross disaster relief efforts have found workers providing special emergency aid to the police, hostages and families of hostages during the Hanafi Muslim incident in Washington, D.C.; helping survivors and families of survivors of the Pan American Airways/KLM plane crash at Brooke Army Medical Center in Texas where the severely burned victims were taken. They were also providing help over scores of counties in the Appalachian mountain areas of Kentucky, Virginia, West Virginia and Tennessee after record flooding created extensive human needs.

The same 1975–76 fiscal year saw Red Cross disaster program expenditures pass $ 42,000,000, the highest level in the organization's history. These figures do not include the value of the services of tens of thousands of trained volunteers without whose participation the Red Cross disaster program would not only be infinitely more costly but well-nigh impossible to implement.

This report will describe the way in which the American Red Cross meets the emergency needs of disaster victims. First, some history. The American Red Cross disaster response dates back to 1881, when Clara Barton, founder of the then months old organization, mounted a relief effort on behalf of thousands of families whose homes, farms and small businesses were wiped out by a great forest fire in Michigan. During the next two and a half decades, Barton and her colleagues organized relief efforts at the scene of the Johnstown flood, the Charleston earthquake, the Galveston and Sea Island hurricanes, Ohio and Mississippi River floods, the Florida yellow fever epidemic and other major catastrophes.

In 1905, the Red Cross disaster program was given formal governmental recognition in the organization's Congressional Charter. Over the years, the responsibilities assigned the Red Cross in this charter have been viewed as both a legal and moral obligation. Federal legislation, including the Disaster Relief Act of 1974, has continued to recognize the role of the Red Cross.

In 1906, President Theodore Roosevelt

formally designated the Red Cross to take charge of relief to individual sufferers following the San Francisco earthquake and fire. During the seventy-one years since that catastrophe the Red Cross disaster program has become institutionalized as a basic and high priority part of the organization's broad array of health and welfare services and has been emulated in varying forms by Red Cross societies in many other countries. Although some of the disaster relief principles developed by Clara Barton – a far-sighted social worker who began her humanitarian career on the battlefields of the Civil War – are still basic to the Red Cross disaster program, the ways in which the program is implemented have undergone many changes.

Until the 1960's, the Red Cross was the primary relief and rehabilitation resource other than insurance for individuals and families affected by disaster. The Red Cross program encompassed not only mass care for victims on a group basis but also individualized recovery assistance which included funds for a variety of disaster-caused needs including repair and rebuilding of homes and replacement of essential household furnishings.

This assistance was provided on an individual casework basis involving careful analysis of each family's needs and family resources. The casework process, involving as it did a high degree of professionalism as well as a certain amount of paperwork, gave rise to some of the negative comments about the Red Cross which have been cited in the past, especially since the process involved took time and occurred during what researchers have called the "brickbat period" when the excitement had died down and impatience to return to normalcy was growing.

(It is interesting to note that today, with the Red Cross providing primarily emergency assistance during the first weeks after a disaster, such complaints are almost non-existent; they are directed against government programs involving long-range assistance and protracted paperwork procedures.)

Beginning in the late 1950's, Small Business Administration disaster loans became available as additional resources; Red Cross assistance was often developed as a supplement to what the family could reasonably afford to borrow. Red Cross assistance was predicated on disaster-caused *need*, not loss, because the organization's funds, derived entirely from voluntary contributions, were not sufficient for the Red Cross to act as an insurance agency might in covering all losses. However, what was considered essential need did change over the years; such items as washing machines, for example, became essentials. It should be noted, too, that Red Cross assistance included many things that would not have been considered essential by a public welfare agency and that the Red Cross took no liens on property rebuilt with Red Cross funds. All Red Cross assistance was, and is, an outright gift.

The Red Cross also considers such resources as savings in light of the family's total living plan, potential income, etc., so that a family that has been saving for a child's college education or has medical problems with a potential impact on either family living costs or income does not have to wipe out such savings to qualify for Red Cross assistance.

The federal government entered the family assistance arena even more directly when Congress passed legislation making funds available to pay off mortgages on earthquake-damaged homes in Alaska in 1964. The government has increasingly become the primary resource for meeting long-term recovery needs such as the building and repair of homes. The broad array of programs included in the Disaster Relief Act of 1974 includes disaster food coupons, unemployment insurance, temporary housing for up to a year – rent free, low interest disaster loans and state-administered and partially state-financed individual family grants which may provide up to $ 5,000 for urgent needs.

The impact on the Red Cross program of the broadened government programs can be seen in this striking statistic: If the Red Cross

was still conducting the same program after Tropical Storm Agnes in 1972 as it had after the northeastern floods of 1955, Red Cross expenditures would have been approximately $ 220,000,000 instead of the $ 23,000,000 actually spent to provide emergency assistance only. Obviously, no agency dependent on voluntary contributions as its source of income could have funded so large an expenditure.

The American Red Cross disaster program today is essentially one of providing emergency services and assistance. Additional recovery assistance is provided only when government programs are not available to a family or that assistance is not adequate to cover essential uninsured losses. On Guam, for example, there were a number of families whose needs were not adequately covered by the $ 5,000 grants and who could not qualify for SBA disaster loans.

The steady growth of flood insurance coverage also impacts Red Cross disaster expenditures. Just as the advent of Homeowners Comprehensive Insurance reduced the need for Red Cross assistance following tornadoes, the expansion of flood insurance in recent years is beginning to have a comparable effect. Although such coverage is still spotty, a comparison of the total claims paid out after Agnes in 1972 to the total claims paid out in the same states following Eloise three years later shows a tenfold increase in flood insurance payouts even though the total damage was considerably smaller.

In spite of both federal programs and expanding flood insurance coverage, however, average Red Cross disaster relief expenditures keep rising. More people seem to be affected by disasters. Also, local Red Cross chapters have improved their response to small local disasters so that the annual total has risen from about 12,000 to over 37,000 in the past ten years.

The Red Cross program today includes the following: Mass care – shelter, food, clothing and supplementary medical assistance for disaster victims and evacuees and food and other assistance for emergency workers (during a recent prairie fire in North Dakota, for example, the Red Cross fed 1,500 firefighters; in the Appalachian floods, the Red Cross fed tens of thousands of victims and emergency workers, sheltered *over 21,000* in 213 shelters). While it has been Red Cross experience that as many as two-thirds of the homeless may move in with friends and relatives, in major disasters there are still many who do need temporary shelters, sometimes for many weeks, and that the friends and relatives who take people in after a disaster may also need food, cots and blankets from the Red Cross to augment the household's capacity. The Red Cross also distributes cleaning supplies, operates aid stations when needed, establishes health facilities in shelters, handles thousands of welfare inquiries from anxious relatives outside of the disaster area, and provides blood and blood products for disaster victims when needed.

Individualized assistance: The Red Cross also provides individual families with funds for food, clothing, essential furnishings so they can begin to resume normal living in their own homes or temporary quarters, health needs – including replacement of lost eyeglasses, dentures, prostheses, prescription drugs, etc., emergency transportation, rent for up to thirty days, minor home repairs to make a home quickly livable again, and replacement of personal occupational clothing and tools so that a wage earner can return to work if his job has not been disrupted by the disaster.

Additional recovery assistance may be provided as indicated earlier, where government programs are not available or are inadequate to meet a specific family's needs. An example of this kind of situation occurred last year when the same storm system caused tornado damage in Mississippi and Arkansas. The individual family grant program was implemented in Arkansas but not in Mississippi. As a result, Red Cross assistance was much higher in Mississippi, where 150 families received

Red Cross help that was provided by the Section 408 grants in Arkansas.

Red Cross assistance is, insofar as is practical and realistic, provided on a standardized basis. Volunteers and staff in the field utilize price guides that provide uniform amounts of assistance based on age and family size, insofar as many items of assistance are concerned. This system, which has made it possible to streamline the Red Cross relief-giving process, was instituted in 1971 to eliminate the possibility of inequities from the previous system which permitted a great deal of judgment on the part of the caseworker and often led to lower income families receiving less than middle income families for such help as food and clothing.

Preparedness planning is the key to successful Red Cross relief operations. The Red Cross agrees with those who decry ad-hoc measures instead of adequate preplanning. On the national level, the Red Cross works closely with the Federal Disaster Assistance Administration, the Defense Civil Preparedness Agency, the National Weather Service, the Department of Agriculture, the Military and the Coast Guard, the United States Geological Survey, the Department of Health, Education and Welfare and other agencies with disaster-related programs. The Red Cross also has working relations, often spelled out in written statements of understanding, with a variety of non-governmental agencies including the AFL-CIO, National Defense, Transportation Association. Catholic Charities, Mennonite Disaster Services, Lutheran Church, Southern Baptists, Seventh Day Adventists, Salvation Army, American Legion, American Hospital Association, American Humane Society, the Methodist Church among others. Comparable working relationships exist on the state and local level but, obviously, this varies widely depending on the disaster experience and concerns of local communities. Red Cross response begins with over 3,100 local chapters coordinated by more than sixty division headquarters which are in turn supported by the national organization structure.

Such planning ranges from participation in the FDAA-sponsored earthquake response plans to coordinating the disaster response efforts of thirty-five local agencies in the city of Worcester, Mass. The Red Cross has its own short-wave radio communications network, telecommunications and supply systems, as well as a variety of training courses covering all basic elements of disaster planning and response.

In recent years, the Red Cross has also moved into the field of advocacy, aiding disaster victims in obtaining government benefits, espousing broader federal programs, promoting the National Flood Insurance program, and improved land use measures and building codes. A recent Red Cross motion picture, "Disaster Before It Hits Home" hits hard at the need for such measures to prevent disasters before they occur. Red Cross TV materials include short films on flood, tornado, hurricane and fire safety, flood cleanup, and a short explanation of available Red Cross and government resources. Much of this material is in English and Spanish.

Every effort is made to reach all segments of a disaster-stricken population. In big cities, where Red Cross volunteer disaster action teams respond to fire after fire in inner city areas, the organization is closely identified with local groups of all kinds. In the Mississippi Delta, after a series of bad tornadoes in 1971, the Red Cross developed a rural response project to train local people to be a part of their community's disaster preparedness and response.

One example of how such planning pays off was during the 1977 snowstorms which paralyzed a large part of New York and other states. In snow-marooned Batavia, New York, not only was the local Red Cross chapter able to assist some 3,000 stranded travelers and Batavians, but on a nearby Indian Reservation the snow-bound Indians found a trained Red

Cross volunteer in the midst and providing assistance. In Buffalo, Red Cross volunteers using snowmobiles and skis brought food to people stranded in their office buildings and factories.

The Red Cross also works closely with some disaster research groups (the University of Massachusetts recently Xeroxed *15,000* pages of Red Cross records!) of all kinds in the hope that such research will eventually contribute to more effective disaster planning and relief operations and to the mitigation of disaster hazards. While the Red Cross itself sponsors little research outside of its Blood Program because it lacks the funds to do so, Red Cross staff participate extensively in workshops, on advisory committees and as resources for various NSF-funded projects.

Mass Emergencies 3 (1978) 55–59
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THE AMERICAN NATIONAL RED CROSS AND IMAGE MAINTENANCE: A RESEARCH NOTE*

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The sociological literature concerning disasters has typically indicated that members of the public with disaster experience hold a negative image of the Red Cross. For example, Barton (1970) notes that, "The recurring fact ... is the existence of a significant minority who express hostility toward the Red Cross and similarly professionalized relief agencies." (p. 297).

Moore (1958) in a study of two tornado disasters observes that the Red Cross was a major source of relief for families in both communities, but that respondents also ranked the Red Cross among the lowest in terms of its adequacy of performance. Of twelve organizations listed, the Red Cross was ranked twelfth in one community and eleventh in the other. This is a surprisingly negative evaluation for an organization which provided relief to more households in both communities than any other single agency.

Similarly, in the classic study of the Flint-Beecher tornado, Form and Nosow (1958) found that the Red Cross suffered the greatest number and percentage of negative evaluations of any of the more than fifty organizations mentioned in interviews with victims. This pattern of negative responses was interpreted as being potentially due to the Red Cross' relatively long-term involvement in the rehabilitation process.

Quarantelli and Dynes (1972) summarized such findings. They state that "Townspeople often see the Red Cross and Governmental rescue teams as impersonal, unsympathetic, cold, and insensitive to local problems and issues." (p. 70). Thus while the Red Cross is typically viewed as *the* disaster relief agency, evidence has appeared to indicate that disaster experience tends to generate negative evaluations of the agency.

There are a number of factors which may account, in part, for the negative evaluations. First, the dual structure of professionals and volunteers utilized by the Red Cross has been offered as a source of local resentment. Disaster operations are generally directed by professional staff members whose actions, at times, may lead to conflict with local volunteers in the organization (Adams, 1970; p. 394–5). Second, regional officials typically inundate a community during a disaster. Unfamiliar with local social, economic, and cultural conditions, these "outsiders" are often resented. As Quarantelli and Dynes (1972) observed: "The victims feel that it is *their*

* The research reported in this paper was supported by Grant Number ENV77–10202 from the National Science Foundation Research Applied to National Needs (NSF/RANN) Project. The opinions and interpretations presented are those of the authors and do not necessarily reflect the opinion of the National Science Foundation.

The authors wish to acknowledge the dedicated assistance of Charles E. Faupel and Claire M. Renzetti, who worked during the summer as interviewers and assisted in a number of other related tasks including interview schedule construction and pre-testing.

disaster and they do not want outsiders coming in to take credit for the work done during the emergency period." (p. 70). Third, unlike other relief agencies, the Red Cross continues its operations into the period of long-range relief and restoration. As has been noted, it is during this period that social conflict tends to emerge in the disaster process. (Dynes and Quarantelli, 1971; Wenger, 1978). Fourth, not only are Red Cross officials frequently "outsiders," but in the past regulations governing the issuance of their assistance during the rehabilitation phase tended to conflict with the open, "no questions asked," aid given during the emergency period (Adams, p. 395). Whatever the reasons, however, the literature has traditionally been consistent in demonstrating that the Red Cross suffers from a negative image among disaster victims.

With respect to this literature, two observations can be made. First, although the traditional studies were consistent in their findings, recent research reported by Wright (1976) once again raises the question of the image of the Red Cross. Wright reports that following the Wilkes-Barre flood, the Red Cross when compared to other organisations, did not receive the consistently negative evaluations reported in the past. This study would seem to indicate that either the situation is changing, or that faulty generalizations may have been drawn from limited cases in the past. Inasmuch as the Red Cross has modified its regulations concerning long-range assistance, it may be that Wright's findings are more a reflection of a changing situation.

Second, all of these investigations were conducted with samples of disaster victims immediately or shortly after the impact of the disaster agent. As such they are indicative of immediate post-disaster observations by victims, but do not directly address the question of the long-term effect of disaster experience and other factors on the image of the Red Cross. The image of the Red Cross, or any other relief organization, is the result of numerous disaster experiences that combine in an interactive manner to produce the agency's legacy. To examine this issue requires studying communities which have experienced repeated disasters at a point distant in time from the most recent impact.

It is with respect to these two issues that this paper examines the image of the Red Cross. Simply put, we are interested in considering the evaluation of the Red Cross in communities that have experienced disasters in the past. On the basis of prior investigations we would expect that the agency would be negatively evaluated by at least a significant minority of the residents of such communities. The extent to which such observations hold for the long-term image has not been investigated previously.

METHODOLOGY

Currently we are engaged in an investigation of disaster knowledge and planning in three mid-western communities. These communities were selected because they appeared to possess elements of "disaster subcultures". One community is a flood community that has experienced serious flooding on two occasions in the last decade, although no major flood has occurred since 1969. Another of the communities has experienced tornadoes. It has been hit twice in the last eight years, the most recent being in 1973. Finally, a community with extensive hurricane experience was selected. This community is located on the Gulf Coast and has experienced numerous impacts and threats over the years; its last major experience was in 1969.

Within each community a random sample of households was selected. In each community approximately 300 interviews were conducted by telephone with response rates varying by community from a low of 67 percent to a high of 85 percent. The respondents were queried about their knowledge of disaster be-

havior and hazards, their past disaster experience, and their expectations for emergency action on the part of local organizations.

Among the questions asked was the following: "Do you agree or disagree that the Red Cross has come to be regarded by disaster victims in the United States as a very helpful disaster-relief agency? " The answer to this question combined with information regarding the respondents' disaster experience constitute the data-base for this report.

Findings

Overall, 907 respondents answered the central question. Of these, 748 (82.6 percent) agreed, 131 (14.4 percent) disagreed, and 27 (3 percent) indicated they did not know. Initially this speaks very well for the image of the Red Cross. The overwhelming majority of these respondents in disaster communities apparently believe that the Red Cross is positively viewed by disaster victims.

However, breaking down the data by the previous disaster experience of the respondents yields results which would apparently support the previous literature. As can be seen in Table I, 16.6 percent of those with disaster experience disagreed with the statement, while only 9.5 percent of those without such prior experience disagreed. The differences in the two distributions is statistically significant (Chi Square = 9.8, $p \leqslant 0.01$).

It should be noted, however, that the statistical significance of the above finding rests on a difference of only 7.1 percent between the disagree responses of the two experience categories. Although the relationship is statistically significant, the difference of 7.1 percent is probably of marginal substantive importance.

Further analysis reveals that the relationship between perceived Red Cross image and disaster experience varies according to community. Table II displays the relationship in each of the three communities. In two communities there is clearly no statistically significant relationship exhibited. In the flood community the Chi Square statistic does indicate statistical significance [1].

TABLE I

Crosstabulation of Responses to Red Cross Image Question by Respondents' Experience[a]

Image Response[b]	Disaster Experience Yes	No
Agree	81.0% (512)*	86.1% (236)
Disagree	16.6% (105)	9.5% (26)

*Numbers in parentheses indicate raw values. Chi Square = 7.3 ($p \leqslant 0.05$). [a]The question posed was "Do you agree or disagree that the Red Cross has come to be regarded by disaster victims in the United States as a very helpful disaster relief agency." [b]"Don't Know" responses have been eliminated from the table.

TABLE II

Crosstabulation of Responses to Red Cross Image Question by Respondents' Disaster Experience and Community[e]

Community	Hurricane[a]		Tornado[b]		Flood[c]	
Image Response[d]	Experience		Experience		Experience	
	Yes	No	Yes	No	Yes	No
Agree	78.3% (209)*	83.3 (30)	87.6 (184)	85.9 (79)	76.8 (119)	87.0 (127)
Disagree	19.5 (52)	11.1 (4)	11.0 (23)	9.8 (9)	19.4 (30)	8.9 (13)

*Numbers in parentheses indicate raw values. [a]Chi Square = 0.82 (n.s.). [b]Chi Square = 0.00 (n.s.). [c]Chi Square = 5.88 ($p \leqslant 0.02$). [d]"Don't Know" responses have been eliminated from the table. [e]The question posed was "Do you agree or disagree that the Red Cross has come to be regarded by disaster victims in the United States as a very helpful disaster relief agency."

DISCUSSION

Clearly, in some instances, disaster experience and presumed contact with the Red Cross will generate ill will, or the perception of negative evaluations by others, toward the Red Cross. However, it can reasonably be offered that this observation may apply to any organization involved in relief activities, even under the best of circumstances. Although the data presented would appear to statistically support this conclusion, and the findings are consistent with the bulk of previously reported research, the difference in the percentage of those who perceive a negative image in the experienced and inexperienced categories is relatively small. It is so small that it may not be of great importance.

One additional observation can be made from the data presented. Earlier it was mentioned that the Red Cross has altered its regulations regarding eligibility for and the amount of relief. This alteration involves a shift from decision criteria based on need to a system based on "across the board" or equal treatment. In the past the Red Cross has always proceeded on a "no questions asked" basis during the emergency period and then shifted to relief on the basis of need during the longer-term rehabilitation period. As Adams indicates, "The policy of meeting 'need and not loss' sometimes appears to victims of a disaster to be a program designed to reward persons who have not planned for an emergency and punish those who have" (p. 395).

Of course the sudden shift from the relatively open emergency regulations to the restrictive rehabilitation regulations did not aid the organization's image. However, since Hurricane Camille in 1969, the Red Cross has shifted toward a more equitable program of standardized relief during rehabilitation based on loss [2]. By chance, not design, two of the communities studied had their most recent major impacts in 1969 or prior to this change in policy. One of the communities' (tornado) most recent impact was in 1973; after the policy change in 1971.

Comparing the responses of those with disaster experience, we find that 19.5 percent and 19.4 percent disagreed with the statement in the hurricane and flood communities. However, only 11.0 percent disagreed in the tornado community. It should also be noted that among those without disaster experience there appears to be no significant differences in the "disagree" percentages in each community.

Another way of looking at this is to compare the differences in percentage "disagree" responses between the experienced and inexperienced groups in each community. The tornado community shows a difference of only 1.2 percent, while the hurricane and flood communities show differences of 8.4 percent and 10.5 percent respectively. If this difference is interpreted as a "percentage loss in image," it is obvious that the Red Cross has fared better more recently.

In conclusion, it appears that the severe negative evaluations of the Red Cross reported in the short-run following disasters do not persist in the form of an organizational legacy over longer periods of time. There are, perhaps, three possible explanations for differences between short- and long-term perceptions. First, as noted, the change in regulations concerning rehabilitation relief and a resultant less apparent shift in regulations from the emergency to rehabilitation phases may have reduced even the short-term hostility among disaster victims. Although the evidence reported here does not directly address the question of the effects of changes in these regulations, it does suggest the hypothesis that the Red Cross has garnered some benefit in terms of its public image [3].

Second, it should not be forgotten that the Red Cross is an agency which has public contact continuously, not just during disaster periods. The agency provides numerous other

community services on a continuing basis. Over the long-run, these services might reasonably be expected to mitigate against any negative feelings generated in the midst of crisis situations.

Finally, the Red Cross' image is also manipulated through the mass media. The agencies relief efforts are faithfully reported when disaster strikes. Furthermore, it is not at all unusual to be reminded repeatedly of the agencies' services through public service messages or advertisements soliciting contributions. In all probability all of these factors contribute to the overall image of the Red Cross.

These findings clearly indicate that the previous literature, by concentrating on more immediate disaster reactions, may have misconstrued the Red Cross' true public image among disaster victims. The discrepancies between previous findings and ours would indicate that further research should proceed with the goal of investigating the process of image development for relief agencies. Perhaps then, in the professional literature, the agency's cross will be less of a burden to bear.

NOTES

1 In an analysis such as this the "Don't Know" response category may become of statistical importance and even alter the interpretation of the results. For this reason significance tests were performed both including and excluding that category. Since no difference in outcome was found only the agree and disagree categories are used in the Tables.

2 Information concerning the shift in Red Cross rehabilitation relief regulations was obtained in a conversation with Mr. Roy Popkin, Assistant National Director of Disaster Services for the American National Red Cross. The authors wish to thank Mr. Popkin for his kind assistance.

3 Additionally it should be noted that, concurrent with the change in regulations, the Red Cross has had a reduced involvement in long-term, high cost rehabilitation which cannot be standardized (e.g. replacement of structures) as direct federal moneys have become available. It could be suggested that the federal bureaucracy has, perhaps, absorbed some of the image problems involved in such projects.

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Mass Emergencies 3 (1978) 61–65
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NEW ASPECTS OF THE SOCIOLOGY OF DISASTER: A THEORETICAL NOTE

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If a sociologist speaks of a "disaster" he inevitably means its social causes and effects, regardless of whatever concept of society he consciously or covertly bases his thinking on. In other words: while an earthquake in the uninhabited Sahara may well be a "disaster" to a geologist, such a classification would not be relevant to a sociologist. In general he would claim that a disaster is only interesting to a sociologist to the extent that it entails social implications. Hence the question of social (more specifically, collective) behavior in such a disaster-situation becomes vitally interesting. Consequently, the phenomenon of "disaster" can never be studied detached from collective behavior theory.

THE CONCEPT "DISASTER" IN SOCIOLOGY

It seems significant to us and well worth mentioning that recent West German sociology (i.e. post–1945) is unfamiliar with an equivalent of the American "sociology of disaster". This fact may be symptomatic of that repression of historical memories of events prior to the defeat of Nazism which has been characteristic for post-war society in the Federal Republic and from which its sociology has been no exception. Thus it is easy to understand that – due to a lack of domestic research – theoretical and empirical work done in this field in the Federal Republic first built upon American "sociology of disaster" and has only now (with the work of Wieland Jäger, 1977a, b) begun to take critical issue with it.

Previous definitions of "disaster," whether products of everyday thinking or of the "sociology of disaster." contained revealing and hence highly significant elements. To begin they construed disasters as something "sudden"; a break in the continuity of normal events. They proceeded from the premise that disasters (crises) were "events" which elicited social behavior only in crisis situations (i.e. are "reactions to events," cf. Jäger 1977a, b). Even if one could thereby establish a connection between disaster and social behavior ("reaction"), the disaster took on a superordinate and thus not exactly social character. By perceiving a "disaster" as a sudden event which occurs independently of, and in a certain sense isolated from, normal social processes, this type of sociology came to an analytical dead-end. Those affected by the disaster could only react. Taken to its ultimate consequences, this undialectical way of looking at things led to a defensive approach to the problem. A system which had "suddenly" been disturbed must be protected. The disaster itself remained on the level of an "act of God," against which human action was obviously incapable of accomplishing anything.

Two lines of reasoning decisively influenced this way of thinking. For one thing, an event which could be described in terms of the natural sciences was confused with those of

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its effects which unfolded in a coherent process and which could therefore be described by the social sciences. This resulted in misleading analogies from the realm of the natural sciences. The disaster then became a type of experimental interference from without, against which a system-bound process simply reacts. Secondly, the influence of a "mob-psychology" perspective (in the tradition of Le Bon) made its baneful presence felt in analyses of collective behavior. "The tradition of European social and cultural criticism combined the phenomenon of collective behavior with the vision of a whipped-up uninhibited mass of hoi polloi, a vision which could only be tackled with the categories of a peace-and-order-psychology" (Heinz/Schöber 1972). Nowadays one operates with such concepts as "panic," "melee," "hysteria," etc. This suggests behavior on the part of those collectively affected which breaks loose from all social rationality, such as during a disaster.

As one can easily recognize from these two ways of thinking, the sociology of disaster was and still is basically molded by concepts deriving directly from the system, concepts which are therefore blatantly apologetic. In accordance with the character of the social "systems" which these ways of thinking favor, the latter expose themselves to charges of being "capitalist" sociology. For the predominant conditions, the political, economic and cultural spheres are not called into question, but rather declared as the not-to-be-disturbed order of things. The result of this shortsightedness, however, is that with these points of departure neither the disaster itself nor the behavior of the participants can ever be explained as anything but "deviance" from "normal" behavioral modes set off by "unstructured lack of clarity". This is Smelser's own expression when he says: "The clearest cases of unstructured lack of clarity occur in situations of 'completely incomprehensible disasters'...." (1972).

Summing up, we can now say that in the sociology of disaster up until now, the disaster has (a) been a sudden, unexpected break in the continuity of events (in a normal situation, in normal times), an intrusion of something alien, hence (b) something not to be derived from scientifically determined social processes but which (c) stems from seemingly obscure symbolic contexts (out of the realm of "nature" or "technology"). The mystification of disaster and of collective behavior entailed by it could thus be retained, even if sociological assertions of limited scope, such as H.E. Moore's "disaster culture" (1956), were now nonetheless possible.

For various sociological disasters, strategies (practical as well as theoretical) have been developed from these preliminary theoretical or pre-theoretical efforts. In general we can clearly see that the goal of all of these strategies is to repress the disaster as an event and to camouflage its causes and effects at decisive points by trying to re-establish a previous "normal" state of affairs once again. In practice the conviction has established itself that one should "return to the normal routine," in other words, that a disaster can only be effectively combatted with bureaucratic (administrative and organizational) measures, something which can all too easily be squared with a structural-functionalist sociological approach. Accordingly, collective behavior on the part of the disaster's direct actors is defined as quasi-uncaused, as "spontaneous," and is therefore only tolerated as long as organized relief is not available because this will then re-establish the normal state of affairs. Finally intervention on the part of the public in a disaster is perceived by the "competent authorities" as an undesirable disturbance. It is ironic, that the most disturbing behavior is often that of those sections of the public who most uncritically and compliantly adopt the view that the disaster is an exotic event, for example, the uninvolved gaping onlookers at the scene of the disaster,

Organizationally this basically publicophobic attitude is revealed especially in the development of disaster defense in the German Federal Republic which, for the time being, has been finalized in the "Act for the Extension of Disaster Defense" (Gesetz über die Erweiterung des Katastrophenschutzes, KatSG). In addition, the linking-up of disaster-defense and civil-defense organizations with the military precautions of civil defense and civil-defense planning makes intervention on the part of the public even more of a disturbance to the competent authorities. What then would be the reaction of a population living in an area predicted to be a scene of operations but which has few or no shelters at its disposal? Will it simply "remain at home" as NATO with its "stay-put-policy" requires, and as the Federal legislator tries to ensure in section 12 ("Regulations on where to stay") in the Act on the Extension of Disaster Defense of 1968? " (Dedekind).

NEW PATHS IN THE SOCIOLOGY OF DISASTER – THE ANALYSIS OF ANTAGONISMS

A "disaster" must at least be seen as a social process whose evolutionary regularities have already been predestined in the regularity of the foregoing unfolding of other social processes. These evolutions are propelled and characterized by social antagonisms (conflicts of interest). Therefore we must, in addition, investigate whether or not, and in what manner, the theory of historical and dialectical materialism may be made the basis of an analysis of disaster events and their ensuing collective behavior. As Heinz and Schöber put it: "Such a procedure means that the analysis of collective phenomena begins with an analysis of the mode of production of the society in question and of its development" (1972). For an investigation in the German Federal Republic this means that we must include the social conditions of an advanced capitalism in the analysis. Therefore the entire social structure (not just the formal state structure), all classes and all groups must be taken into consideration. And for the student of disaster this implies that "access to social reality cannot be achieved in a completely detached contemplative manner" (Heinz/Schöber 1972), a view which is held by many sociologists of disaster. But what follows from this? Precisely this: practical action; and not only on the part of organizations, but collective action on the part of those affected, "in the course of which the theory must stand the test and practical experiences must be integrated into the theory" (Heinz/Schöber 1972).

According to Blumer, "social problems must be seen as a product of a process of collective definitions," (1970) and definitions reflect social interests. Once this basic assumption is made, our preliminary efforts in the sociology of disaster will clearly indicate the impossibility of a valid definition of disaster for an entire society. In societies which are characterized by antagonisms, let us say, between the two protagonists on the labor market (capital and labor, – in Marxist terms the two basic classes of a capitalist society), it would be superficial to try to employ as one's starting point a definition common to all classes. This would also fail to recognize the historical dimensions, as it does not take account of the fact that those who rule bring their point of view to bear in the definitions which they construct and utilize as instruments of domination. Speech and thought are just as partisan as actions. (Let us just consider the word "strike," in order to recognize at once with what diametrically opposed concepts this concept is associated according to one's position on the labor market or, according to one's class position.)

If we proceed from the premise that the disaster is defined from out of a specific consciousness of class or group, and that this precise consciousness is essential to the

form of social (collective) behavior engaged in, then we can conclude from this that each social class brings to bear its own rationality of ends and means. In the extreme case, the rationality of one class would not be comparable to the rationality of the other class. Despite this, both classes may act rationally. Exaggerating somewhat, the question might be formulated something like this: Would it not be more proper and realistic in a disaster to speak of an antagonistic disaster-society with disaster-beneficiaries and disaster-victims?

What a benefit or a loss is, is something which is already grounded in the values of a particular society. In a disaster one does not forget one's family, one's place of business, nor does one forget one's possibilities of exercising power. What one does has already been learned – *nolens volens* – and what one fails to do is what has been learned but forgotten. This latter is important now: disaster action is not easily performed by many because previous social processes have, in regard to individuals, classes or groups, destroyed or inhibited knowledge or deliberately distributed it unevenly. "Disasters" are the results of the fact that "social secrets were continually produced. If dangers did not have secret causes, then the lightning could have struck 'out of the blue' " (Clausen and Jäger, 1975).

The disclosure of hidden dangers and of hidden behavior-options during the "disaster" is responsible for the fact that disaster-behavior can appear as "radical" and/or "innovative" compared with previous behavior. The broader, more comprehensive, the totality of roles which is activated in such behavior, the more radical will be the behavior. The less conjectured an act (conjectured in general or by a particular actor or collectivity), the more innovative it will be. But even the way in which radicalness and innovation act together must be studied again and again in each disaster, in each case in conjuncture with a study of previous historical processes.

Disasters are thus a "normal" (and often highly revealing) component of the social systems themselves. This depends on the regularity with which antagonisms in a particular society allot knowledge to different classes or groups. If one mentions a "disaster," then it can only mean that a potential for social conflict has become astoundingly acute and must simultaneously be blunted by a suitable redefinition of the situation: after all, it is "only a disaster," the system is all right. But through this, society in reality undergoes a metamorphosis. It depends upon the radicalness and innovation of the specific disaster-behavior "during the disaster" – a metamorphosis which is extensive in cases of greater radicalness and rapid in cases of greater innovation ("all too rapid" for those who define "disaster") (cf. Clausen 1978).

In analyzing "disasters" and collective behavior the following points should be studied.

(1) In which "languages" of which classes or groups is reality (the disaster) being defined? Who, therefore, is in command of the situation?

(2) How radical and/or innovative is collective behavior in "disasters"? And on the part of which classes or groups? This especially against the background of their position in the process of production, distribution and profit realization.

(3) Whether or not classes or groups also influence each other before, during or after a "disaster". Here the temporal dimension short, medium or long-term influence must be considered. For whom do things change rapidly ("too rapidly")?

(4) What are the special goals and tasks, the interests of institutions and organizations in case of a "disaster"? In this aspect the role played by propaganda must be included, as well as non-disclosure and misinformation about the various contexts and processes in a "disaster," in particular the role played by the mass media.

(5) In addition this applies more specifically

to "disaster defense organizations" and organization associated with them, most especially those that bear arms i.e., soldiers, border guards, police.

(6) Who profits or loses in and from the "disaster"? Here the question of an "antagonistic disaster-society" should be considered in particular, a society which – or so it is assumed – is subject to the same laws as antagonistic "normal society", but here exposed to extreme conditions of profit realization or loss minimization, backed up by extreme social sanctions.

(7) How can suitable research tools be developed in order to encompass the specific collective behavior in those populations to be investigated? Behavior and attitudes before a "disaster" (the "normal situation"), during a "disaster" (the "exceptional situation") must all be subjected to an equally rigorous investigation.

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Mass Emergencies 3 (1978) 71–81
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SERVICE UTILIZATION AND ADJUSTMENT PATTERNS OF ELDERLY TORNADO VICTIMS IN AN AMERICAN DISASTER*

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INTRODUCTION

On May 6, 1975, a tornado touched down in the southwest corner of Omaha in the state of Nebraska. It traveled in a northeasterly direction through residential, commercial, and industrial areas of the city, leaving a path of destruction nine miles long and 600 yards wide, for a total of 2,000 city blocks. Both the death and injury tolls from the disaster were amazingly low; only three persons were killed while 157 were treated in hospitals for generally minor injuries.

Federal, city, and agency officials responded immediately to the tornado, resulting in the quickest recovery to date following a major natural disaster. The entire team from the United States Federal Disaster Assistance Agency arrived in Omaha the day after the storm. The cleanup effort initiated by city government officials and disaster agencies was accomplished within two weeks.

The Omaha tornado was unique, not only because of the low death and major injury rates as well as prompt cleanup, but also because of the homogeneity of the residential area affected. The section was generally composed of white, blue-collar to upper middle-class individuals living in single family residences. The victims tended to be adequately insured against disaster-related losses. Thus, although they suffered material loss and disorganization for a period of time, they did not generally experience debilitating economic loss or the personal crisis caused by death or major injury of family members.

In September of 1975, the Gerontology Program of the University of Nebraska at Omaha contracted with the Eastern Nebraska Office on Aging (ENOA) to examine: (1) the social and psychological impact of the tornado on the older population of Omaha, (2) the service delivery efforts of ENOA and other agencies serving an aging clientele, and (3) the priorities necessary to perform significant and meaningful services for the elderly in subsequent natural disasters. Although this investigation focused on the aged (i.e., those victims over 60 years of age), comparable data were gathered to illustrate the similarities and differences of responses for younger victims as well as "non-victims."

*The study from which this analysis is drawn was supported by research funds provided by the Department of Health, Education, and Welfare (Grant Nr. 90A444/01) through the administrative auspices of the Eastern Nebraska Office on Aging, Omaha, Nebraska.

THE "ELDERLY" VICTIM

Until quite recently, there have been very few age-specific references as to how the elderly fare in natural disasters. Consequently, the information from these studies is limited and occasionally inconsistent. When the elderly are identified, it is generally as one of many segments of a disaster-ridden community (Marks et al., 1954; Moore, 1958; and Form and Nosow, 1958). Specifically, the aged are mentioned as representing a proportionately higher number of the victims (Titmuss, 1950; Bernert and Ikle, 1952; Moore and Crawford, 1955; Wallace, 1956) and classified as one of many groups which tend to suffer greater financial loss, physical injury, and emotional disturbance (Marks et al., 1954; Moore, 1958; Form and Nosow, 1958; Loomis, 1964; Parr, 1970; White and Haas, 1975). Although older persons apparently have experienced the greatest losses and need the most services, they have either requested or received less in available disaster relief (Baldi, 1974; Poulshock and Cohen, 1975; Bolin, 1975; Drabek, 1975; Friedson, 1961).

Given the above inequities and general lack of reliable information, the present paper pursues two sets of data. The first involves a number of extensive interviews with young and old disaster victims, along with a sample of individuals not directly affected by the tornado. The second set is derived from interviews and consultation with numerous service providers identified as playing a significant role in the disaster recovery process. Such an approach to data collection gives the research both an objective and subjective dimension. Besides the "standard" approach of describing and analyzing the findings, this report addresses the dual concerns of the social scientist and the policy planner, in that it points to several specific service implications (Bell, 1975; Kara, 1977).

THE SAMPLE

The present data are drawn from a series of interviews with a *quasi-experimental sample* of tornado victims residing in the urban area of Omaha, Nebraska, in the fall of 1975. In correlating information sources, victim lists were compiled through reference to (1) police records, (2) the Eastern Nebraska Office on Aging, (3) the Red Cross, (4) the U.S. Department of Housing and Urban Affairs, (5) the Mennonite Disaster Service, (6) the Salvation Army, (7) the National Guard, (8) the Interfaith Human Services Disaster Task Force, (9) the fire department, and (10) numerous hospitals and emergency service centers throughout the affected community. Thus enumerated, victim groupings were subsequently stratified on the basis of *age* (i.e., those 60 years of age and older versus those from 18 to 59 years) and the *degree of damage*

TABLE I

Background Characteristics of Interviewed Persons By "Treatment Condition"

Disaster Status	Mean Age	Educ.	Median SES[a]	Monthly income	Male	Fem.	White	Married[b]	Occupational status		% who are[d]		
									Retd.[c]	Empl.	Prot.	Cath.	Jew
Victims (N = 200)	52	13	55	$810	90	110	198	153	60	140	45.5	44.5	3.0
Non-Victims (N = 100)	54	12.3	59	$740	49	51	97	71	47	53	49.0	44.0	2.0

[a]In the absence of female employment, the respondent's SES was determined by reference to her husband's work.
[b]Spouse living with each person,
[c]Retirement status based on self-report.
[d]"Other" and "no preference" categories have been omitted.

sustained to the households in question (i.e., dichotomized designations drawn from police and actuarial estimates). The final sample consisted of a total of 200 randomly chosen victims and 100 "controls," the latter carefully matched to the victim population through the use of census and related materials.

As can be observed from Table I, the matching of "control" to "experimental" subjects has produced two fairly comparable subsamples of adults. For the most part, both groupings are made up of roughly equal proportions of males and females. The respondents are white, nearly equally divided in terms of religious affiliation, and the mean age of "experimental" versus "control" residents is fifty-two and fifty-four, respectively. The median socioeconomic status rankings (Reiss, 1961) for both groups, in turn, are fifty-five and fifty-nine. It should be noted, however, that "experimental" residents have slightly higher median incomes and formal education. "Control" respondents, on the other hand, exhibit proportionately more retired representatives.

From the standpoint of national comparison, data cited by Schulz (reported in Bell, 1976) and Carp (1972) suggest the present sample to be overly representative of upper occupational levels. This suggestion is borne out by two related indicators – education and income. The mean educational level of the sample, for instance, was 13 years, a figure well above the national average for all age groups (Daniels, 1974). In addition, the median income of the respondents was $ 780 per month. This figure is considerably greater than that indicated by Streib and Schneider (1971) or Bogue (1975) [1].

MAJOR VARIABLES

Emotionality – Emotionality referred to the respondent's phenomenal perceptions of anxiety associated with the disaster event. In the present investigation, each individual was presented with a series of twenty-one emotionally-tinged adjectives (e.g., afraid, nervous, joyful, upset, happy, secure, etc.). Each word was displayed along a continuum suggesting the degree or extent to which each stimulus emphasis was manifest. A response range of "1" (little or none) to "5" (a great deal) was provided for both victims and non-victims. The task consisted of responding to each word relative to two reference periods. The time frames in question were "one week following the tornado," and "at the present time" (a mean of 30 weeks subsequent to the destruction).

Perceived Stress – Stress was considered a state of social and/or psychological tension arising from one or more circumstances characterized by a real or perceived threat. In terms of the present study, the aforementioned natural disaster was viewed as such a circumstance. Stress reactions were explored in terms of three dimensions:

(1) physical or health-related problems, e.g., headaches and upset stomachs;

(2) decision associated stresses, e.g., difficulties in making decisions, inability to carry out routine tasks, and forgetting to take medications; and

(3) emotional or affect-related expressions, e.g., nervousness, anxiousness, and quickness to weep or become angry.

Respondents were asked to indicate the type and specific instances of each stress reaction for various family members as well as themselves. A stress index was subsequently computed for each individual comprising the victim population.

Interpersonal Stability – Interpersonal stability was concerned essentially with the consistency and/or lack of disruption in interpersonal exchange. In the present investigation, consideration is given to such stability in three general areas – family, friends, and neighbors. Specifically, each respondent was asked to indicate the extent of his or her involvement in each area (the definition of the grouping was left to the respondent). The reference question

was whether the individual spends "less," "more," or "about the same" amount of time in each designated setting vis-à-vis pre-disaster circumstances. In addition, an affective assessment was made of all reported shifts. Victims and non-victims were asked to note, "In what ways have relationships changed since the tornado?" Response categories ranged from "1" (much worse) to "4" (much better than before).

Perceived Needs – Perceived needs were those phenomenal expressions of difficulty experienced by disaster victims at various temporal points of reference subsequent to the tornado in question. Through the utilization of open-ended questions, respondents were asked to recount the principal difficulties they had encountered over five time periods:

(1) the first two weeks following tornado impact (T_1),

(2) two to eight weeks later (T_2),

(3) three to four months post-disaster (T_3),

(4) five to seven months after "H" hour (T_4), and

(5) "currently" – an average of 30 weeks after the tornado (T_5).

An analysis of responses yielded the following categories of perceived need:

(1) utility services such as telephone, water, and electricity;

(2) contractor repairs, i.e., the difficulty of finding reliable persons to make repairs quickly and fairly;

(3) insurance settlements, i.e., the problem of finding people to appraise damage, file claims, and negotiate settlements;

(4) residential relocation, i.e., finding a new or temporary residence, moving, and getting settled;

(5) general cleanup, i.e., repairs to homes, removing debris, cleaning, etc.;

(6) emotional tensions, e.g., having problems making decisions, being nervous, emotional, or edgy; and

(7) refurbishing, i.e., replacing or purchasing new furnishings or belongings.

Service Utilization – Service utilization referred to the use of the services of various community relief agencies by disaster victims. Of principal concern in the present study were the number of contacts made in this regard. Specifically, respondents were asked to indicate the number and types of agencies from which services or aid was derived over the thirty week period in question. No consistent effort was made to assess the length or extent of the assistance received. Attention was directed to the age of the various service utilizers.

HYPOTHESES

Although it is difficult in an exploratory investigation to speak of true hypotheses worthy of empirical testing, it is at least helpful to examine the implications of previous research in this regard. To date, this research has been generally pessimistic relative to the older disaster victim. For the most part, it is expected that these individuals will exhibit a somewhat conflicting pattern of need expression and service utilization. That is, *while the aged should experience greater physical and emotional loss as a result of disaster circumstances (manifested, in turn, by greater objective and subjective "need states"), they will, nevertheless, make fewer demands on disaster relief agencies than their younger counterparts.*

THE FINDINGS

The first and foremost implication of a natural disaster relates to its negative impacts upon target populations. In the present instance, the focus of attention is upon the elderly vis-à-vis a younger contingent of disaster victims. The specific concern relates to the phenomenal experience of anxiety and stress associated with each grouping.

Table II presents a picture contrary to present expectations. It is observed, for example, that when one considers those adjectives which connote a more "anxiety-ridden" orientation, it is the *younger* not the older

TABLE II

Point Biserial Correlations Between Age Categories and Emotional Adjective Ratings for Both Experimental and Control Subjects[a]

Emotional referent	Experimental Group (N = 200)		Control group (N = 100)	
	One week post disaster	30 weeks post disaster	One week post disaster	30 weeks post disaster
Afraid	−0.23**	−0.02	0.06	0.08
Thoughtful	−0.05	0.03	−0.21*	−0.13
Desperate	−0.01	−0.11	0.10	0.13
Steady	−0.11	0.05	0.04	0.04
Secure	0.18**	0.15*	0.18	−0.10
Fearful	−0.28**	0.05	−0.15	0.03
Frightened	−0.23**	−0.03	−0.10	−0.04
Pleasant	0.13*	0.05	0.15	−0.13
Nervous	0.15*	0.13*	0.23**	0.13
Loving	−0.08	0.09	0.09	−0.11
Panicky	0.10	0.09	0.11	0.15
Joyful	−0.11	0.11	0.04	−0.16
Happy	−0.10	−0.14*	0.14	−0.00
Shaky	0.11	0.03	0.13	0.05
Tense	0.13*	0.07	0.26**	0.07
Contented	0.12*	0.11	−0.14	−0.27**
Terrified	0.11	−0.08	0.03	−0.09
Worrying	−0.26**	0.13*	0.07	0.12
Cheerful	0.20**	0.06	−0.12	−0.05
Upset	0.33**	0.01	0.19*	0.09
Calm	−0.10	0.03	0.16	−0.14

[a]A positive correlation indicates a higher score for those subjects "60 years of age and older".

*$p = < 0.05$.

**$p = < 0.01$.

victim who scores higher on each rating scale. One week subsequent to disaster events, younger respondents rank significantly higher on such adjectives as "afraid" ($p < 0.01$), "fearful" ($p < 0.01$), "frightened" ($p < 0.01$), and "worrying" ($p < 0.01$), while older victims rank significantly higher on *positive* adjectives such as "pleasant" ($p < 0.05$), "secure" ($p < 0.01$), "contented" ($p < 0.05$), and "cheerful" ($p < 0.01$). Although the aged respond more often to terms such as "nervous" ($p < 0.05$), "tense" ($p < 0.05$), and "upset" ($p < 0.01$), these adjectives do not seem to denote as much emotional upheaval and anxiety as those chosen by their younger counterparts. The picture presented by the control group would appear to underscore the pattern observed in the experimental instance. Clearly, the disaster has been an influential event relative to the adjective rankings of both young and old.

Not only was it expected that the aged would experience more anxiety following the disaster in question, it was also anticipated that they would take longer to resolve disaster-related anxieties. Recourse to Table II once again, however, does not bear this out. Thirty weeks subsequent to the disaster event, there appear to be no marked differences in anxiety expressions of victim groupings. An examination of

TABLE III

Relationship Between Stress Indications and Age (Victims Only)

Area of stress	*r*	N	%	Significance level
Physical/health related	–0.17	197	98.5	0.008
Decision associated	0.09	197	98,5	0.115
Emotional/affect related	–0.30	197	98.5	0.001
"Other" stresses	–0.07	197	98.5	0.160
Personal stress (all types)	–0.14	196	98.0	0.026
Total reported stresses (all members)	–0.32	199	99.5	0.001

individual protocols, on the other hand, reveals a tendency toward earlier anxiety resolution on the part of the aged. This pattern of response is not sufficient, however, to warrant a general conclusion on the matter.

Both physical and emotional stress reactions are reported accompaniments of anxiety. In the physical realm, these reactions may range from headaches to upset stomachs and even more serious manifestations. From an emotional standpoint, the individual may respond by becoming nervous, anxious, and exhibit a propensity to weep or become angry. Associated with these physical and emotional concomitants are difficulties in decision making, an inability to carry out simple tasks, etc.

A careful examination of Table III reveals that when the age of victims is correlated with reported stress reactions, in all but one instance (decision-related) *younger* victims report *more* stress associated with disaster aftermath than do the aged. Not only are physical ($r = -0.17$; $p < 0.008$) and emotional ($r = -0.30$; $p < 0.001$) stress indications more dramatically in evidence in the case of younger victims, but the correlation with *all* reported reactions ($r = -0.32$; $p < 0.001$) strongly favors a *less* stressful impact in the case of *older* respondents.

An additional concern of this study involved the types of interpersonal support structures drawn upon by disaster victims – regardless of the degree of physical or emotional stress experienced. It has long been observed that as formal organizational involvement declines, the elderly seek the informal social and emotional outlets of family, friends, and neighbors. These primary types of association purportedly maintain a sense of self worth and involvement deemed essential to psychological well-being. Accordingly, in a disaster such as the one in question, the maintenance of these relationships should become quite critical.

As is seen in Table IV, differences in informal social relations are noted only in the case of "experimental subjects." For the most part, non-victims maintain the same frequency of interaction with family, friends, and neighbors as they did prior to the tornado. The victim population, on the other hand, registers significant changes in all areas. In each instance, however, the differences reflect the *age* of the victim. Overall, the aged spend "about the same" or "more" time with family ($\chi^2 = 6.56$; $p < 0.038$), friends ($\chi^2 = 14.47$; $p < 0.001$) and neighbors ($\chi^2 = 17.43$; $p < 0.001$) than do their younger counterparts. That is, the amount of change or disruption wrought to tornado victims (as reflected in indications of "less" involvement) falls heaviest within the younger category of tornado victim. These disruptions are significant at the 0.05 level or less.

In a related fashion, elderly victims are seen to regard their relations in the areas of family ($r = 0.37$; $p < 0.001$), friends ($r = 0.28$; $p < 0.001$), and neighbors ($r = 0.37$; $p < 0.001$)

TABLE IV

Interpersonal Stability Indications for Both Experimental and Control Subjects

Areas of interpersonal involvement	Experimental subjects (N = 200)			Control subjects (N = 100)		
	χ^2	*df*	Significance level	χ^2	*df*	Significance level
Family	6.56	2	0.038	1.06	2	0.588
Friends	14.47	2	0.001	1.11	2	0.575
Neighbors	17.43	2	0.001	1.52	2	0.467

as "better" or "much better than before." The younger victim notes no significant changes in subjective relations with either grouping.

In addition to differential stress indications, the data also reveal the *practical* need picture of tornado victims. In this case, as Table V makes apparent, there is little difference between older and younger respondents. With the exception of reported emotional and mental tensions, which appear to be resolved most quickly by older victims, there is no consistent pattern of age-specific needs expressed over the five time periods of investigation. Clearly, the elderly have not borne the brunt of disaster-related circumstances as has so often been assumed by social researchers.

TABLE V

Needs and Problems Over Five Time Periods: Comparing Younger and Older Victims

	Weeks 1 & 2 (T_1)	Weeks 2–8 (T_2)	Months 3–4 (T_3)	Months 5–7 (T_4)	Time of interview* (T_5)
Utilities					
Percent under age 60 with problem	20%	2%	1%	–	–
Percent 60 and over with problem	20%	1%	1%	–	–
Chi-square value	0.03	0.17	0.16	–	–
Significance level	0.86	0.68	0.69	–	–
Contractor, Repair, Service Arrangements					
Percent under age 60 with problem	20%	37%	30%	15%	6%
Percent 60 and over with problem	31%	38%	31%	14%	4%
Chi-square value	2.92	0.01	0.00	0.00	0.05
Significance level	0.09	0.91	1.00	0.98	0.82
Insurance Settlements					
Percent under age 60 with problem	11%	15%	6%	–	2%
Percent 60 and over with problem	12%	9%	2%	–	4%
Chi-square value	0.03	1.18	1.37	–	0.29
Significance level	0.87	0.28	0.24	–	0.59
New or Temporary Residence					
Percent under age 60 with problem	24%	22%	11%	8%	2%
Percent 60 and over with problem	18%	10%	13%	9%	1%
Chi-square value	0.53	3.62	0.09	0.00	0.17
Significance level	0.47	0.06	0.77	0.98	0.68
Cleaning and Making Repairs					
Percent under age 60 with problem	40%	20%	9%	8%	11%
Percent 60 and over with problem	36%	30%	18%	8%	9%
Chi-square value	0.12	1.87	2.90	0.03	0.08
Significance level	0.73	0.17	0.09	0.86	0.78
Emotional and Mental Tensions					
Percent under age 60 with problem	23%	15%	17%	14%	12%
Percent 60 and over with problem	22%	12%	7%	4%	1%
Chi-square value	0.00	0.14	3.80	4.14	6.23
Significance level	0.95	0.70	0.05	0.04	0.01
Refurbishing					
Percent under age 60 with problem	5%	3%	10%	6%	3%
Percent 60 and over with problem	8%	7%	13%	7%	5%
Chi-square value	0.29	0.53	0.23	0.01	0.10
Significance level	0.59	0.47	0.63	0.94	0.76

*Approximately 30 weeks post disaster.

TABLE VI

Utilization of Disaster Relief by Age Categories

Disaster relief agency	Percent under 60 who used agency/service	Percent 60 and over who used agency/service	Chi-square value	Significance level
Red Cross	77	46	18.81	0.001
Salvation Army	34	19	4.77	0.03
Food Stamps	68	43	10.99	0.001
Internal Revenue Service	22	9	4.37	0.04
Federal Disaster Assistance Center	52	30	8.25	0.004
Department of Housing and Urban Development	25	19	0.79	0.38
American Insurance	10	4	1.55	0.21
Mennonite Disaster Service	24	24	0.01	0.91
Interfaith Taskforce	27	20	0.84	0.36
Eastern Nebraska Office on Mental Health	5	4	0.00	0.96
Nebraska Bar Association	5	1	0.84	0.36
Catholic Social Services	7	1	1.80	0.18
Police Department	58	34	9.84	0.001
National Guard	74	53	8.60	0.003
Fire Department	22	11	3.57	0.06
Eastern Nebraska Office on Aging	2	11	1.25	0.11

Finally, there is the question of actual service utilization by the aged as well as their younger counterparts. Table VI presents an indication of the various local, state, and federal relief agencies contacted for assistance by tornado victims.

Unlike the pattern observed in the case of reported problems, differential service utilization by age *is* apparent. In seven instances in particular, significant differences are seen which reflect a *greater* use of such assistance by the *young* as compared with the aged – the Red Cross, $\chi^2 = 18.81; p < 0.001$; Salvation Army, $\chi^2 = 4.77; p < 0.03$; Food Stamp Program, $\chi^2 = 10.99; p < 0.001$; Internal Revenue, $\chi^2 = 4.37; p < 0.04$; Federal Disaster Assistance Center, $\chi^2 = 8.25; p < 0.004$; Police, $\chi^2 = 9.84; p < 0.001$; and the National Guard, $\chi^2 = 8.60; p < 0.003$. Although the proportions are not statistically significant, in almost every other instance of relief employment, the *aged* place *fewer* demands upon such agencies. Beyond a doubt, this aspect of disaster and recovery behavior is inconsistent with the almost equal perceptions of need evidenced by both age groups.

DISCUSSION

As many of the preceding findings stand in sharp contrast to expectation, it is as well to explore the circumstances of research in greater detail. As was observed, older victims did *not* experience greater anxiety over destructive events when compared with younger victims. On the contrary, the adjective choices of the aged sample were of a more "positive" character. The elderly individual shortly after the tornado expressed feelings of "security," "contentment," and "cheerfulness" not typical of the younger sample. In the case of the latter, anxiety-ridden (i.e., negative) adjectives such as

"afraid," "fearful," or "frightened" typified their response patterns. Although the elderly reported becoming "tense" and "upset," these expressions connote far less anxiety than those characterizing the young.

A related observation was that the elderly did not seem to require longer periods to resolve disaster-related anxieties. Thirty weeks subsequent to the event in question, for instance, no differences were seen in the anxiety ratings of both groupings. Poorly developed data from research protocols, however, suggested the elderly may resolve their anxieties *earlier* than younger victims.

Although the above findings appear contradictory to logic – especially when one considers the social and physical plight of the nation's elderly as a whole – several things should be kept in mind by way of interpreting the present data. First of all, recourse to Table I makes it clear that the elderly sample in this instance is somewhat atypical of elderly groups. Education, income, and employment data reveal the sample to be generally middle class in orientation. As such, this group has access to a more complete accompaniment of physical, social, and psychological resources with which to weather disaster circumstances.

Secondly, one cannot underestimate the effects of prior disaster experience on the populations concerned. Considering only the element of age, it would seem reasonable to assume that older respondents have confronted a variety of "disasters" in their life times. Although not always of a "natural" nature, these events have, in all likelihood, conditioned an attitude of acceptance relative to loss and suffering. Those having experienced a major depression, two or more wars, separation and divorce, the deaths of loved ones, etc., would have developed a more resilent character – one especially functional to the circumstances of natural disasters. Evidence from individual research protocols would seem to bear out this suggestion.

Although emotionality might be contained or "adjusted to" more quickly by the elderly victim, perceived stresses should, in all likelihood, be greater for later age categories. Such was not the finding of the present research. On the contrary, when the age of victims was correlated with reported stress reactions, in all but one instance (decision-related) *younger* victims reported more stress associated with disaster aftermath than did the aged. Not only were physical and emotional stress indications more dramatically in evidence in the case of younger victims, but the correlation with *all* reported reactions strongly favored a *less* stressful impact in the case of older respondents.

Again, it is quite likely that prior disaster experience can account for the results reported. Along with this, however, it should be pointed out that objectively (that is, from the standpoint of monetary damage) losses in many areas of the tornado's path were not excessive. In instances such as this, it is quite possible that the extent of damage might account for higher reports of perceived stress. Subsequent analysis with this possibility in mind, however, failed to divulge such a pattern. What was clear from this analysis, on the other hand, was that the *young* attached more subjective value to material possessions than did the old. The loss or damage to such items as autos, houses, trees, etc. was regarded as more emotionally upsetting to the younger victims. Apparently, there is considerable validity to the stress reports noted in each age category.

In the area of informal social relations, findings were as expected. That is, the elderly experience fewer disruptions in the areas of family, friends, and neighbors. A significantly greater proportion of aged victims in comparison with younger respondents indicated that they spent "about the same" or "more" time within the areas in question than did their younger counterparts. In addition, the importance of such relations was more strongly emphasized by aged respondents. In this respect, the elderly victim regards his or her relations with family, friends, and neighbors as "better" or "much better than before" the tornado in question. The younger

respondents reported no significant changes in subjective relations with either grouping.

It would appear from these findings that *informal support structures* serve the elderly more effectively in disaster circumstances than they do younger victims. While some increases in activity are noted in each area – especially the first or second week subsequent to disaster – only older respondents consistently value these associations. It seems likely that older individuals perceive of themselves in a more independent and valued position relative to the needs of family, friends, and neighbors in disaster circumstances. Such an orientation might be viewed as a rudimentary experiment in role development for older persons. That is, in disaster circumstances the elderly – because of lowered anxiety and personal stress – might prove the most effective workers in the disaster recovery efforts of other age groups. Such a suggestion is made more along the lines of an hypothesis than a general conclusion at this time.

The suggestions made thus far seem consistent with the somewhat contradictory findings on perceived needs and service utilization patterns. The elderly may, indeed, have experienced the same types of "practical" difficulties with disaster circumstances. The data make clear, however, that they have *not* suffered to any greater extent than their younger counterparts. Nevertheless, previous disaster experience, a more resilient attitude to loss and suffering, the maintenance of informal social support structures, and a generational emphasis upon independence and "carrying one's own weight," may be logically seen as "explanations" for the rather minimal demand placed upon relief agencies for subsequent assistance. When viewed in this light, the question as to whether the aged get their fair share of disaster assistance becomes a moot one.

Before leaving this issue, however, a word should be said as to the points at which the aged in the present study who sought disaster assistance encountered the greatest difficulties. In almost every instance where problems were encountered, the issue concerned the methods or procedures whereby one might gain agency assistance. Specifically, respondents were repeatedly confused, intimidated, and frustrated by time delays, complicated forms, and procedural regulations. These difficulties, rather than physical access to the agencies in question, posed the greater barriers to service utilization. While these problems were cited by a minority of older victims, they seem of sufficient note to alert agency and policy planners to areas where restructuring would be appropriate.

SERVICE IMPLICATIONS

The results of the present research make apparent the interrelated nature of victim needs and service provision. In this regard, it is apparent that any successful service effort must predicate its philosophy of assistance on an understanding not only of the physical and emotional needs of potential "clients," but also on the social and community context which constitutes the arena of service deliverance. To this extent, it may be necessary for the traditional disaster relief agency to simplify its intake procedures to the point of requesting only minimal information. Such an approach in times of crisis may serve to speed service delivery and actually encourage subsequent utilization of agency resources.

A second aspect of the needs-service dimension concerns "pre-disaster" work on the part of the various Area Agencies on Aging. Interviews with both service providers as well as victim populations make evident the need to "condition" (i.e., prepare in advance) older persons to the service potential of specific agencies. Indeed, it is at this point that agency staff can discern reluctance on the part of their aged clientele. Having "isolated" those with such hesitancies, concerted effort can be directed toward the establishment of a firm personal as well as "informed" relationship

with these persons. Such an approach should insure not only a greater awareness of potential agency assistance, but also promote a willingness on the part of seniors to avail themselves of such deserved benefits.

Finally, procedures, forms, etc., should not be pursued or simplified at the expense of the older disaster victim. It seems that nothing can replace an open and sensitive attitude toward these individuals in their time of need. Education, therefore, must be directed at agency staff as well as their aged clientele. The form this "education" will take will be best formulated within the framework of community customs, agency resources, and the expectations of the aged themselves relative to service assistance.

NOTES

1 Corroborative interviews were conducted with the following service providers in an effort to validate both the services available and the utilization patterns of the elderly victims: ENOA, the Red Cross, Department of Housing and Urban Development, the Salvation Army, the fire department, the Interfaith Human Services Disaster Task Force, the office of Civil Defense, and the Mennonite Disaster Service.

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Mass Emergencies 3 (1978) 83–86
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TRAINING ON PERSONNEL, EXERCISES AND STUDIES OF CONTINGENCY PLANNING: PRACTICAL EXPERIENCES OF A BRITISH EMERGENCY PLANNING OFFICER

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Most discussions of training, exercises and studies of mass emergencies are by academic researchers, policy makers or overall disaster planners. This paper instead presents the perspective of a person who has been involved in the practical training for contingency situations in the United Kingdom, for the past eight years. As such, it offers a view of the assumptions and beliefs of persons who occupy positions much closer to the "firing line" than is usually the case.

Once a plan of intervention for major incidents has been prepared, it is necessary to train personnel in the content of the plan, the methods of implementing it and the specialist skills and procedures in relation to equipment for use at such an incident.

Unlike most training, we are, in this instance, concerned with instructing personnel in procedures relating to situations that have probable never occurred before and which individuals cannot easily envisage occurring in the foreseeable future. Thus the instructor is immediately faced with a natural lack of interest and unwillingness on the part of the student to accept that what he or she is being taught is necessary. It follows that careful and indeed novel forms of presentation are required if the interest of students is to be developed.

I have found that, until an area has experienced a major incident, interest of personnel is extremely lacking. My own force area has, however, been faced with a number of major incidents in recent years and, as a result, students are now enthusiastically receptive to being taught their duties and roles in such an emergency. Furthermore, there is now no difficulty in convincing senior officers of the need for such training. Before the spate of incidents, there was very much an ostrich-like approach to the subject with a failure to accept that a major incident required adopting special procedures and techniques.

Sitting a student in a classroom or lecture hall day after day and speaking on the theoretical policies behind incident planning is bound to create disinterest. Wherever possible there must be physical participation by the student. The student must be given an opportunity to exercise one's thoughts and knowledge on the subject.

Take rescue techniques as an example. Whilst rescue is not a main task of police, it is desirable that they have a working knowledge of the subject in order that they can, if necessary, intervene properly in advance of the arrival of the designated rescue services. A short period of instruction in the classroom, followed by a lengthy period of practical training and the application of theory on the training ground will ensure continued interest in the subject. Moreover, if the need for such training can be related to its usefulness in everyday policing, the student will be even more willing to learn.

Similarly with administrative duties, it is necessary to teach the theory of the task and then let students participate by actually filling in forms, books and similar items as they would in a live situation. They will inevitably make mistakes, but during training these can provide useful discussion points. I have seen examples of bad mistakes in training, but the same student seldom makes the same mistake when faced with the actual emergency situation.

When considering the type of training to be given to individuals, some thought must be given as to whether particular training will be required by a particular individual in an emergency. It is of no value to train a student in operational aspects which, in a live situation, that officer will never be called upon to perform. A policy of training on a "need to know" basis is, in my view, of paramount importance. Senior staff will not only need to know their own responsibilities, but also those of all junior ranks if they are to be capable of supervising their personnel correctly. However, junior staff will not only need to know their own level of responsibility but also, and this is most important, need to know at what point they should hand over responsibility to a senior officer and why it is necessary for a senior officer to relieve them of their responsibility.

A plan must be tested and this can only be done by conducting some form of exercise. Exercises do not replace training, neither should they be used as a means of initial training of students. They are a test to see whether training has been successful and where any weak links exist. If they are used as an initial training method, the result will be a chaotic exercise with little, if anything, proven by the event.

Exercises can take several forms and each has its own merits and drawbacks. They can be broadly split into three main types:

(a) The small exercises, designed to accustom an individual to emergency work as a member of a team;
(b) Exercises limited to one particular organisation with other organisations not actually participating but providing the problems and acting as numerous "observers" to detect the faults and shortcomings of the exercised organisation;
(c) The full scale exercise, involving all emergency services and volunteer organisations, including, where applicable, the participation of industrial organisations.

Even the simplest exercise – the small team exercise – if it is to be staged properly, needs careful planning and preparation. The larger exercises require considerably more planning and a major exercise can involve several people and many months of preparation.

The small exercise can be staged in a classroom or confined to a small exercise area without the consequent disruption of the everyday life of the organisation and the population at large. This becomes extremely important in large cities where everyday commitments are unpredictable and no firm guide can be given beforehand as to the numbers of individuals that can satisfactorily be released for the exercise.

One of the smaller regular exercises in my own force area concerns the documentation of casualties and victims of an incident. This is a very important operation in police circles which, in the live situation, probably reflects the efficiency of the intervention more than the actual work at the incident itself.

The actual casualty bureau is used for this exercise with casualty and enquiry information being simulated and fed into the bureau from adjoining rooms. Naturally the "fed" information is not always straight forward and correct. For example an "enquirer" will be deliberately vague. As in a real operation, he or she will be uncooperative and will only give information on questions put to him or her. If the participating officer does not ask the correct question, the full information that would otherwise be available will not be obtained and it will be necessary to work harder to obtain it at a later

time. Whilst the exercise is played seriously we try to keep it light-hearted, feeding-in information and enquiries which, unless the exercised student replies in the correct manner, will precipitate a series of embarassing situations requiring considerable tact to overcome a barrage of abuse from the enquirer.

Exercising one organisation can be most productive. In this situation one organisation, say the medical service, will mobilise as for a live situation whilst all other services will feed in information, mock casualties, etc., with known problems for the medical services to solve. All other services act as observers and directing staff, having been carefully briefed as to their future action according to the response of the medical service. The lessons learned from this type of exercise often result in the updating of plans which were previously thought adequate for the emergency requirement. For such an exercise to be really successful directing staff need to have a vivid imagination and previous experience of live operations in order to feed in the type of problems likely to be encountered.

Large scale exercises are staged by various organisations and services at periodic intervals. There are, however, many drawbacks to them. For one thing, it is extremely difficult to keep large scale exercises confidential until the moment of starting the exercise, thus all services have been primed and will have undoubtedly ensured that their personnel are aware of the exercise and what is expected of them. In many cases I have known of services actually visiting the exercise scene some days beforehand and deciding on their plan of intervention in advance.

Full scale exercises are costly to stage. Damaged trains, aircraft or vehicles have to be transported to the exercise location. Casualties, sometimes in their hundreds, have to be sought, their injuries simulated and during the exercise they have to be fed. This is apart from the cost of transporting them to and from the scene. Finally, if any lessons are to be learned, there must be a large number of observers and directing staff available.

In spite of some gallant efforts, there tends to be a lack of realism in the large exercise. Personnel will usually enter the exercise full of enthusiasm but, on finding the exercise dragging out and insufficient directing staff to observe and report on all aspects of the operation, however small, a loss of interest soon becomes apparent and participants start to "play games". On many occasions I have seen a "serious" casualty being carried improperly, often upside down or even deliberately dropped from the stretcher into a convenient stream of water. Thus the large expense of the exercise produces little valuable learning material.

The "Tactical Exercise Without Troops" produces the best value for time and money involved. Personnel are brought to a location and are faced with a simulated table-top incident. One example of this is the "Air Crash" procedure exercise. Participants are faced with a blank map of a fictitious area on which is staged a crashed aircraft showing models of casualties, victims and property scattered around. The various participants are allocated particular key tasks and then physically develop their work on the model itself, using small scale model equipment. The area is controlled and cordoned off, with traffic diversions being instituted. Casualties are recovered and despatched to hospitals. Bodies are labelled, marked and photographed in situ before removal. A search is made for the flight recorder and, once located, it is guarded. Personal property is located, marked and collected. Aircraft parts are left in situ for the investigators and then finally a sketch map is made of the incident area.

By this means a small directing staff can observe the action taken, ensure the full participation of all students, correct faults as they occur and finally verify that previous training has been absorbed. At the end of the day everybody feels that the effort has been well worthwhile and that they are now better prepared to meet the real thing.

Various other situations can be simulated on similar lines as the air crash, but it is my view that the area should always be depicted as a "fictitious" one. This avoids students becoming too engrossed in minor matters affecting an area that they can readily identify. It is surprising where personnel will place themselves when dealing with an incident on a table-top model. It is only when they can visually see the dangers of such action, for example, standing under an overhanging train which is likely to crash down on them, that students will start to appreciate the need for such exercises.

Recent developments in electronics and other more sophisticated presentation fields have resulted in the production of video film, use of closed circuit television, slide projectors and tape recorders to simulate exercise conditions. Whilst giving a wider scope for presentation, such systems are extremely costly and I have reservations as to the actual benefits derived from them. Personally I find myself concentrating more on the methods of presentation than dealing with the incident itself.

Finally, the "Study". This is a more academic approach to the problem and makes no attempt to simulate the conditions present at a disaster. Problems are set and considered in theory and the proposed solutions discussed in a way which would probably neither be possible nor desirable in actual operations. Attendance at such studies is normally limited to those who can make a definite contribution. They are usually held to advance planning and stimulate interest, particularly amongst senior officers, and to establish operational policy. Studies do not replace the physical or table-top exercise.

Whatever the type of exercise staged, it is important that a debriefing meeting or discussion is arranged afterwards whereby every service participating has an opportunity to state its own views on the lessons that could be learned and to hear the views of the other services representatives.

Such a debriefing should not be held too soon after the exercise. Each service must be given ample time to hold its own in-service debriefing. By adopting this procedure, the services' representatives at the main debriefing present not only their own views of the exercise but also the views of the many members of their own organisation and are thus better equipped to make a valuable contribution to the meeting.

Mass Emergencies 3 (1978) 87–104
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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.

BROUILETTE AND QUARANTELLI'S MODEL

Brouilette 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-

*The author would like to thank Deborah J. Bardo for reviewing previous drafts of this paper. The field data for the research reported was partly obtained under PHS grant 5 R01 MH-15399-04 from the Center for Studies of Mental Health and Social Problems, Applied Research Branch, National Institute of Mental Health, to the Disaster Research Center at Ohio State University. However, the analysis of the data was independently done by the author, and thus the views and opinions expressed do not necessarily reflect those of the Center. We thank the Center for allowing the use of the data in its file.

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.

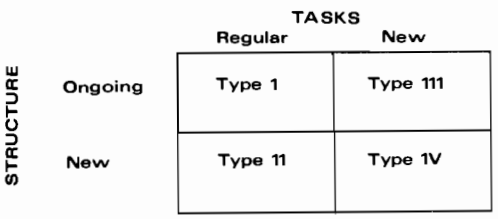


Fig. 1. Brouillette and Quarantelli's typology of patterns of bureaucratic adaptation.

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).

STRUCTURE \ FUNCTIONS	Manifest	Latent	Emergent
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.

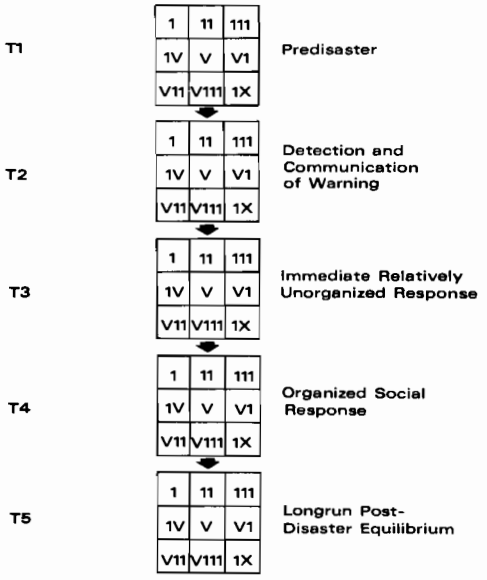


Fig. 3. Organizational response to a disaster episode.

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 predetermined plan, what had been a Type I pattern 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 predetermined manner. These changes could be expected in T_2 and they could continue through the remainder of the episode. If T_1 patterns reemerged 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 officials. 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.

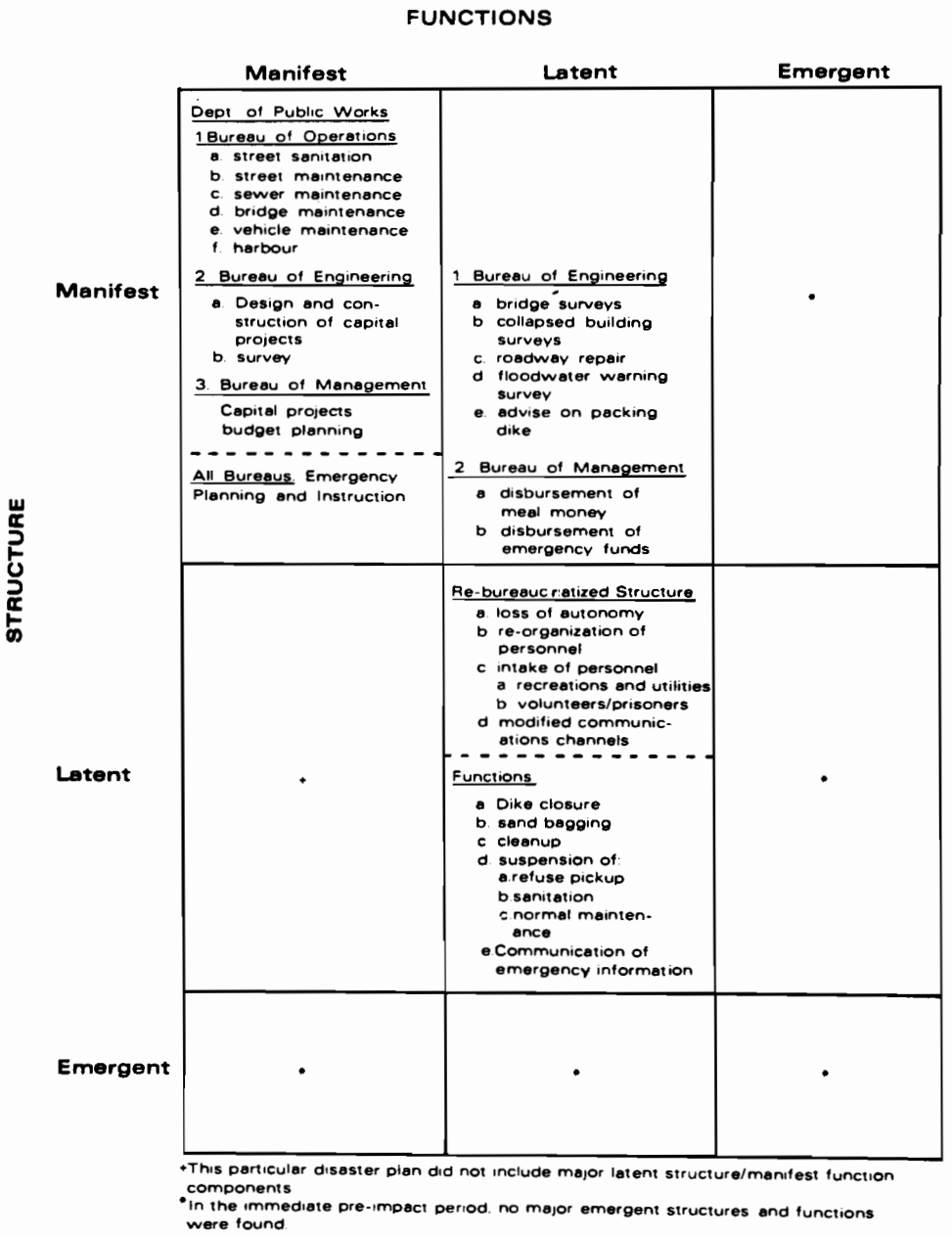


Fig. 4. Pattern of major structures and functions at T_1.

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

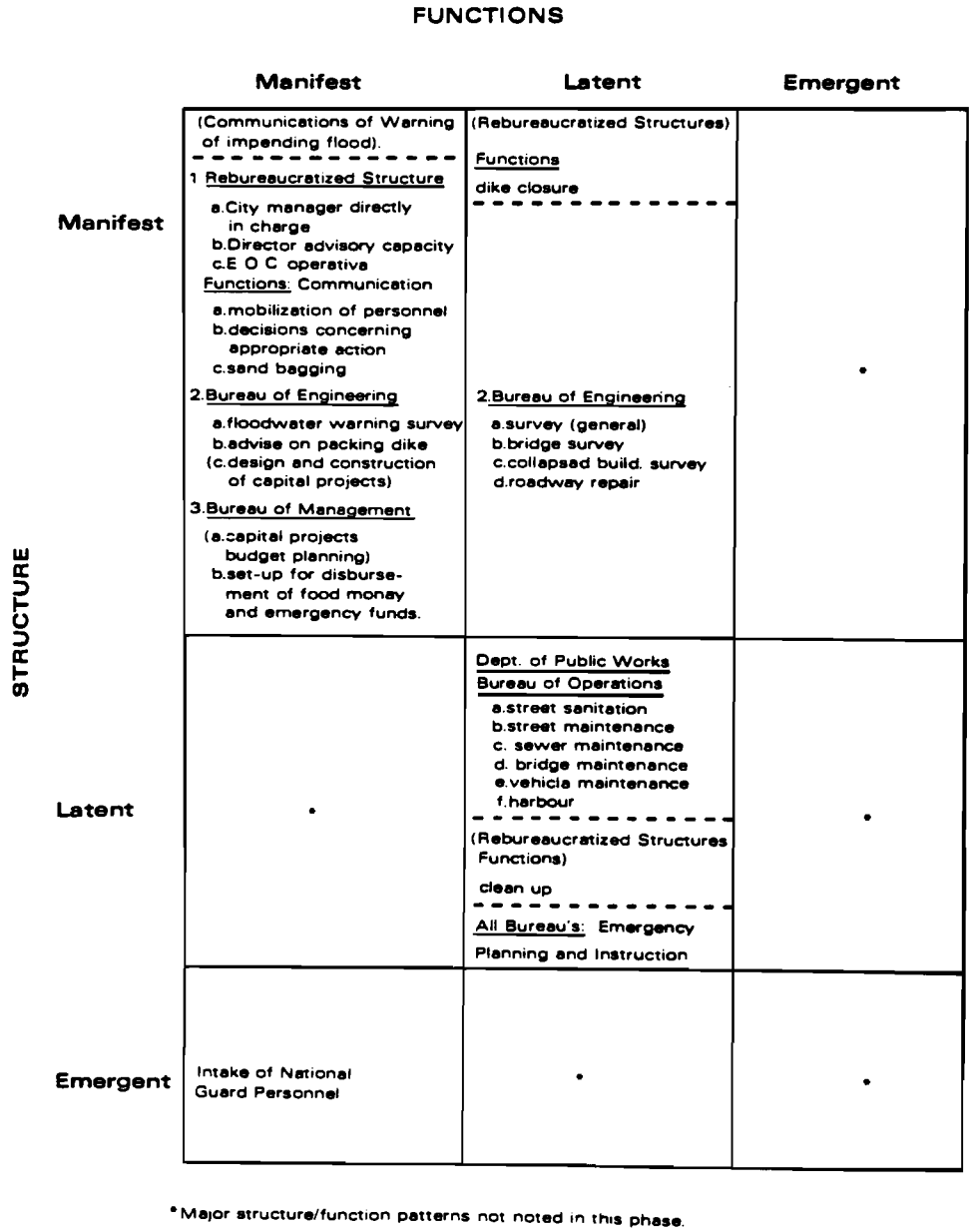
disaster subculture, where the disaster agent is recurring, and where warning provides a sufficient opportunity for some pre-impact preparations, the periods of communication of warning and immediate unorganized response can coincide. Such is the current case. As soon as an outside agency (the weather 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.



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

Fig. 5. Patterns and major structures and functions at T_2 and T_3.

T_{4a}: 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_{4a} 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_{4a} was to

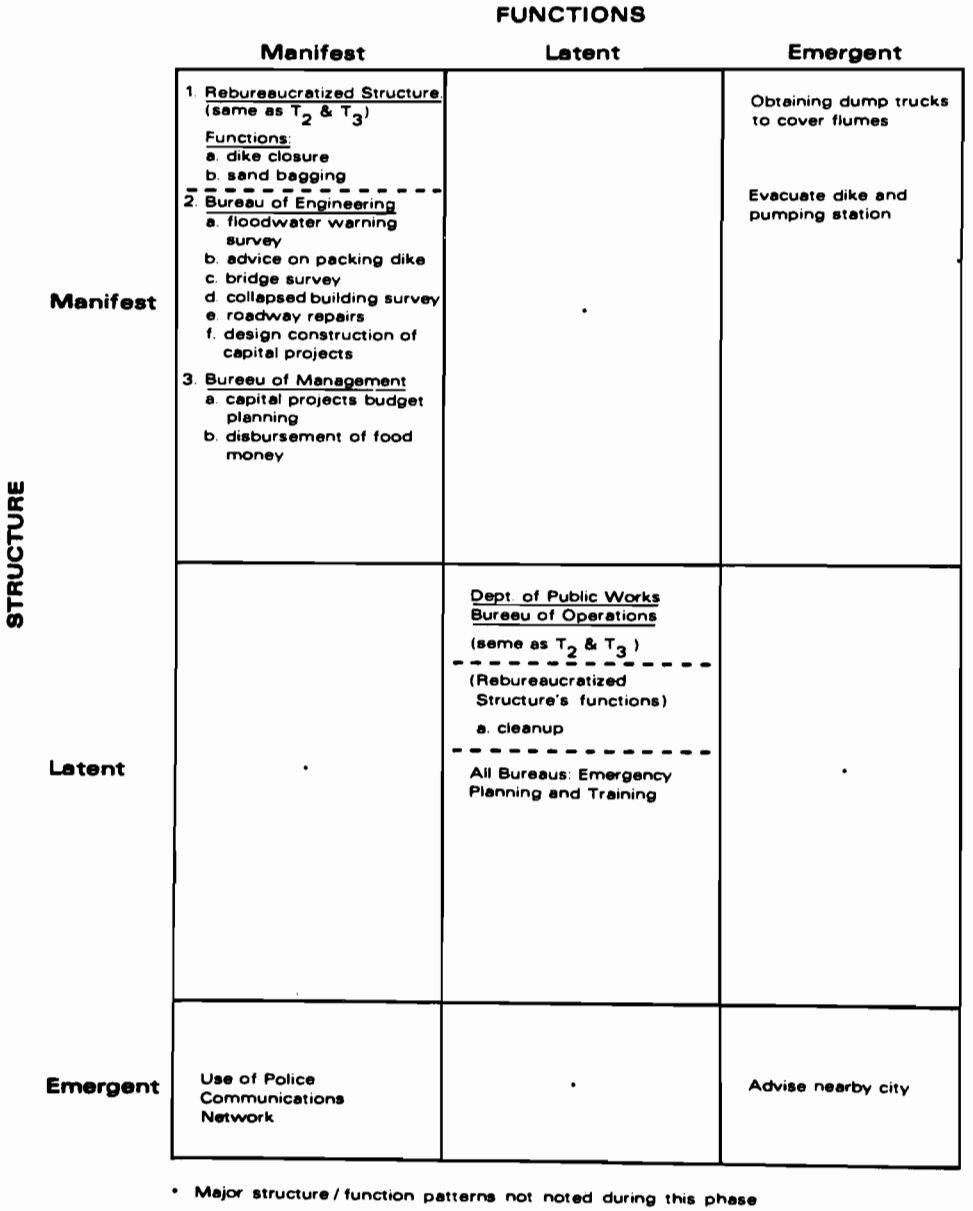


Fig. 6. Patterns of major structures and functions at T_{4a}: organized response to immediate threat.

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_{4b}: 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_{4b} 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 movement 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_{4b} period.

As for the Bureau of Engineering, in the first days of T_{4b}, 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_{4b}, 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_{4b} period, and greater emphasis was placed on resumption of usual activities (Cell I).

T_5: Period of Post-Disaster Equilibrium

As with the other disaster phases it was difficult to specify exactly the timing of the onset of T_5. 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_5 period, in this case, is that there were no significant shifts in structure/function patterns when comparing T_1 and T_5. The event, because of its unprecedented magnitude was defined by the

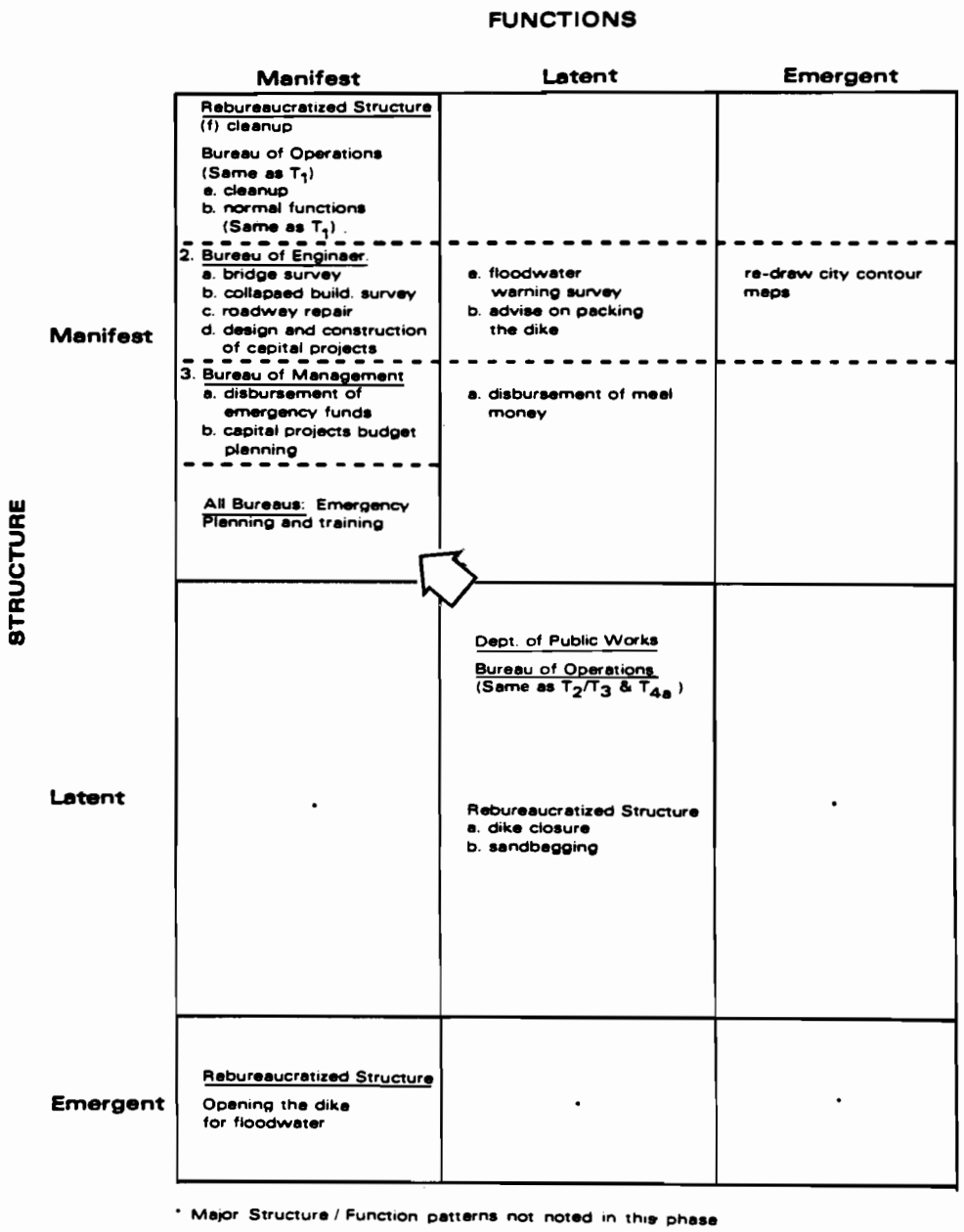


Fig. 7. T_{4b}: Period of short-run post impact response.

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_2/T_3, T_{4a}, or T_{4b} were ongoing at T_5 (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

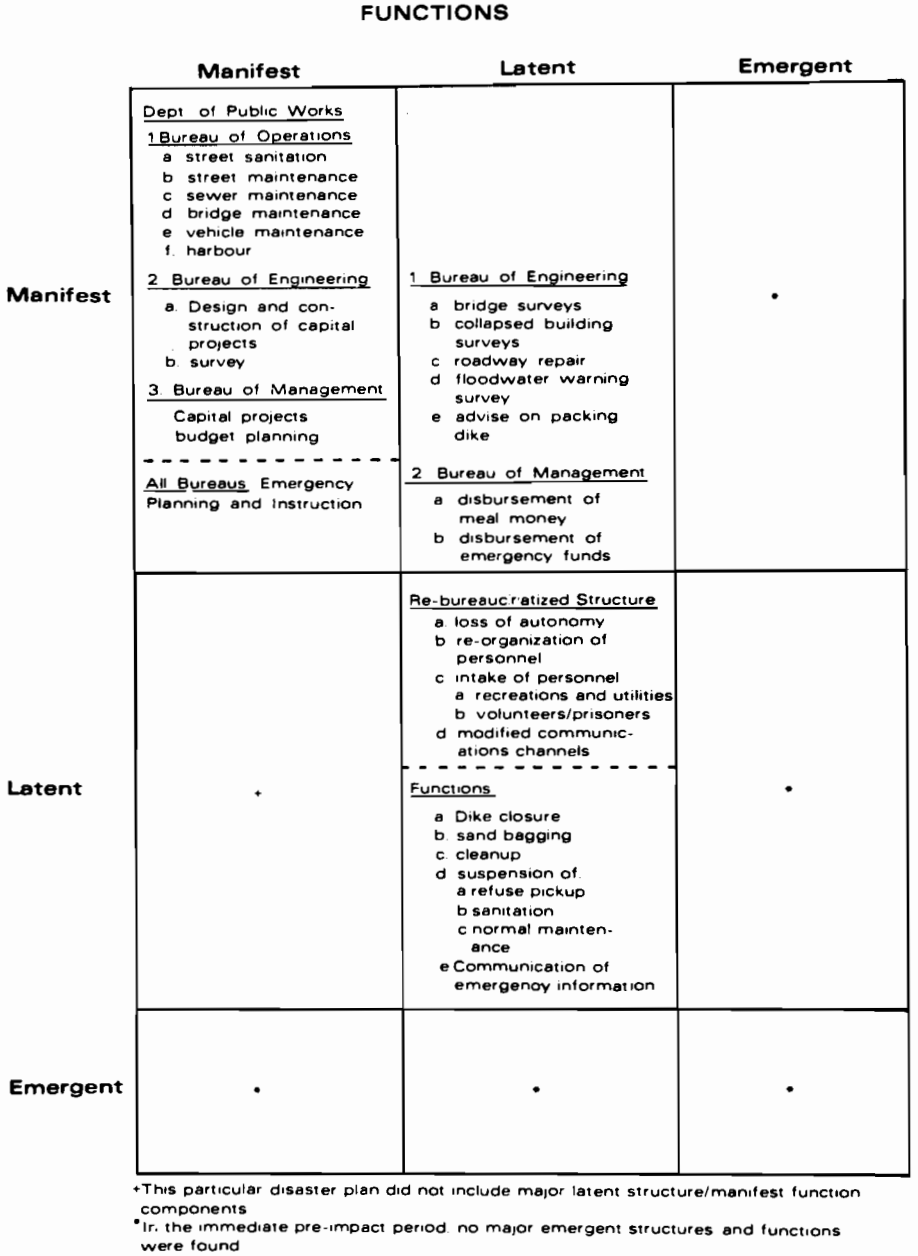


Fig. 8. Pattern of major structures and functions at T_5.

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 idiosyncracy 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 inadequate (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 responses. However, caution must be exercised in establishing the sequence and phasing of events in the individual empirical application.

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Mass Emergencies 3 (1978) 105–115
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THE PSYCHOLOGICAL CONSEQUENCES OF NATURAL DISASTER: A REVIEW OF RESEARCH ON AMERICAN COMMUNITIES*

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For decades social scientists have been unable to reach consensus regarding the psychological consequences of natural disasters. Although most researchers acknowledge the existence of the widely documented "disaster syndrome" – a "dazed" state common in the immediate post-impact period – this seems to mark the limit of agreement. Over the past four decades, two identifiable and essentially opposing positions have evolved. One position holds that natural disasters constitute catastrophic life events which produce adverse psychological reactions among victims. These reactions are seen as problematic both immediately post-impact and throughout the long range; possibly encompassing a period of several years or perhaps the victims' entire remaining life span. The empirical support for this perspective came initially from psychiatric interpretations of natural disasters (Tyhurst, 1957a, 1957b; Menninger, 1952), was buttressed by a series of sociological studies of tornadoes (Moore, 1958a, 1958b; Moore and Friedsam, 1959; Moore, et al., 1963) and has recently gained support from studies of flood victims (Lifton and Olson, 1976; Titchener and Kapp, 1976).

*This study was supported by a biomedical grant from the U.S. Department of Health, Education and Welfare to Battelle Memorial Institute. The opinions expressed are those of the authors' and do not necessarily reflect DHEW policy.

The competing position suggests that although some individuals experience adverse reactions to natural disaster, the extent of negative psychological consequences has been greatly overstated. It is acknowledged that psychological reactions frequently occur in the short-run (to a maximum of a few weeks post-impact), but these researchers argue that apparent longer-run reactions are infrequent and probably a function of a variety of factors, among which disaster impact is only one. This point of view can be traced to Charles Fritz: early analysis of the National Opinion Research Corporation (NORC) disaster studies (Fritz and Marks, 1954; Fritz, 1961) and is supported by numerous studies which have involved a variety of disaster agents – e.g., floods, hurricanes and tornadoes (cf. Drayer, 1957; Bates et al., 1963; Quarantelli and Dynes, 1977; Drabek and Key, 1976; Erickson et al., 1976; Sterling et al., 1977; Taylor, 1976; Fritz and Williams, 1957).

The competing positions, therefore, rest upon the apparently contradictory findings of empirical studies. In such cases, one usually examines the controversy by first assessing the quality of the research designs (e.g., asking methodological questions) and second by reviewing the *theoretical* underpinnings of each competing view, comparing basic assumptions, logical adequacy, parsimony, internal consistency, etc. (cf. Shrag, 1967, p.220). The controversy surrounding the psychological

impact of natural disaster, however, seems to have developed largely in the absence of formal theory. This is not to say that *rationales* haven't been offered; they have come from advocates of each position. For example, initially Fritz (1961) and later Barton (1969) suggested the concept of the "therapeutic community" as an important factor in minimizing adverse psychological reactions. What is lacking on both sides though, is an explicit, formal, theoretical framework which could guide the directions of scientific inquiry and against which empirical findings may be evaluated (cf. Perry and Gillespie, 1976, pp.48–49). Furthermore, in the absence of such a theoretical structure, exchanges among proponents of different views tend to become laden with rhetoric; with no conceptual standard against which to evaluate empirical studies, there is little basis for resolving apparent inconsistencies.

The present paper critically examines the empirical stalemate produced by the unresolved and apparently competing research findings and attempts to clarify the relationship between natural disaster and psychological disorder. This will be accomplished by reviewing the theoretical context of natural hazards research and proposing a conceptual model or framework for understanding the psychological consequences of natural disaster. The initial task involves investigating the nature of the problem, and in so doing we shall pursue three basic queries: What is the theoretical context (often implicit) for existing natural disaster research? What definition of psychological disorder has been used in past studies of mental health in disaster? What are the appropriate research questions when examining the relationship between natural disaster and psychological disorder?

THE NATURE OF THE PROBLEM

Most disaster researchers have based their investigations on the proposition that any psychological disorder is the outcome of stress caused by the disaster. Although stress is an important integrating concept, the study of stress crosses the boundaries of many disciplines and may focus on different conceptual levels of analysis – we talk of stress as it impinges upon individuals or complex organizations or even whole societies. To enhance communication and make research findings more readily comparable, it is necessary to specify the way in which stress is characterized, as well as the appropriate level of analysis. For the most part, disaster researchers have not given much explicit attention to these matters, making it difficult to draw upon the results of related stress research where some natural disaster was not involved; for example, medical studies of stressful life events.

In different literatures, stress has been treated as a stimulus (Rasmussen, 1973 pp.4–8); as a response (Selye, 1956); as an inner state (Modlin, 1966; Horowitz, 1974); and as an organism-environment transaction (McGrath, 1970 p.14; Lazarus, 1966). Most studies of natural disasters have used the last mentioned approach and defined stress in terms of the transactions between some organism (very broadly characterized) and its environment. In one of only a few theoretical pieces, Allen Barton (1969) argues that natural disaster impact alters the nature and quantity of "inputs" to a social system, thereby producing changes in the nature of the "demands" made upon the constituent elements of the system. This "demand-adaptation model" has been widely used in studies of natural disaster and appears to be effective whether the focal system elements are individuals (Fritz and Marks, 1954); families (Bolin, 1976); established organizations (Dynes, 1970); emergent organizations (Perry et al., 1974); communities (Haas et al., 1977); or societies (Lessa, 1964). Therefore, the natural disaster itself is not equated with stress. Natural disasters cause changes in social systems which, in turn, require system elements to adapt to different demands. In this context, stress can be understood in

terms of the exchanges which occur between the *altered* social system and its *adjusting* components. Hence, the basic model to be examined links the three central constructs as depicted in Fig. 1.

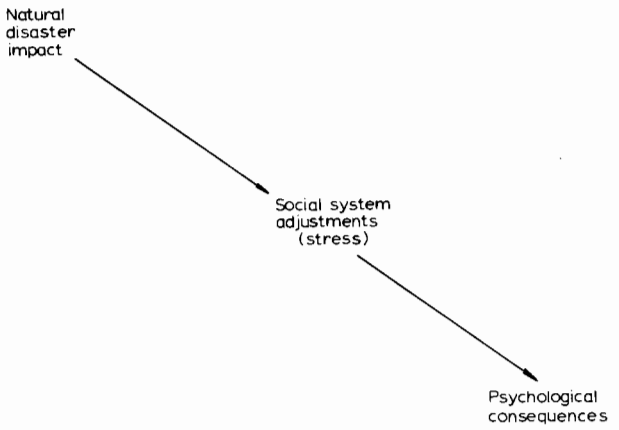

Fig. 1. Relationships among disaster impact, stress and psychological consequences (arrows represent temporal paths).

Our second query pursues further the task of identifying the phenomena to be studied; namely deciding what is meant by "psychological consequences". Again, in the disaster literature, only scant attention has been given to this problem. Usually, definition is either left implicit and the phrase "mental illness" used to cover the widest range of meanings, or among empirical studies some operational definition of "psychological consequences" is equated with an observable measure – e.g., victim self-report, interviewer diagnosis, admission to care, etc. This is not to suggest that one should undertake the herculean, and probably impossible, task of "rectifying" the numerous, disparate theories of psychopathology and create a single definition of mental illness. It is essential, however, when evaluating studies of the psychological consequences of natural disaster, to carefully attend to specific definitions and operationalizations, as well as the underlying conceptions of psychopathology.

Many conflicting claims regarding the relationship of natural disaster and mental illness may be resolved by acknowledging that researchers have used different conceptions of psychopathology in designing studies and consequently have chosen different measurement strategies which tend to yield uncomparable results. Those who have found a correlation between disaster and mental illness have tended to employ a psychodynamic perspective, which directs concern with anxiety states, subjective unhappiness and other maladjustment evident through psychiatric diagnosis (cf. Scott, 1958 p.29). Further, these studies depend largely upon victim self-report and clinical interviews as measures of psychological consequences. On the other hand, studies which have not found a strong relationship between disaster and mental illness tend to use a behavioral model of psychopathology sensitive to individuals' maladaptive behaviors, usually measured by rating scales, observers reports or admissions to psychiatric care (Ullman and Krasner, 1970 p.327; Wilson, 1962).

One should be aware that the above mentioned "measures" are sensitive to different aspects of human behavior and constitute different criteria for establishing the presence of psychological consequences. Thus, it is *not* appropriate to assume that they are acceptable *equivalent* indicators of mental disorder. Instead of interpreting the empirical findings as conflicting, then, one should conclude that the different measures employed offer evidence that some types of psychological reaction are common following natural disaster and other types are not. Hence, we have much evidence that people usually answer in the affirmative when consequences are "defined by the victims themselves in response to the question, 'Have you noticed any emotional stress among family members as a result of the disaster'?" (Moore and Friedsam, 1959 p.136). When the psychological consequence of interest is admission to psychiatric care, however, it is evident that this reaction is rare and that few victims of natural disaster seek such institutional help

(cf. Bennet, 1970 p.456; Bates et al., 1963). Thus, careful review of the measurement strategies of existing empirical studies directs attention away from the problem of apparently conflicting findings and toward the more productive task of cataloging the nature and frequency of different types of psychological consequences associated with natural disaster. Furthermore, by focusing upon the measurement of observable psychological *consequences*, there is also the advantage of avoiding the conceptual and definitional stalemate which arises when one attempts to derive an acceptable operationalization of "mental illness" (cf. Bandura, 1969 pp.9–19).

Given the preceding discussion of the nature of stress and psychological disorders, it is apparent that simple models (such as that depicted in Fig. 1) are not particularly useful for understanding the psychological consequences of natural disaster. It has been argued that an essentially post hoc methodology in combination with a low emphasis upon theory construction has contributed to the perpetuation of an oversimplified view of the problem; namely that disaster is a direct and unconditional cause of mental illness (cf. Lifton and Olson, 1976). The perspective which appears to appropriately address the problem sees disaster as a contributory cause; as one of a number of factors which together determine psychological consequences. The remainder of this paper focuses upon the specification and elaboration of a conceptual model of the factors which effect the psychological consequences of natural disaster.

CONCEPTUAL ISSUES IN PSYCHOLOGICAL CONSEQUENCES

Recent research conducted by Thomas Drabek and his colleagues (Drabek et al., 1975; Drabek and Key, 1976; Erickson et al., 1976; Sterling et al., 1977) has outlined a conceptual framework to explain the effects of disaster impact upon the health self-perceptions of victims. Using a similar perspective, we shall attempt to expand upon and formalize this approach by concentrating on channels through which natural disasters impinge upon individuals and by introducing additional detail when specifying relevant theoretical dimensions.

We shall order the presentation of our framework by considering specific factors which lie within three theoretical dimensions: (1) characteristics of the disaster impact; (2) characteristics of the social system; and (3) characteristics of the individual. In the sections which follow, each dimension will be addressed in turn and literature supporting the inclusion of specific factors will be reviewed. Finally, the full model will be assembled and discussed.

Characteristics of Disaster Impact

One of the most integrated and detailed schemes for a typology of collective stress situations was devised by Allen H. Barton (1969). In developing his typology, Barton convincingly argues for the primary importance of three aspects of disaster which mediate the social and physical consequences of disaster impact: forewarning, duration, and scope of impact. Whether or not some threat is detected and forewarning is *possible* largely depends upon technological issues (Mileti, 1974 pp.9–11). Even if the disaster agent is detected, forewarning can occur only if an adequate message dissemination system exists for delivering the warning to the threatened population. In terms of the consequences of disaster impact, warning permits time (the precise amount of which may vary greatly) for preparations and safeguards which can to some extent: (1) reduce deaths and injuries; (2) decrease the destruction of kin and friendship networks; and (3) reduce property damage (Williams, 1964 pp.97–102). Also, as Fritz and Marks (1954 p.35) have indicated, an adequate period of forewarning permits a degree of "psychological preparation" for the disaster impact.

The idea of "duration" references the time involved as well as the character of disaster impact. Time, however, is the critical dimension. Whether duration is long because of multiple or many secondary impacts (such as in urban snow disasters in the United States) or because of a long steady impact (e.g., a severe drought), the result is the same: a long duration "may gradually drain resources and lower aspirations so that the whole system moves toward a less satisfactory equilibrium, or toward collapse as a system ... a brief duration disaster still may have long-lasting injury and destruction, but relief and recovery can be carried on unhampered by further impacts" (Barton, 1969 p.40). Again, the longer the duration of impact, the greater is the chance that kin and friendship networks will be disrupted and the greater the likelihood of property damage.

Scope of disaster impact refers to a primarily geographical dimension: how large is the impact area. The obvious correlates of increasing scope are increases in the sheer number of people who can be affected and increases in the absolute amount of property exposed. Among natural disaster agents, hurricanes tend to have a large scope of impact while tornadoes tend toward a limited scope. It should be pointed out that all three factors reviewed here correlate with *type* of disaster agent, especially when we are interested in natural disasters. Therefore, we have treated these factors as characteristics of disasters which have implications for other classes of variables more directly related to psychological consequences.

Characteristics of the Social System

While characteristics of the disaster tend to affect psychological consequences indirectly, variables which measure characteristics of the social system more often involve direct effects. From the research literature, we have selected seven factors which are characteristic of social systems and which have been found to mediate the psychological impact of natural disaster: level of community preparedness, presence of a disaster subculture, development of the therapeutic community, destruction of kin networks and friendship networks, the extent of property damage, and presence of institutional rehabilitation. These factors are interrelated and will be discussed in terms of the *patterns* of these interrelationships.

Level of community preparedness describes the state of emergency preparations undertaken by communities, including any planning for the management of disaster impact, as well as plans for post-impact reconstruction. The level of community preparedness affects (either directly or indirectly) all of the other factors discussed as social system characteristics. Initially, it should be noted that level of preparedness is related to the presence of disaster subcultures (cf. Anderson, 1965). Disaster subcultures tend to develop in communities which routinely experience disaster (e.g., places exposed to seasonal floods or tornadoes) and may be described as organized groups of individuals coordinated in advance of disaster impact, who undertake some form of pre- or post-impact ameliorative activities. Such activities include groups which routinely help make and lay sand bags in flood-prone communities (Anderson, 1965) and groups which routinely participate in a search and rescue capacity. As Drayer (1957 p.154) has pointed out, such subcultures arising in response to "recurrent natural disasters lend themselves well to adequate psychological preparation of the population, particularly if the disasters have a tendency toward seasonal periodicity with enough frequency to give each succeeding generation some degree of personal experience with them". Furthermore, high levels of preparedness and the presence of disaster subcultures tend to correlate with the development of a "therapeutic community" reaction (cf. Fritz, 1961 pp.688–692). Barton (1969 p.207) suggests that the therapeutic community reaction "helps to compensate for the

sorrow and stress ... with an unexpected abundance of personal warmth and direct help". As described in the literature, the therapeutic community represents informal mass social and physical support; victims are rescued, sheltered and reassured by fellow community members. It should also be pointed out that this informal response "supports action by the public [formal] authorities and large-scale organizations devoted to relief and reconstruction" (Barton, 1969 p.283). Therefore, the development of a therapeutic community reaction enhances the opportunity for formal and informal psychological support for victims in both the short and long run (cf. Roen et al., 1966; Quarantelli and Dynes, 1972).

It was mentioned previously that the level of community preparedness was inversely related to the destruction of kin networks and friendship networks. Kin networks are here conceived in terms of people's interaction and exchange patterns with their kinsmen. Numerous studies of community disaster report that intense kin relationships are highly supportive and promote post-disaster recovery success among victims (Drabek et al., 1975 p.486; Bolin, 1976 p.268). Thus, to the extent that kin networks are destroyed, one should expect negative psychological consequences for victims.

The effects of destruction of friendship networks are very similar to those described in relationship to kin networks. In both cases, we are describing the stress-buffering role of social support (Dean and Lin, 1977). Friendship networks refer to peoples' patterns of interaction with friends (and/or neighbors). Barton (1969 pp.63–124) has pointed out that intact friendship networks ensure victims' access to much post-impact aid; since relatives only infrequently live adjacent to one another, immediate aid is likely to come from victims' friendship networks. It has also been argued that when both kin and friendship contacts are available, kin relationships are more important in victims' successful adaptation, especially in the long run (Drabek and Boggs, 1968). Nevertheless, in the short run, or when kin bonds are weak or absent, the role of friendship networks is an important one.

Finally, it has also been pointed out that level of community preparedness varies inversely with the extent of property damage. If we think of property in anthropological terms as our culture inventory, it must be acknowledged that material things play an important role in peoples' definitions of self (Wallace, 1961, pp.171–193). In examining reactions to disaster, Wallace (1957, p.23) suggests "the sudden perception of physical destruction of the natural environment and material culture with which one is identified seems to elicit fundamentally the same paralytic [psychological] response ...". Thus, widespread destruction of property can produce negative psychological effects in the short run. The extent of property damage is also related to the nature, amount and speed of institutional rehabilitation made available to stricken communities. In general, the greater the damage, the more extensive is the institutional aid (loans, donations, etc.) which flows to the community from external sources (Haas et al., 1977). Evidence also suggests that the presence of extensive institutional rehabilitation serves to reduce negative psychological consequences among victims in the long run (Fogleman and Parenton, 1959 pp.133–135).

Characteristics of the Individual

Two factors which are characteristics of individuals are particularly important in understanding the psychological consequences of natural disaster: pre-impact psychological stability and grief reactions. In our earlier discussion of epidemiological concepts, it was indicated that many of the "after-only" research designs "found" a direct link between disaster impact and mental disorder only because they could neither control nor assess

pre-impact psychopathology. In general, if an individual is psychologically unstable *before* disaster impact, he will remain so *after* impact. The only qualifier needed here is that a few investigators have reported that *some* "unstable" individuals (particularly those diagnosed as senile) have been shown to *briefly* exhibit "stable" behavior (usually task-oriented helping actions) in natural disaster circumstances. Since this finding has not been consistently reported and in each case the individual quickly reassumes a "mentally ill" role, it is here acknowledged as an intriguing anomaly.

Perhaps, one of the most prominent sources of psychological disorder, whether chronic or acute, is the death or severe injury of a kinsman or a close friend. In the case of natural disaster where death or injury can occur during a short time span *and* one may even witness the event, the psychological consequences for survivors may be tremendous (Fritz and Marks, 1954 p.40). In discussions of various stress response syndromes in reaction to natural disaster, psychiatrists have paid surprisingly little attention to grief reactions (cf. Horowitz, 1974; Lifton and Olson, 1976; Titchener and Kapp, 1976; Kastenbaum, 1974). Bugen (1977) has developed a theoretical model for understanding human grief reactions which is based upon the pioneering work of Lindemann (1944). Bugen contends that the *intensity* and time duration of psychological reactions associated with grief may be characterized in terms of two dimensions (see Table I). The closeness of the survivor's relationship to the deceased and the survivor's perception of the preventability of the death. Thus, when the relationship is central (in the case of ones' spouse) and the death was preventable (e.g., if the couple were warned but failed to evacuate prior to a hurricane), one would expect the survivors reaction to be intense and prolonged. Other conditions yield different reactions. What this implies for disaster research is that one must assess the nature of relationship and perceptions of preventability to understand a survivor's psychological reaction. Although both concepts exist in the disaster literature (cf. Crawshaw, 1963), they are not often juxtaposed and have not previously been used in any integrated conceptual framework. The concept of grief reactions of different intensity and duration begins to shed some light on psychiatric studies which offer conflicting claims about the longer-term psychological consequences of exposure to disaster deaths (cf. Kastenbaum, 1974). When one takes Bugen's model into account, the fact that some survivors suffer longer-duration disturbances than others is readily explainable.

TABLE I

Typology of grief reactions by closeness of relationship and preventability of death (adapted from Bugen, 1977 p.197)

Closeness of relationship	Preventability of death	
	Preventable	Unpreventable
Central relationship	Intense and prolonged reaction	Intense and brief reaction
Peripheral relationship	Mild and prolonged reaction	Mild and brief reaction

THE CONCEPTUAL FRAMEWORK

We have now examined three dimensions relevant to understanding the channels through which natural disasters impinge upon the psychological stability of individuals (victims). Twelve important factors have been isolated and literature related to each has been reviewed. The emphasis however, has been upon conceptualization and organization. The review of literature was not intended to be exhaustive since such reviews are available elsewhere (cf. Barton, 1969; Dynes, 1970; Mileti et al., 1975). Our purpose was to sort out findings and summarize data which specify

interrelationships among the factors included in the theoretical framework.

Two additional points should be made before presenting the full conceptual model. First, this work should not be confused with the presentation of a causal theory; to describe it in such terms would be misleading. Instead, we are beginning the process of theory building, not completing it. We have examined empirical findings, inductively constructed images of time order and made inferences about possible relationships among factors.

The second point relates to our treatment of demographic variables – age, sex, socio-economic status, race, etc. The only other recently published theoretical efforts in this area (Sterling et al., 1977; England and Kunz, 1977) explicitly include demographic variables in their models. We acknowledge the role of demographic variables in matters such as the definition of appropriate grief reactions and perceptions of kin and friendship networks. In the interest of clarity of presentation, however, we have elected to leave demographics *implicit* in our model. In most sociological and social psychological theory, demographics may be taken as given; in this case it is acknowledged that demographics should be included as exogenous variables prior to any testing of the conceptual model.

Figure 2 shows the interrelationships among the twelve factors that we have considered and their direct relationships to adverse psychological consequences. In keeping with conventions in the research literature, we have used three boxes to represent psychological consequences, divided in terms of time into initial, later and long-term consequences. "Initial psychological consequences" begin in the time period immediately post-impact and are considered to last approximately one week. It is during this period that virtually all investigators have reported finding evidence of "the disaster syndrome" which was described in detail by Wallace (1957 p.23). "Later psychological consequences" describes the period running from about one week post-disaster through the following six months. "Long-term psychological reactions" refers to the period which begins six months post-impact and continues for the remainder of the victim's life. In the discussion which follows, we shall examine the role of the relevant factors in producing an adverse psychological response in each of the three time periods.

As previously indicated, initial psychological consequences usually take the form of the well-known disaster syndrome. Wallace (1957 p.23) describes the symptomology in three stages: initial shocked or dazed behavior, followed by

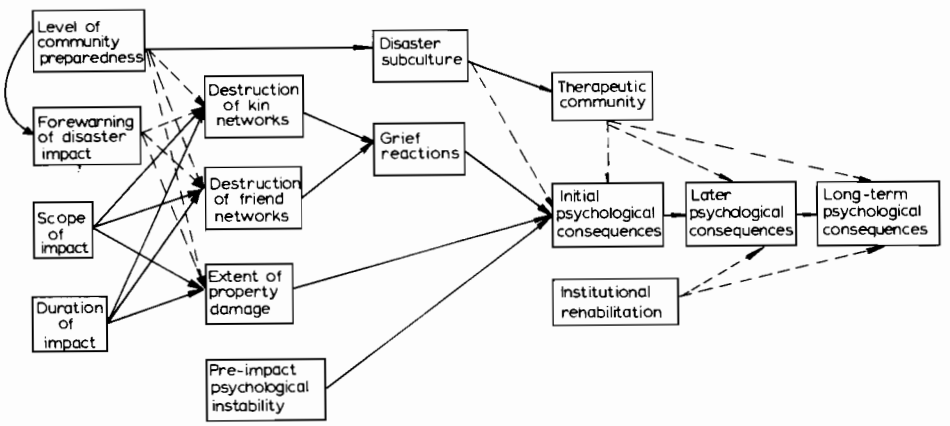

Fig. 2. Interrelations of factors important in understanding psychological consequences of natural disasters (solid arrows represent positive relationships, broken arrows represent inverse relationships).

a generalized anxiety state characterized by docility and obedience, and finally a state of mild euphoria sometimes alternating with mild depression. Drayer (1957), Fritz and Marks (1954) and Lindemann (1944) all agree that these behaviors should be considered "normal" disaster reactions as long as they remain relatively temporary in nature and do not persist beyond the initial period. In terms of our conceptual framework, the disaster syndrome is primarily a function of the destruction of social support networks (kin and friends) and mazeway disintegration due to property loss (cf. Wallace, 1957). In most cases, the victim adapts to these losses in a relatively short time and resumes a pattern of successfully coping with the environment (Lazarus, 1966). Severely negative psychological reactions in the initial period may arise as a function of two factors: pre-impact psychological instability or a grief reaction. Pre-impact psychological instability can produce disaster related psychopathology if one takes a process view of symptom etiology and characterizes disaster impact as a precipitating event. Such reactions are usually labeled post-traumatic neuroses and "represent a previously incipient neurosis brought on by the traumatic disaster experience or ... the victim's realization, subsequent to the disaster, of personal mutilation or of marked negative changes in his life situation" (Goldstein, 1960 p.55). It is to be emphasized that adverse psychological reactions of this type tend to persist and show up in the "later" and "long-term" periods depicted in Fig. 2.

Grief reactions constitute the second major source of negative psychological consequences in the "initial" period which can persist into the "later" and "long-term" periods. The important point here (drawn from Bugen's model) is that *some* grief reactions will run their full course in the initial period, e.g., in the case of the *unpreventable* deaths – whether the relationship to the survivor is peripheral or central (see Table I). Longer-term grief reactions are to be expected when the survivor perceives that the death was preventable; these reactions have been documented to persist for considerable time periods when the victim's relationship to the survivor is central (cf. Bugen, 1977 p.202).

SUMMARY AND CONCLUSIONS

The previous discussion focuses upon negative psychological consequences which might accrue from the impact of natural disasters. It is meant to suggest that under specified conditions it is *possible* that some individuals could experience negative psychological consequences. At the same time, we have tried to emphasize that most disaster studies – particularly those conducted by researchers operating within the medical model – are not designed in a way that permits them to detect *disaster-related* psychological disorders.

Furthermore, it should be pointed out that negative psychological consequences tend to be the exception rather than the rule. Many studies of communities following disaster impact indicate that some people are better off as a result of the experience (for summaries of such data see Fritz, 1961; Barton, 1969; Quarantelli and Dynes, 1972; Taylor, 1976). Empirical studies of short-term psychological consequences suggest that negative reactions are quite rare – helping-oriented activities, the absence of panic, self-reliance and resource-sharing instead dominate as short-term responses (cf. Quarantelli and Dynes, 1972; Kinston and Rosser, 1974). Also, research indicates that, although well documented and described, the "disaster syndrome" in fact afflicts only a very small proportion of victims. As for evidence of longer-term psychological reactions (whether positive or negative), the number of available empirical studies – using an acceptable methodology – is limited. Research based upon records of admissions to psychiatric treatment following disaster have indicated that such admissions typically decline rather than increase (Bates et al., 1963;

Bennet, 1970). Sterling et al. (1977), using perhaps the only quasi-experimental research design yet reported in the disaster literature, found that victims of a tornado disaster showed no longer-term negative effects. Thus, the available empirical evidence suggests that long-term negative psychological reactions are rare, if not nonexistent. The apparent recent exception is the case of Buffalo Creek where Kai Erikson (1976) and others (Rangell, 1976; Titchner and Kapp, 1976; Lifton and Olson, 1976) argue that victims did experience numerous traumatic reactions. It should be indicated, however, that these studies are based upon a medical model of psychiatric disorder, rely upon a methodology subject to considerable argument and represent a single case (cf. Taylor, 1976 pp.279–280).

The primary purpose of this paper, however, is not to argue that there are negative or positive psychological consequences of natural disasters. Instead, we have presented a conceptual model which isolates important variables and specifies the channels through which disaster impact impinges upon individuals and might produce some psychological consequences, either positive or negative. The conceptual framework is advanced in a spirit of tentativeness; it is a working model. The value of this model lies in the fact that it represents an explicit attempt to conceptualize and integrate existing empirical knowledge.

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Mass Emergencies 3 (1978) 117–132
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ARE THERE LONG TERM EFFECTS OF AMERICAN NATURAL DISASTERS?

ESTIMATIONS OF EFFECTS OF FLOODS, HURRICANES, AND TORNADOS OCCURRING 1960 TO 1970 ON U.S. COUNTIES AND CENSUS TRACTS IN 1970*

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I. INTRODUCTION

Hardly a week goes by without some attention in the mass media to the damage from and the victims of natural disasters. The damages and injuries wrought by the tremendous forces of nature lead to dramatic news stories and television footage. Disaster victims quite deservedly attract sympathy, with public agencies and voluntary organizations providing quick rescue help and emergency shelter and care. However, last week's damages and victims recede in memory to be supplanted by this week's occurrences. Clearly, floods, tornados and hurricanes excite public interest and enjoy public sympathy, at least in the very short run period after occurrence.

If last week's flood is old news, what then is last year's damage? The immediate aftermath of a natural disaster is usually the focus of considerable attention and proffered help, but what about the long term needs for reconstruction? Are there significant long term needs that result from disasters that require more attention than is currently being given under current American policy?

To be sure, current federal disaster relief and rehabilitation policy in the United States as expressed in PL 93-288 "Disaster Relief Act of 1974," shows some nominal concern for long term effects of natural disasters, containing a provision (Title V) aimed at providing relief and rehabilitation support for the long term needs of disaster stricken communities. But, this section of the legislation has never been implemented, possibly expressing federal agencies' concern whether there are demonstrable needs for such relief and rehabilitation efforts.

These are the questions to which the research to be described in this paper is addressed. We have attempted to estimate the long term effects of the major floods, tornados and hurricanes that occurred in the decade 1960 to 1970, a period chosen because of accessible data. The effects studied are those that manifest themselves in distorted population, housing and economic decline (or growth) in small areas – census tracts – within urbanized places and in counties throughout the United States. These estimated changes are calculated using data from the 1960 and 1970 U.S. Censuses, and several disaster data bases in a unique, powerful research design, to be described in greater detail later in this paper.

The nature, duration, and magnitude of long

*The findings reported in this paper are derived from research conducted under NSF RANN Grant ENV 76 15441 "Research Program on Natural Disaster Recovery Processes."

term effects of natural disasters has been the focus of previous research, almost exclusively in the form of case studies of relatively large disaster events typically occurring in smaller settlements (Bates et al., 1963; Cochrane, 1975; Erikson, 1976; Friesma et al., 1977; Haas et al., 1977; Barton, 1969; Dacy and Kunreuther, 1969). These case studies have provided rich detail on how some communities reacted to disaster events but they all suffer from the chronic problems of case studies. First of all, they focus on events that are quite atypical, usually on the most serious end of the continuum of disaster magnitude. Secondly, they are all handicapped in being unable to disentangle the events that took place after the disaster that were reactions to the disaster from events that would have taken place anyway. Thus, the conclusions of some case studies that the disaster events accelerated growth (or brought about a decline) cannot be evaluated since we ordinarily have no way of discerning what would have happened to the community had the disaster not occurred.

The research we report here is free and clear of some of the deficiencies of case studies. We will present analyses of the long-term effects of all the major floods, tornados and hurricanes that occurred in the period between 1960 and 1970. Furthermore, we have developed a method that will provide estimates of what would have occurred to places experiencing disaster events if the disaster had not occurred. Finally, the disaster events we will study are serious occurrences, but not exclusively those whose magnitudes swamp the capacities of the places involved: our events include those that occur in large urban places as well as those that occur to relatively sparsely settled spots in the country.

II METHOD

The method employed to estimate the long-term effects of natural disasters takes advantage of the fact that the U.S. Census provides fairly detailed demographic, housing and some economic measures on small sub-areas within metropolitan places and for all counties. Since two adjacent censures can be linked (with some error, as we were to learn) it is possibly to calculate the changes in those respects experienced by such areas over the decade intervening. Those calculated changes represent the outcome of many processes, some of which can be modelled. Based upon our understanding of change processes for small areas generally, we can calculate for each such area, what its expected 1970 state is, given its position in that respect in 1960, and the change processes typical of places that are roughly comparable. If we then identify those areas that have experienced disasters within the decade 1960 to 1970, we can estimate how change processes have been effected positively or negatively by such experiences. Since disasters occur at various times during the decade, we can also see how 1960–1970 change is affected by when the disaster occurred within the decade. Presumably those disasters that occurred closer to the 1970 Census should show stronger impacts on small area changes than those occurring earlier in the decade.

This general approach was applied separately to all counties in the United States and to all tracts in metropolitan areas that experienced major disasters, along with all tracts in a "control" sample of metropolitan areas that did not experience a disaster. The general linear model was applied to the estimation procedure using models of the general form shown below (for tracts):

$$Y_{1970i} = Y_{1960i} + \Sigma b_i T_i \ \Sigma + b_k M_k + \Sigma b_i D_i + e$$

where

Y_i is some 1960 or 1970 measure for tract i, e.g. total tract population, total housing in tract,

$\Sigma b_i T_i$ is a vector of tract characteristics that relate to tract change, e.g. land area, location in SMSA, socio-economic

composition in 1960,

$\Sigma b_k M_k$ is a vector of SMSA and regional characteristics for the SMSA and region in which the tract is located, e.g. SMSA size and growth rate,

$\Sigma b_i D_i$ is a vector of variables indicating whether or not the tract experienced a disaster in the period and of descriptors of such events,

e is the usual stochastic error term.

Similar models were used for counties with appropriate modifications. Since economic activity measures were ordinarily not available in any detail for tracts, and are available only for counties, the economic activity effects of disasters could only be estimated for these larger units.

Although the models used provide a means for estimating disaster effects that are net of other changes occurring either in tracts or counties, the models were unable to separate out the effects of disasters from the effects of public policies that were applied to relief and rehabilitations activities that were reactions to the disaster. Hence, the estimates for long-term disaster effects that will be presented later on in this paper are estimates for disasters *and* accompanying endogeneous recovery efforts, aid given by political units and private organizations originating outside the disaster stricken areas, and the resulting reactions of housing markets for both rental and owner occupied units.

Clearly the worth of the procedure employed is highly dependent on our ability to undertake with some degree of accuracy two important steps: First, we have to be able to match 1960 and 1970 census tracts and counties so that data from the two censuses refer to the same spatial areas. Secondly, we need to be able to pinpoint the location of natural disasters finely enough to be able to detect which tracts and which counties had such experiences in the 1960–1970 decade. The next section of this paper addresses those two issues.

III THE CENSUS DATA BASES FOR COUNTY AND TRACT ANALYSES

The decade 1960–1970 was one that marked considerable growth in the American population and an even greater growth in its housing stock. Urbanization trends continued with more and more of the American population congregated within metropolitan areas. At the same time within metropolitan areas, growth and decentralization led to some degree of reapportionment of residential locations within such areas. All these trends meant that areal aggregates used by the U.S. census and designed to reflect the political boundaries of American localities and the population distributions within such boundaries were changed. The consequence for our study was to make it difficult to identify areal units that were identical in boundaries from the 1960 to 1970 Censuses.

Least difficulty was found for counties, important political units outside of the New England states and Alaska [1], and hence less likely to change. Of the 3,141 counties to be found in the relevant portions of the U.S., 3102 comparable county units could be defined consisting overwhelmingly of exactly comparable counties and a few units made up of combined contiguous counties whose boundaries when combined were comparable. Hence, our data base for our county impact analysis consists of the 3,102 counties and county units whose boundaries were essentially unchanged in the Censuses of 1960 and 1970.

A Census-defined Standard Metropolitan Statistical Area consists of a county containing a city of 50,000 or more and includes the contiguous counties that are urbanized. In a period of rapid urbanization and growth, new SMSA's are recognized by the census for each new census. The period 1960 to 1970 was no exception. However, since tracts are defined only for existing SMSA's, those places advanced to SMSA status with the 1970 Census were not tracted in 1960. Hence, our census tract analysis must necessarily be based on only those SMSA's

which were already defined as such in 1960. Since the number of SMSA's for the U.S., so defined, far exceeds the number that experienced a natural disaster in that period, we devised a sample of SMSA's which consists of all the 1960 SMSA's experiencing at least one disaster and a probability sample of all other SMSA's drawn so that the final sample of SMSA's represents the size distribution of SMSA's in the U.S.

Much more difficulty was experienced with census tracts, areal subdivisions of metropolitan areas that are created for census purposes. Tract boundaries are drawn when an area becomes an SMSA according to rough guidelines that direct local census tract committees to observe physical demarcations as boundaries (e.g., rivers, major highways, and the like) and to encompass roughly homogeneous areas with about 1,500 dwelling units and 4,000 residents. Clearly, a tract first defined in 1940 or even 1960 may have changed a great deal by 1970 while areas that were essentially unpopulated in 1950 or 1960 may now house many thousands of residents. Each decennial census recognizes these changes by redrawing some of the tracts. Of the 10,720 tracts that we finally used in our analysis, 70% were exactly comparable in boundaries (or changed in trivial ways) in 1960 and 1970. An additional 12% of the tracts represent merges of groups of tracts (usually pairs) that through mergers maintain comparable boundaries between the censuses. An additional 18% are "roughly"comparable encompassing areas that are 90% or more identical from one census to the other. Merged and roughly comparable tracts are precisely those experiencing the greatest amount of change from 1960 to 1970; that is the reason they were split or merged or boundaries changed. Hence, in the census tract analysis the degree of area comparability has to be taken into account.

Merging the two census files required a great deal of handwork, especially for census tracts. We are confident that we have units that are either exactly comparable in area or are comparable enough for our purposes when the small degree of incomparability is taken into account.

IV THE DISASTER DATA BASE

To conform to the requirements of the form of analyses specified by the model presented earlier, we needed to be able to identify all the disaster occurrences taking place between 1960 and 1970 along with information on their locations in space and time, as well as on their magnitudes. Unfortunately, there is no single source that contains all the required information with sufficient specificity. Instead, there are a variety of data sources, each of which suffers to some degree from more or less grievous faults.

To begin with, there are literally thousands of events that could have precipitated natural disasters, but which occurred in sparsely populated areas or were of minor magnitude even though occurring in a populous area. For example, the National Severe Storm Forecast Center's tornado file enumerates more than 7,000 tornado events in the decade 1960–1970. The vast majority of these events, however, are not natural *disasters* because they neither inflict injury nor damage. Of this very large number, only 24 were serious enough to be the occasion of a Presidential Disaster Declaration and only 129 were serious enough to be the object of a Small Business Administration declaration. Clearly, events which had no short term consequences for life or property can scarcely have any long term effects. Similar counts can be made of other types of potentially disastrous events: Most riverine floods cause little or no damage because they are either minor in extent or because they occur in places where there are few people and little in the way of property.

Secondly, there is a variety of sources of data on natural disasters each of which takes a different slice into the total set of events that might qualify as disaster occurrences. One of the more comprehensive files is the tornado file (machine readable) compiled by the National Severe Storm Forecast Center which purports to contain every tornado occurring in the United States since 1945. Although this data

base is more inclusive than we need, it also contains important locational information (latitude and longitude to nearest minute of points where each tornado touched land and where it raised again) and damage and injury estimates.

Another set of comprehensive sources is the American National Red Cross Chapter Reports filed with national headquarters. While the Chapter Reports contain fewer accounts of disaster events, more serious events are almost certain to be included. Other sources used include the files of the Small Business Administration, the Federal Disaster Assistance Administration, the National Hurricane Center, publications of the U.S. Geologic Survey – especially the *Hydrological Atlas* and *Water Supply Papers* – flood hazard boundary maps filed with the Federal Insurance Administration, and files of the New York Times.

These data sources each take a different slice into the universe of natural disaster events, provide different items of information about each event recorded and are difficult to reconcile one with each other. Fortunately, when they cover the same classes of events, they each tend to record more faithfully the more serious occurrences.

Finally, with the exceptions of the tornado tape, most of the data sources are at best vague and at worst silent on an important characteristic of the disaster events. They do not record precisely where the disasters took place, a characteristic that is quite critical for our purposes of locating which small areas experienced disaster events in the period 1960 to 1970.

Two main questions lay behind our use of the disaster data bases. First, we needed to enumerate all the disaster events that were serious enough that their long term effects might conceivably be measurable. That is, the amount of damage to property or to persons had to be more than simply minimal. We were surprised to learn how trivial were most of the events that were recorded. Employing a definition of "serious" that would mark off about the top 20th of disaster events [2], we arrived at the enumerations shown in Table I separately for counties and for SMSA's. It should be noted that the criteria used were not high: we were concerned that too high a threshold would leave us with very few natural disaster events to study.

A second use of the disaster data base was to locate in quite precise terms where the natural disaster events occurred within metropolitan areas, in order to identify which census tracts were likely to have been impacted by a disaster event. To answer this question, the tornado tape provided by the Severe Storm Forecast Center was the most adequate since it provided the latitude and longitude to the nearest minute of the beginning, end, and major bends in each tornado's path. Even this information was not as accurate as desired since accuracy to the nearest minute meant that the path's location

TABLE I

Serious Natural Disaster Events Occurring in the Decade 1960–1970

A. Counties:
   1. Number of counties experiencing at least one natural disaster event = 1,140 (or 37% of all counties in Census data base)
   2. Number of counties experiencing disaster events:*
      Tornados: 677
      Floods: 516
      Hurricanes: 137

B. Standard Metropolitan Statistical Areas (SMSA's):
   1. Number of SMSA's experiencing at least one natural disaster event = 56
   2. Number of SMSA's experiencing disaster events:*
      Tornados: 33
      Floods: 35
      Hurricanes: 8
   3. Number of tracts experiencing disaster events:*
      Tornados: 505
      Floods: 419
      Hurricanes: 260

* Since the same natural disaster event could have affected more than one county, SMSA, or tract, these numbers represent a considerably smaller number of separate and distinct disaster events.

was obtained with an accuracy ± one mile, a relatively large measurement error calibrated to the average size of census tracts (averaging 8 square miles). The hurricane tape provided by the National Hurricane Center also contained detailed locational data on the eye of each hurricane and its position at frequent time intervals. However, since hurricanes are rather diffuse phenomena, this information had to be supplemented with data from the Small Business Administration's home loan program.

Locational data on floods posed the most serious problems. Detailed maps showing the extent of flooding in the major urban flood of the 1960's do not generally exist; the few exceptions to this pattern (for example, certain *Hydrological Atlases*) were found to be unusable for other reasons (for example, only a small portion of the total flood area was mapped). It was therefore necessary to rely upon Flood Hazard Boundary Maps outlining the 100 year flood plains for the areas in question, picking those flood plains containing addresses upon which SBA home loans had been given as a consequence of the floods in question.

The locational data upon which the census tract analyses are based are obviously only approximately correct. We are most sure that we have tracts that experienced tornado damage among the tracts we have so designated, but most likely we have included as such tracts that actually were not impacted. The errors of over-inclusiveness are greater most likely for hurricanes and floods [3]. It should be noted that the consequences of these errors are to water down the estimates of effects to be presented later in this paper, since areas have been included that did not actually experience disaster events. This under-estimation applies primarily to the analysis of disaster effects on census tracts: We are quite certain that we have correctly classified counties as to whether each was impacted by a disaster.

V COUNTY LEVEL DISASTER EFFECTS

For most sections of the United States counties are important (and sometimes the only) units of local government, providing in many cases police protection, medical services, educational services and emergency rescue and relief. Even in metropolitan areas such as Los Angeles and Chicago, county governments provide a significant number of local urban services, and in rural areas counties are often the only local government body able to provide essential services. In short, counties are important political units and often important economic units as well.

For our purposes, we have identified 3102 counties (or combinations of counties) for which we have census data for both 1960 and 1970. Because counties are relatively large geographic units, we are quite certain that we have been able to correctly identify those hit by natural disaster events in the decade 1960–1970. However, by the same token, it seems unlikely that we will be able to find long lasting disaster effects because counties are large enough to obscure, possibly, those enduring effects that are characteristic of the smaller areas within them that may have been impacted by the disasters in question. The damages and injuries inflicted by the typical flood, hurricane or tornado have occurred to so small a proportion of the structures, enterprises and households located within typical counties that it is not likely that these events have been a serious threat to the total resources of the counties in question.

To discern the effects of disaster events on counties we employed the model described earlier in this article. The results of the application of this model to the percentage changes (1960–1970) in housing stock and population are shown in Tables II and III. The county characteristics that we have included in the model are measures of the composition of the population in the counties, certain economic variables such as median household income and propor-

TABLE II

Regression of Percentage Change in Total County Housing
Between 1960 and 1970 on Disaster Hits and Selected 1960 County Variables

Independent variables	Dependent variable is percentage change in total county housing, 1960 to 1970[1]		
	b	SE	signif.
Area of county (square miles)	0.000	**[2]	0.850
% non-white (1960)	−0.020	0.021	0.352
Median age of all persons (1960)	0.122	0.071	0.089
Median family income (1960)	−0.002	**[2]	0.000
% unemployed (1960)	−1.038	0.117	0.000
% in manufacturing (1960)	0.253	0.026	0.000
% in trade (1960)	0.101	0.085	0.235
% built after 1949	0.916	0.032	0.000
County in SMSA[3]	8.495	0.803	0.000
Flood hit	0.417	0.785	0.531
Hurricane hit	2.001	1.435	0.163
Tornado hit	0.810	0.693	0.243
Intercept	−10.837	2.890	0.000
R^2 =	0.384		0.000
N =	(3078)		

[1] $\text{Percentage change} = \dfrac{\text{Total county 1970 housing} - \text{Total 1960 housing}}{\text{Total 1960 housing}} \times 100$

[2] Standard error too small to record.

[3] Any time during decade or by 1975.

tion unemployed in 1960, as well as measures of the housing stock in the counties.

The regression coefficients (b_i) shown in Tables II and III should be interpreted as follows: a unit change in an independent variable is accompanied by a change in the percentage growth in population or housing that is shown by the value of the corresponding b. Thus in Table II, a shift upwards of one year in the median age of all persons in a county is accompanied by 0.122% increase in the housing stock. The value R^2 shown at the bottom of the tables represents the extent to which the characteristics used in the model "account" for the percentage changes in housing or population in the decade in question [4]. In addition, the last (right hand) columns of Tables II and III contain significance levels for the b's, a measure of the extent to which the b in each row differs significantly from zero. Thus an entry of 0.000 in this column indicates that there are fewer than 1 in a thousand chances that a coefficient of that size could have been drawn by random sampling of circumstances in which the "real b" was zero.

While there may be some interest in all the coefficients of Tables II and III our primary concern is with those associated with the three types of natural disasters, as shown in the last three lines in each of the tables. Note that these coefficients are not large enough to be significantly different from zero: that is, *there are no discernable effects of either floods, tornados, or hurricanes on the changes in population or housing stocks experienced by counties in the period between 1960 and 1970.*

Additional analyses were also made of the effects of natural disaster events on other characteristics of counties, including housing values, rents, age composition, educational level of population, and family income. In the interests

TABLE III

Regression of Percentage Change in Total County Population
Between 1960 and 1970 on Disaster Hits and Selected 1960 County Variables

Independent variables	Dependent variable is percentage change in total county population, 1960 to 1970[1]		
	b	SE	signif.
Area of county (sq. miles)	0.000	[2]	0.199
% non-white (1960)	−0.046	0.021	0.030
Median age of all persons (1960)	0.455	0.072	0.000
Median family income (1960)	0.001	0.000	0.028
% unemployed (1960)	−0.252	0.119	0.034
% in manufacturing (1960)	0.191	0.026	0.000
% in trade (1960)	0.148	0.086	0.084
% built after 1949	0.867	0.032	0.000
County in SMSA	9.904	0.814	0.000
Flood hit	−1.245	0.796	0.118
Hurricane hit	2.562	1.454	0.078
Tornado hit	0.306	0.703	0.663
Intercept	−37.002	2.930	0.000
R^2 =	0.395		0.000
N =	(3078)		

[1] $\text{Percentage change} = \frac{\text{Total 1970 population} - \text{Total 1960 population}}{\text{Total 1960 population}} \times 100$

[2] Standard error to small to record.

of simplicity of presentation, these tables are not presented here [5]. While there were a few instances in which the disaster coefficients were large enough to be statistically significant, no coherent interpretable pattern emerged. In short, there appear to be no firm findings that indicate that natural disasters have any effects on counties that last for an appreciable period of time.

The expectations we stated at the beginning of this section – that no direct and lasting effects of natural disaster events would be found on the level of counties – have been borne out. For the entire set of counties, it is clear that there are no significant effects of disasters on growth trends in either population or housing. There are several reasons for this finding: first of all, the damages and injuries directly attributable to the disasters are very small in relation to the population bases and housing stocks of the counties involved. Even in rural counties, where the ratios of damage to stock may be regarded as largest [6], this ratio is apparently too small to expect that the task of reconstruction would absorb significant proportions of county resources. Secondly, disaster policies on the federal, state and local levels in effect during the decade of the 1960's may have been sufficient to provide enough additional support for reconstruction to dampen considerably the lasting effects of natural disaster events on counties.

In short, the general thrust of the findings presented above lead to the following conclusion as the most plausible interpretation: *disaster events occurring within counties in the period between 1960 and 1970 have no discernible consistent effects that survive more than a very short period of time.*

VI THE LONG TERM EFFECTS OF NATURAL DISASTERS ON CENSUS TRACTS

Compared to counties, census tracts are very small in population and area. If size were the only conditioner of discernible long term disaster effects, we should be able to discern such effects when we shift to census tracts as the unit of analysis. This section presents the results of the application of our general model to intercensal tract changes for the period 1960 to 1970.

The specific model used was constructed with the following consideration in mind. First, changes in a tract during the period 1960 to 1970 are partially a function of the characteristics of the tract at the start of the period. In particular, it is necessary to take into account the 1960 level of the characteristic being studied, i.e. heavily populated tracts as of 1960 are likely still to be heavily populated in 1970. In addition, one must take into account 1960 housing characteristics, the 1960 socio-economic composition of the tract, the location of the tract in the SMSA. And so on.

Secondly, trends in a particular tract are likely to reflect changes that are occurring in the SMSA in which the tract is embedded. Thus a tract in Dallas is likely to share in the overall growth patterns of Dallas just as tracts in a declining SMSA, as Worcester Mass., are likely to share in the general SMSA decline in that place.

Thirdly, binary dummy variables were used to represent whether a tract was "hit" by a natural disaster of a given type during the period 1960 to 1970 [7]. More elaborate specifications of disaster events were also tried (results not reported here) but with no resulting enhancement of our understanding of the effects of natural disaster events.

Finally, variables were entered into the model that captured the degree of merging and uneven matching that was necessary to make the 1960 and 1970 tract files compatible. Since such adjustments were made most often for tracts in areas experiencing high growth or decline, these variables were especially important in removing artifacts of method from our estimations of disaster effects.

The direct impact of a natural disaster event is felt upon the physical structures, land and inhabitants of the areas impacted. The destruction of residential dwellings, stores and factories, public utilities and public facilities and injuries and deaths inflicted upon inhabitants constitute the direct impact of a natural disaster. Consequently, we can expect that at least a major indicator of long term disaster effects would be alterations in the growth patterns of an area's housing and population. Certainly the destruction of dwellings lowers the population carrying capacity of an area, at least temporarily. Deaths and injuries directly lower population levels and can possibly make an area less attractive as a place to live in. Clearly, were nothing else to happen, the expected impact of a natural disaster event would be to alter the growth patterns in housing and population in a downward direction, i.e. fewer houses and persons than would otherwise be expected. Of course, the occurrence of a disaster does cause "other things to happen," including relief and rehabilitation measures along with reconstruction of the damaged physical structure of the area.

On the average, five years have elapsed between the occurrence of the average disaster we studied and the taking of the 1970 census [8] with some occurring as much as ten years earlier but none less than a year. In that period much could have happened to restore the *status quo ante* and possibly to catch up with general local growth trends. Hence all we can discern in our data is whether the tracts that were subject to tornado, flood, and/or hurricane events showed growth trends in the period between 1960 and 1970 that were more, less, or the same as tracts that did not suffer such incidents. Tables IV and V present our findings with respect to population and housing growth trends [9].

Population growth trends are analyzed in Table IV. Obviously the most important pre-

TABLE IV

Regression of Total Population 1970 on Disaster Hits and Selected Tract and SMSA Characteristics

Independent variables	Dependent variable is total population in tracts, 1970		
	b	SE	Signif.
Total tract population 1960	1.09	0.009	0.000
Median age 16 and over (1960)	–44.0	5.6	0.000
Median household income (1959)	0.095	0.017	0.000
% housing built before 1940	–16.3	1.29	0.000
Number of trailers (1960)	5.36	0.580	0.000
% Non-white (1960)	–12.05	1.37	0.000
Tract area (sq miles)	9.88	0.896	0.000
SMSA population 1960 (000's)	0.084	0.013	0.000
SMSA population change 1960-1970	21.9	3.41	0.000
SMSA % unemployed (1960)	–67.4	25.2	0.008
Exactly comparable tract 1960–70*	–769.1	80.2	0.000
Ring City tract	–444.1	21.5	0.000
Central City tract	–767.6	75.4	0.000
Tornado hit	224.7	142.8	0.116
Flood hit	239.1	156.6	0.127
Hurricane hit	250.6	198.0	0.206
Intercept	2850.5	254.2	0.000
R^2 =	0.706		0.000
N =	(10654)		

* "Exactly comparable tract" is a binary variable taking on the value of 1 if the tract in question was identical in 1960 and 1970 or formed over a group of tracts that had as a group identical boundaries in 1960 and 1970.

dictor of a tract's total population in 1970 is the same tract's population in 1960. The regression coefficient, 1.09, associated with this variable indicates, *ceteris paribus*, that tract populations grew by 9% from 1960 to 1970. The remaining coefficients can be interpreted directly in terms of the numbers of people over and above that expectation that may be found associated with each of the tract characteristics shown. Thus for each additional year in the 1960 median age of persons 16 and over there are 44 fewer persons than predicted in tracts in 1970.

The reader's attention is directed toward the coefficient for "exactly comparable tract," a measure that marks whether a tract (or group of tracts) changes boundaries in between the two censuses. Tracts that did not change boundaries (and hence are exactly comparable) were most likely to decline in population, by an estimated 769 persons, expressing again the fact that tracts whose boundaries it was not necessary to change were tracts that remained relatively constant in population.

As one might expect the determinants of tract housing stock, as shown in Table V, are quite similar to those for population as shown in Table IV. It should be noted that the housing stock in that period was growing at a faster rate than tract population, 13% as compared with 9%.

At the bottom of Tables IV and V are shown the coefficients for each of the three types of natural disasters. Although all the coefficients are positive, none of them are statistically significant. As in the case of counties, *there are no*

discernible net effects of natural disaster events on growth trends in housing or population stocks for census tracts in the period 1960 to 1970 [10].

Additional analyses were performed on subsets of tracts. No particular pattern was shown for tracts from SMSA's of different sizes indicating that disasters had negligible effects in small sized metropolitan areas and in larger ones as well. Stratifying tracts by median family income in 1960 (an indicator of socio-economic level), we found that high income tracts (approximately the upper third in median income level) appear to be favorably impacted by flood disaster events. They have significantly higher growth rates than would be expected on the basis of their other characteristics. No explanation comes to mind for these counter-intuitive findings: perhaps all they indicate is that residential locations on the flood plains of urban places are attractive sites and hence are both likely to have higher income households and higher growth rates.

Regression with tract characteristics other than housing and population were also run with no particularly strong patterns emerging. Drastic alterations in income, age structure and housing values were not associated with any of the three disaster events [11].

The results of our analyses of the long lasting effects of the three types of disaster events on both counties and Census tracts can be succinctly summarized: *for the period 1960 to 1970, there are no discernible effects of the natural disaster events occurring in that period which materially altered population and housing growth trends for counties and for census tracts.*

VII IMPLICATIONS FOR DISASTER RESEARCH AND DISASTER POLICIES

The attempt to assess long-term effects of

TABLE V

Regression of Total Tract Housing 1970 On Disaster Hits and Selected Tract and SMSA Variables

Independent variables	Dependent variable is 1970 total tract housing		
	b	SE	Sign.
Total housing 1960	1.13	0.008	0.000
Median age (16 & over) (1960)	–12.31	1.74	0.000
Median household income (1959)	0.036	0.005	0.000
% housing built before 1940	–6.24	0.398	0.000
Number of trailers (1960)	2.0	0.178	0.000
% non-white (1960)	–2.58	0.422	0.000
Tract area (sq miles)	3.85	0.276	0.000
SMSA population 1960 (000's)	0.016	0.004	0.000
SMSA population change (1960–1970)	6.39	1.05	0.000
SMSA % unemployed (1960)	–20.12	7.78	0.010
Exactly comparable tract	–245.45	24.72	0.000
Ring City tract	–115.19	29.53	0.000
Central City tract	–206.8	23.25	0.000
Tornado hit	64.65	44.0	0.142
Flood hit	72.21	48.26	0.135
Hurricane hit	103.20	61.03	0.091
Intercept	906.9	76.4	0.000
R^2 =	0.711		0.000
N =	(10654)		

natural disasters that was described in the previous sections of this article have led us to a number of conclusions concerning both the existing data bases that are available to the research community for the study of natural disasters in the U.S., about the nature of the distributions of such disasters for what may be called a typical decade in recent U.S. history, and finally about natural disaster relief and rehabilitation in the United States. Each of these sets of implications are taken up in turn in this section.

A. Concerning the Existing Natural Hazard Data Bases

The data bases upon which this report was constructed were not collected, obviously, for the purposes to which we put them and hence our experiences with trying to use them for our goals were frustrating. The ideal natural hazards data bases would most likely have been far from the agencies' capabilities and certainly far beyond their interests to produce. Yet there are some steps that can be taken by the agencies in question which would, at minimum cost, make their data bases more usable by these researchers and by others.

These recommendations involve two steps that can be taken by the agencies in question and a third step that involves construction of a new institution, a disaster data archive. The first recommendation involves computerization of existing data bases in a form that would facilitate the transfer of information among agencies and from agencies to researchers. Although most agencies have either done so or are in the process of so doing, it is important to stress that computerization can be done in ways that restrict outside-the-agency applications and that such forms should be avoided, if at all possible. For example, the excellent American National Red Cross Chapter Reports are currently on tape, but in a form that makes it easy for ANRC to get hard copies of its reports but make it difficult for anyone else to use the computer tapes for research purposes [12].

A second step that could aid future disaster research considerably would be for agencies to standardize data bases. Standardized procedures, formats, codes, etc., should be used whenever possible, including the adoption of such general procedures as using the Federal Information Processing Standards codes for states, counties and other places.

The most pressing need for standardization is in defining and retaining in records the actual locations of disasters. The data bases, with the exception of the NSSFC's tornado tapes, do not allow one to accurately locate disasters with any precision even within such gross categories as counties and municipalities. Of course, part of the problem lies in the ambiguous locations of disasters, especially hurricanes, but damage and injuries located by counties would be a serious improvement over current imprecision.

A third step that could be taken involves the centralization of records, a step that would require the development of a new institution that would serve as an archive with the mission of collecting, cataloguing and disseminating data on the incidence, location and sequelae of natural hazards phenomena. Although it is clear that such an archive would be of immense utility to researchers, there are also policy purposes that might be directly served by the construction of such an archive that may also justify the considerable startup and maintenance costs involved. For example, hazard risk assessment would be considerably strengthened by better historical records on the risk experiences of communities and larger areas. If disaster locations could be recorded in fine detail, the disaster experiences of local communities could be used to bolster arguments for disaster mitigating land use management and structure construction standards.

B. The Distribution of Disasters by Severity and Size

It should now be abundantly clear that many events routinely labelled "natural disasters" are not really disasters in any literal sense of

the word, especially when regarded from the perspective of communities, states, and the federal establishment. *This is not to state* that the occurrence of a natural disaster event is a trivial event to the individuals, households, firms, and possibly neighborhoods that have directly experienced the impact, a topic to which we will return shortly.

This point is made dramatically if we consider damages and injuries from floods. For the 1,612 counties for which at least one ANRC Chapter Report exists for the decade 1960–1970, we may note that *over the entire decade,* the average impacted county experienced losses that amounted to less than one person killed, about 12 injuries, with four dwellings destroyed, and 22 dwellings suffering major damage. Similar average losses were experienced by counties that had experienced a tornado event. Even the most serious hazard, hurricanes, produced decade accumulated injuries and damages amounting to 1.4 deaths, 179 injuries, 42 dwellings destroyed, and 137 with major damage. What long term disaster effects could be expected from such events for counties whose average population was 78,000 people and 25,000 dwellings in 1960? For the typical disaster stricken county loss of life from automobile accidents exceeds loss of life from natural hazards by a ratio of 50 to 1; the loss of property through natural decay exceeds the loss of property through natural hazards by approximately twice that magnitude. No one would seriously maintain that automobile accidents and natural decay have long term effects on counties.

Of course, these events are not trivial from the point of view of the victims involved and there may be quite serious long term effects on the health and economic well being of the households and firms that have been directly the victims of even the smallest natural disaster events. The contrast is with the community as a whole for whom the disaster events experienced are relatively light. Three important conclusions stem from this contrast between the individual and social viewpoints:

First, in assessing the likely effects of natural disasters on various units, it is essential to take into account the magnitude of the losses involved against the resources at the command of the unit in question. Thus, the resources of an individual or household are small in comparison to the losses experienced by an impacted unit [13], while for a city, county, or state, the ratio of losses to resources available is small. The larger such an *impact ratio* (ratio of damages to available resources) the larger the need for outside help.

Secondly, although we are skeptical that there are any long term recovery assistance needs for communities, no implications should be drawn for such statements about individual, household, and business victims. We do not know from this analysis whether or not there are some long term disaster assistance needs on the levels of individuals, families and businesses.

Thirdly, the preceding points address themselves primarily to *average* disasters, and are not addressed to those outliers in the severity distribution, the Betsy or Agnes hurricanes, a Topeka-sized tornado or a Denver-sized flood. These outlying disaster events are ones in which the impact ratios are high, i.e. where the damages and injuries represent an important proportion of the persons and structures available. For example, we estimate that in the Topeka tornado, the ratio of damaged dwelling units to total dwellings is about 1 in 10 [14]. Of course, we are not sure what values of the impact ratio indicate the need for long term rehabilitation measures, but we are sure that only when this impact ratio is high does it make sense to look for such long term needs.

It should also be noted that the impact ratio is affected both by its numerator and denominator. This means that the same physical event when experienced by a small community may have much *more serious implications than when experienced by an SMSA.* Indeed, that is why so much attention has been given in the disaster literature to events which have occurred

in small towns, e.g. Xenia, Rapid City, Conway, Buffalo Creek, and so on [15]. Catastrophic events for larger places – events on the order of the 1906 San Francisco earthquake – can hardly be understood with any degree of sureness by extrapolating from the experiences of a Xenia or Buffalo Creek disaster event.

C. Implications for National Disaster Policy

Wholesale revisions of our national disaster policy appear to come about in reaction to statistical outliers, not to what might be called the "average, once-a-month" American disaster. We believe that our research which presents a rather good description of the average disaster at least establishes one clear finding: The "average, once-a-month American" natural disaster does not look like Topeka 1966; it does not look like the Thompson Canyon flood, and it does not look like Agnes or Buffalo Creek. Our findings also raise the question whether it is wise to base national disaster policy on the statistically rare and unusual event.

In the ideal, but never realized, case of unlimited resources, policies based on the worst imaginable situation assumptions are reasonable and defensible. In such a world, every airport could be prepared for a Canary Islands type of aircraft accident, every hospital prepared for the aftermath of a nuclear holocaust, and every city prepared for a Topeka tornado or a 1000 year flood. But, there are other demands on resources and given such limitations, the question can be raised: How big a disaster is it rational and efficient to prepare for? Perhaps the most reasonable policy may be simply to admit in advance that such catastrophic events cannot be prepared for and to expect that special measures would have to be taken *ad hoc* if such events were to occur. There are several reasons for this suggestion:

First, there is probably no set of relief rehabilitation measures that would be fully adequate to handle what might be called "extreme value" events, most of all because no policy could ever possibly anticipate and plan for all the relief and rehabilitation problems that events of this magnitude will pose. Secondly, because such events are rare, it makes sense to tailor relief and rehabilitation measures to the specific place and specific type of disaster that would take place. Thus, a superforce hurricane hitting Miami might require different types of relief and rehabilitation measures than a superforce earthquake occurring in Los Angeles, because Miami and Los Angeles are different places and also because hurricanes and earthquakes leave behind different sequelae. Finally, federal disaster policy should not be overhauled every time a new catstrophe comes along and then applied in the interim to the average, once-a-month disasters that occur all the time. We should have a federal disaster policy that is tuned to the needs that are generated by the average disaster and applied to those events alone.

A final complication of the distributional characteristics of natural disasters is that the perspectives on the natural disaster problem varies with the level of aggregation involved. A local community's perspective may be conditioned largely by its own historical experiences with natural disasters, most likely *not* including a major serious event (at least, not within the memories of persons currently living), because such catastrophes are extremely rare for any given place. In contrast, catastrophes are not as rare when viewed from the national perspective since the experiences of local communities when aggregated to the national level represent a formidable problem indeed. What it implies is that policies designed to deal with the national disaster problem and which appear to be rational and effective from that viewpoint, may be seen as burdensome, irrational, inefficient and perhaps even counter-productive from the viewpoint of the communities to which they are

applied. No better example of this difference in perspective can be cited than the Flood Insurance Program. From a Federal viewpoint, the program has much to recommend it. From the viewpoint of a specific community whose memories do not contain a hundred year flood, the policy may appear to be capricious and inequitable. From the Federal perspective, hundred year floods occur every three months, with four or five such floods occurring each year over the nation as a whole.

This last point suggests that Federal disaster relief and rehabilitation policies have to consider not only the costs of policy to the nation as a whole but the costs imposed upon local communities. Costs imposed upon local communities without corresponding tangible perceivable benefits may lead to the deterioration of national policy in the United States as its impact upon local communities becomes felt.

NOTES

1 Alaska does not have counties or census tracts (in 1960) and hence has been dropped from the relevant analyses.

2 See Wright et al. (1978) for complete enumeration of criteria of seriousness employed. One criterion employed (in the use of ANRC Chapter Reports) was that damage from the disaster reported had to exceed 50 or more in the following index:

$$\text{Damage index} = \text{Twice the number of houses destroyed} + \text{The number of houses with major damage}$$

3 For one event for which we were able to get accurate maps showing the exact extent of flooding, our estimated flooded tracts correlate 0.7 with those shown to be flooded on the presumably more accurate maps. It should also be noted that the analysis presented in the next section is not substantially changed if we use the actual flooded tracts instead of our estimated flooded tracts.

4 Thus R^2 of 0.38 in Table II indicates that 38% of the variation among counties in percentage change in housing may be accounted for by the variables shown in that table. Clearly there are other processes that account for such changes that are not presented in Table II, including such artifactual differences as errors of measurement in either independent or dependent variables.

5 A full analysis of these potential disaster effects is shown in Wright et al., (1978) Chapter 6.

6 In Wright et al. (1978) separate analyses are shown for counties of varying population sizes. In each size class, natural disaster effects are essentially zero.

7 Alternative specifications of the disaster variable were also tried (see Wright et al., 1978) including measures of the amount of damage or injuries resulting from the event as well as interactive terms that weighted damage by the time the disaster occurred in the period 1960 to 1970. Since these alternative specifications did not materially change the results shown later in this section, we opted for the simpler binary dummy representation of disaster "hit."

8 This is not entirely accurate since the disasters were not uniformly distributed among the years intervening so this estimate may be as much as six months to a year off.

9 Note that the form of analysis for tracts differs from that employed for counties. In Tables II and III the regression equations predicted the percentage change in population and housing stocks while in Tables IV and V, the equations are predicting the absolute size of housing and population stocks, a difference in approach made necessary by the fact that there is much more continuity in population size for counties than for tracts.

10 To make certain that these results are not artifacts of the difficulties experienced in matching tracts, these analyses were run separately for exactly comparable tracts (results not shown here: see Wright et al., 1978) with results essentially the same as shown in Tables IV and V.

11 Some statistically significant disaster effects were found, but their substantive significance was usually slight.

12 Specific details about this and other data bases are given in Wright et al. (1978) Chapter V.

13 The authors are currently seeking support for research that would produce estimates of long-term effects on individuals and households through a survey of "victims" of past disasters.

14 Note that the Topeka tornado is so far out on the distribution of tornado events during the decade 1960–1970 that it must be regarded as a one-in-a-thousand year tornado for metropolitan areas subject to risk. Given the number of SMSA's in tornado prone portions of the country, a tornado the size of Topeka can be expected once every two or three decades.

15 Because such outliers are very rare for large places and relatively rare for even smaller places, statistical studies of long range disaster effects are unable to say much about what happens when the impact ratio is very large. We are forced to conclude that the study of long range impact of natural disaster events that are outliers will have to be restricted for some time to come to case studies with all the implications for generalizability that this method implies.

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Mass Emergencies 3 (1978) 133–142
© Elsevier Scientific Publishing Company, Amsterdam – Printed in The Netherlands

AMERICAN RELIGIOUS ORGANIZATIONS IN DISASTER: A STUDY OF CONGREGATIONAL RESPONSE TO DISASTER

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This study develops and tests sociological hypotheses explaining the participation in disaster response activities by eighty-six congregations in Xenia, Ohio following a tornado. The analytical framework conceptualizes all organizations as having a demand-capability balance. That is, there are demands for services which are met by organizational resources. During normal times, the demand-capability balance is the result of both its historical context and immediate conditions. The interaction of these elements results in the characteristics of the focal organization and its resulting activities. A disaster alters this balance by providing a new set of immediate conditions and changing previous contextual elements. This changed balance influences both organizational characteristics and organizational activities. This framework is used to predict congregation disaster response using elements of the pre-disaster demand-capability balance and disaster conditions.

BACKGROUND

In the past, studies of community disasters and disaster recovery have tended to ignore the activities of religious organizations. Interest has focused on other community organizations, such as, police and fire departments, or hospitals which have regular pre-disaster tasks that are the same or similar to the tasks which they perform following disaster impact. Groups which engage in disaster behavior somewhat different from their everyday tasks, have been much less studied.

Thus, in most studies which have dealt with religious behavior in disasters (for example, Ahler and Tamney, 1964; Dynes and Yutzy, 1965) church activities are only peripherally described. In particular, there exist almost no studies aimed at understanding the level of involvement and differential response of individual organizations or congregations in the entire community. The study by Davis (1970) is an exception but it is primarily a descriptive account. Martin (1976) has recently presented an extensive study of church activities following a flood. However, his study focuses on the larger denomination rather than on individual community congregations.

Despite this lack of attention given to religious organizations in disaster by researchers and disaster planners, community congregations are involved in recovery activities at all stages of disaster. One descriptive study (Moore, 1958) reports that congregations collect and distribute food, clothing, money, furniture, and other physical goods and provide many needed services. Regular congregation and clergy activ-

ities are also expanded following disaster. This role has been shown to be closely linked to the overall community disaster response because of the victim's preference for local, personal relief activities, the ability of congregations to effectively organize volunteers and control the flow of donated material aid, and the flexibility of congregations to meet unmet needs in the community (Smith, 1977).

A more in-depth understanding of the differential responses of individual community religious organizations is provided by an exploratory study, conducted by the Disaster Research Center, of congregation activities in Wilkes Barre, Pennsylvania following the flood of 1972. From interviews conducted with the pastors or leaders of nine religious organizations it appeared that active congregation disaster response is related to proximity to disaster area, previous community involvement of the congregation, damage to congregation facilities and member's homes, and levels of congregational and denominational resources. This study of Wilkes Barre congregations provides evidence of the possibility for predicting the disaster response of individual community congregations using certain pre-disaster and post-disaster characteristics (Ross and Smith, 1974).

THE ANALYTICAL FRAMEWORK

The analytical framework developed in this paper for the explanation of congregation disaster response reflects two trends in sociology. The first trend is the expansion of the conceptualization of disaster organizations to include those organizations which perform tasks and develop structures that are different from their pre-disaster tasks and structures. Religious organizations are classified as extending organizations since they are "extending their activities into new and unexpected functions for them during the emergency period" (Dynes, 1974: 145). This has expanded the range of organizations studied following disasters to include church congregations, financial institutions, mental health systems, etc.

The second trend is the use of an organizational perspective to study religious organizations (see, for example, Moberg, 1964; Harrison, 1959; Snook, 1974; Wood, 1970 and 1972; Wood and Zald, 1966; Benson and Dorsett, 1971; and Davidson et al., 1969). This deviation from the traditional "Church-Sect" frame of reference both avoids some of the criticisms of earlier frames of reference (Benson and Dorsett, 1971) and links studies of congregations in disaster with studies of other disaster organizations.

Consistent with developing an organizational perspective to study congregations and borrowing heavily from the perspective of organizational functioning proposed by Haas and Quarantelli (1964; more extensively presented in Haas and Drabek, 1973), the analytical framework used here views an organization as attempting to meet demands made on the organization with the capabilities that can be mobilized to meet the demands. With organizational survival it is assumed that there is a degree of balance between organizational demands and organizational capabilities. This balance never reaches equilibrium because of periodic changes or situational conditions which affect the characteristics of organizational capabilities and/or organizational demands. Despite this dynamic character of the framework, it also proposes that the current demand-capability balance is not spontaneous and unique, but rather a continuous outgrowth of a context of organizational and environmental patterns and trends from previous time periods. To account for

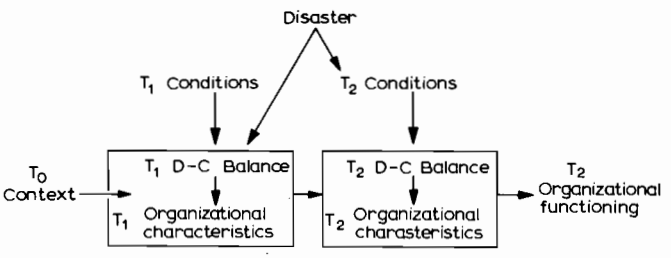

Fig. 1. Determinants of post-disaster organizational functioning.

organizational functioning following disaster, adjustments must be made for the impact on some of the more established contextual elements. These changes affect both the post-disaster demand-capability balance and the organizational disaster response (see Fig. 1).

Parts of this model have been frequently used to understand organizational functioning under stress following disasters (for example, see Quarantelli, 1966; Adams, 1969; Forrest, 1972; and Dynes et al., 1972). Recently Taylor (1976) has made extensive use of this approach by combining it with a collective behavior perspective to analyse an emergent mental health system response to disaster.

HYPOTHESES

Utilizing the demand-capability framework to predict congregation disaster activities, the first hypothesis states that there is a positive relationship between demands and congregation disaster functioning. Internally, demands for congregation disaster response activities are measured as a function of the damage to congregation facilities, members' homes and business property, and the loss of members' employment. The measurement of external demands is more problematic. However, the congregation's distance from the disaster area is likely to be associated with the needs of the general community being seen as legitimate demands within the congregation's domain. It is hypothesized that *congregations with greater demands will be more involved in disaster response.*

The second component of the demand-capability balance, organizational capabilities, is composed of three dynamic elements: 1) the normative/structural element, 2) the member participation and interaction element, and 3) the resource element.

The normative/structural element includes both abstract norms which are clustered into roles, positions, and system domains (Haas and Drabek, 1973: 110) and the structural and programatic consequences of these norms. Based on a review of the disaster, organization, and religion literatures it is expected that congregations involved in disaster response will be characterized by a more liberal theology [1], a higher level of community involvement [2] and benevolence giving, a more social (vs. spiritual) congregation role [3], an active disaster role definition [4], a less particularistic outlook [5], a decision-making process more centralized around the pastor [6], and larger numbers of members and congregation bodies associated with the decision-making process [7]. It is hypothesized *that congregations with normative/structural characteristics most adaptable to disaster functioning will be more involved in disaster response.*

The second element of organizational capabilities, member participation and interaction, is measured using pre-disaster levels of participation and communication by congregation members in various congregation programs. Most congregations keep formal records regarding Sunday worship attendance, Sunday School attendance, membership in men's, women's, and youth organizations, and the frequency of social occasions, worship services, and congregation newsletters. It is hypothesized that *congregations with higher pre-disaster rates of participation and communication will be more involved in disaster response.*

The final element of organizational capabilities is organizational resources. Congregation resources closely linked with organizing a disaster response include congregational budget, membership size, staff size, and possession of certain building facilities such as a kitchen, a sanctuary, and other miscellaneous rooms. It is expected that *congregations with larger amounts of these disaster relevant resources will be more involved in disaster response.*

RESEARCH SITE

The location selected to test these hypotheses is Xenia, Ohio. In 1974 Xenia had a

population of 25,000 and was encircled by Greene County, population 125,000. Within Greene County there were 138 individual congregations ranging in size from 10 to 3,200 members representing 35 different denominations. Compared to national statistics the make-up of the denominations tends to overrepresent conservative and fundamentalist protestant theologies. One-third of the congregations were situated in Xenia and the remainder were located within a ten mile radius of the city.

On April 3, 1974 a tornado hit Xenia leaving 1,200 casualties, nearly half the population homeless, and severely damaged a major portion of the town including almost half of the community's churches. The resulting response of congregations was extensive.

To measure congregation response an exhaustive list of disaster activities was developed using interviews with emergency organization and congregation personnel and local newspaper accounts. Congregation response was measured using two indexes: the first counts the number of different recovery activities performed during the emergency period (the week following the tornado) [8]; the other counts the number of different recovery activities performed after the emergency period [9]. The intensity of each activity could not be accurately measured since congregations did not keep records of the numbers and extent to which disaster victims were helped. As a crude measure of intensity activities performed for members of the community in general were counted twice those activities performed for members only.

A questionnaire was developed to measure the elements of the demand-capability ratio and congregation disaster response. It was pretested using six congregations in Columbus, Ohio which were of the same general denominational make-up as those in Xenia. It was also reviewed by the leaders of an ecumenical disaster organization in Xenia.

The questionnaire was sent to the pastors of the 138 congregations in Greene County in July 1975, 16 months after the impact of the tornado. After a two month response period 60% (N = 83) of the questionnaires were returned. Tests for response bias indicated that there were no significant differences between respondents and non-respondents regarding geographical and denominational make-up. Response bias regarding disaster activities was accomplished by dividing congregations into early, middle and late responding groups and by assuming that any trends found could be generalized to the non-responding group. Analysis indicated that late responders, and therefore, non-responders, were slightly less involved in congregation disaster response.

FINDINGS

Presented below are the findings which test the four hypotheses relating the various indicators of organizational demands and capabilities with congregation disaster response [10].

Demands

Focusing first on disaster demands, it can be seen in Table I that the distance of the church building from the impact area is significantly related to both emergency and long-term disaster response. The correlations of 0.40 and 0.41 are among the strongest found in this study and indicate that the closer a congregation is to the disaster area the more involved it is in both types of disaster response.

Damage to church buildings is also shown to be related to congregation disaster response. Congregations suffering larger losses as a result of the tornado are more involved in long-term disaster response ($r = 0.30$).

Member damage is tested using both the number of households experiencing different types of damage and the percentage of the total congregation that this number represents. Congregations involved in both types of disaster response are more likely to have larger numbers

TABLE I

Correlation Between Disaster Demands and Disaster Response

Variable		Type of disaster response	
		emergency response	long-term response
Distance from impact area	r =	0.40***	0.41***
	n =	83	81
Damage to church	r =	0.15	0.30**
(dollar loss)	n =	82	80
Damage to Members . . .			
Number with total damage	r =	0.21*	0.30**
	n =	81	79
Percent with total damage	r =	0.12	0.13
	n =	69	69
Number with	r =	0.15	0.31**
major damage	n =	81	79
Percent with	r =	0.31**	0.42***
major damage	n =	69	69
Number with	r =	0.27**	0.29**
minor damage	n =	81	79
Percent with	r =	0.26*	0.06
minor damage	n =	69	69
Number with injury	r =	−0.02	0.05
	n =	80	78
Percent with injury	r =	0.21*	0.12
	n =	68	68
Number with	r =	−0.06	0.10
business damage	n =	81	79
Percent with	r =	0.04	0.29**
business damage	n =	68	68
Number with short	r =	0.04	0.17
work stoppage	n =	81	81
Percent with short	r =	0.06	0.02
work stoppage	n =	69	69
Number with long	r =	0.25*	0.43***
work stoppage	n =	81	79
Percent with long	r =	−0.01	0.09
work stoppage	n =	69	69

*$p < 0.05$
**$p < 0.01$
***$p < 0.001$

of households experiencing total damage (r = 0.21 and 0.30), major damage (r = 0.15 and 0.31) and minor damage (r = 0.27 and 0.29) and are more likely to have more households experiencing long periods of employment loss (r = 0.25 and 0.43). Emergency response is significantly associated with the percentage of households with major damage (r = 0.31), minor damage (r = 0.26) and the percentage of households experiencing injury (r = 0.21). Long-term disaster response is associated with the percentage of households with major damage (r = 0.42) and business loss (r = 0.29).

These findings indicate that congregations with greater demands are more involved in disaster response.

Normative/Structural Characteristics

Some capabilities of congregations presented in Table II are also significantly associated with congregation disaster response. Both emergency and long-term disaster responses tend to be associated with the normative characteristics of a more liberal theology (r = 0.17 and 0.39), a more positive community involvement (r = 0.34 and 0.55), higher levels of benevolence giving (r = 0.36 and 0.30), a more social (vs. spiritual) role (r = 0.19 and 0.26), and a more active disaster role definition (r = 0.23 and 0.21). Particularism is not significantly associated with either type of disaster response.

The more structural factors, centralization and complexity, are unrelated to congregation disaster response. It may be that these types of structural elements are not developed within congregations to the point where they significantly affect their functioning.

In summary, nine of the eighteen correlations are significant, supporting the hypothesis that normative/structural characteristics affect congregation response to disaster.

Member Participation and Interaction

Measures of pre-disaster participation and interaction are also significantly associated with disaster response as shown in Table III.

Emergency response is positively associated with Sunday worship attendance (r = 0.32), Sunday school attendance (r = 0.29) and with woman's organization membership (r = 0.30) and youth organization membership (r = 0.32). Long-term response is associated with women's

TABLE II

Correlations Between Normative/Structural Congregation Characteristics and Disaster Response

Variable		Type of disaster-response	
		emergency response	long-term response
Theology	r =	0.17	0.39***
	n =	61	61
Community orientation	r =	0.34**	0.55***
(previous involvement)	n =	70	70
Benevolence giving	r =	0.36**	0.30**
	n =	55	55
Importance of social	r =	0.19*	0.26*
(vs. spiritual) role	n =	77	77
Active disaster role	r =	0.23*	0.21*
	n =	77	77
Particularism	r =	0.09	–0.13
	n =	75	75
Centralization	r =	0.05	0.05
(number of clergy decisions)	n =	75	75
Complexity	r =	–0.03	–0.02
(number of decision-making bodies)	n =	69	69
Complexity	r =	–0.05	–0.07
(number of decision-making leaders)	n =	71	71

*$p < 0.05$
**$p < 0.01$
***$p < 0.001$

TABLE III

Correlations Between Member Participation and Interaction and Disaster Response

Variable		Type of disaster response	
		emergency response	long-term response
Total Sunday worship	r =	0.32**	0.17
attendance	n =	74	73
Percent Sunday worship	r =	–0.33**	–0.34**
attendance	n =	70	70
Total Sunday School	r =	0.29	0.07
attendance	n =	72	72
Men's organization	r =	0.19	0.19
membership	n =	72	72
Women's organization	r =	0.30**	0.42***
membership	n =	72	72
Youth organization	r =	0.32**	0.18
membership	n =	73	73
Number of newsletters	r =	0.01	0.10
per month	n =	74	74
Number of social	r =	0.11	0.31**
occasions per month	n =	71	71
Number of weekly	r =	0.05	0.05
worship services	n =	74	74

*$p < 0.05$
**$p < 0.01$
***$p < 0.001$

organization membership ($r = 0.42$) and the number of social occasions each month ($r = 0.31$).

Using the percentage of the members who attend Sunday worship as a measure of participation results in negative associations with both types of disaster response ($r = -0.33$ and -0.34). This indicates that congregations with higher levels of worship participation are less likely to participate in either type of disaster response.

While only a third of the member participation and interaction characteristics are positively associated with disaster response there is a general positive association between membership levels (size) and both types of congregation disaster activities. However, the findings for percent Sunday worship attendance indicate that the more a congregation is oriented toward worship activities the less likely it will be active in disaster activities.

Resources

Congregation resources, presented in Table IV, all tend to show significant positive associations with both types of congregation disaster response. The size of the congregation budget per member was tested to determine whether it was size or the precent of members committed which is important. As with attendance, it appears that size is more important than high levels of member commitment. It can be seen that both types of disaster response are related to the number of members ($r = 0.27$ and 0.18) and to the number of households ($r = 0.26$ and 0.27). Finally, three of the four types of building facilities are also significantly

TABLE IV

Correlations Between Congregational Resources and Disaster Response

Variable		Type of disaster response	
		emergency response	long-term response
Congregational budget	r =	0.32**	0.21
	n =	59	59
Congregational budget per member	r =	–0.33**	–0.31**
	n =	59	56
Number of members	r =	0.27*	0.18
	n =	72	72
Number of households	r =	0.26*	0.27*
	n =	71	71
Number of ministerial staff	r =	0.38***	0.22*
	n =	80	79
Having a kitchen	r =	0.48***	0.37***
	n =	77	77
Having a sanctuary	r =	0.32**	0.19*
	n =	77	77
Having large rooms	r =	0.41***	0.30**
	n =	77	77
Having small rooms	r =	0.08	0.01
	n =	77	77

*$p < 0.05$
**$p < 0.01$
***$p < 0.001$

related to both types of congregation response. Overall, the findings regarding congregation resources support the fourth hypothesis.

Multivariate Analysis

The results of the step-wise regression analysis are presented in Tables V and VI. The analyses indicate that distance from the impact area (a demands element) has a larger beta weight than any other variable for both types of disaster response (B = 0.47 and 0.50). For emergency response the four variables percent Sunday worship attendance (B = 0.28), having a kitchen (B = 0.26), the number of members attending Sunday worship (B = 0.22), and community orientation (B = 0.19), are shown to be of about equal importance. One each of the four model elements are selected as a determinant of emergency congregation response.

TABLE V

Multiple Regression Analysis of Variables Predicting Emergency Congregation Response

Variable	Mult R	R^2	Simple r	Beta
Having a kitchen	0.48	0.23	0.48	0.26
Distance from impact area	0.62	0.39	0.40	0.47
Percent Sunday worship attendance	0.69	0.47	–0.33	–0.28
Number of members attending Sunday worship	0.72	0.52	0.32	0.22
Community orientation	0.74	0.54	0.34	0.19

Multiple R	0.74
R square	0.54
Standard error	3.94

Analysis of variance	df	Sum of squares	Mean square	F-ratio	
Regression	5	799.2	159.8	10.29	$p<0.001$
Residual	43	667.7	15.5		

The analysis of long-term congregation response indicates that, in addition to distance from the impact area, community orientation (B = 0.34), percent Sunday worship attendance (B = –0.27), and membership in women's organizations (B = 0.22) are selected as im-

TABLE VI

Multiple Regression Analysis of Variables Predicting Long-Term Congregation Response

Variable	Mult R	R^2	Simple r	Beta
Community orientation	0.54	0.30	0.54	0.34
Distance from impact area	0.68	0.47	0.41	0.50
Percent Sunday worship attendance	0.74	0.54	–0.34	–0.27
Membership in women's organizations	0.76	0.58	0.42	0.22

Multiple R	0.76
R square	0.58
Standard error	6.09

Analysis of variance	df	Sum of squares	Mean square	F-ratio	
Regression	4	2070	517.6	13.97	$p<0.001$
Residual	41	1518	37.0		

portant determinants. Resources was the only model element which does not have a variable selected by the analysis.

In summary, the multiple regression analysis explains 54% of the variance in emergency response and 58% of the variance in long-term response. Variables tended to be chosen from each element of the demand-capability framework. While disaster demands, measured by distance from the disaster area, is the element with the largest Beta values, approximately half of remaining explained variance is accounted for by the selected capability variables.

DISCUSSION AND CONCLUSIONS

The major finding of this study is that the conceptual framework works well for explaining congregation response to disaster. First of all, the findings indicate that religious organizations do adapt to changes in their environment related to disaster impact close to the congregation. These changes in their organizational activities are related to changes in demands as a result of the disaster, such as the amount of damage experienced by the congregation, its members, and the surrounding community. It is possible that the environmental changes associated with the increase in demands might also reduce the organization's capabilities; however, there is no indication of this.

The pre-disaster demand-capability balance is also related to this adaptive response. Each of the three capability elements studied has shown a number of significant correlations with congregation disaster response. The test of the hypothesis relating normative/structural congregation characteristics and disaster response supports this statement. Pre-existing normative variables, such as church theology, community orientation, benevolence giving, social role, and disaster role, are all positively associated with church response to disaster. The three more structural variables showed no strong associations. It appears that the elements of congregation structure studied have little effect on organizing disaster response activities, while pre-existing congregation norms are an important determinant.

The second capabilities element, member participation and interaction, is less clearly associated with disaster response. In support of the hypothesis. emergency response is associated with four measures of participation; long-term response is related to one membership measure and to the number of monthly social occasions. Most of these measures are closely a function of membership size, which is a resource element. Using the percent Sunday worship attendance as a participation measure results in a negative association. It appears that the importance of member participation and interaction for disaster response is a function of size, a resource, and not member commitment to worship activities.

The final hypothesis, dealing with congregation resources and disaster response is also supported. All of the resources studied were related to one or both types of congregation response except having small rooms. In most cases the correlations with emergency response are stronger than the correlations with long-term response. This is likely to be a result of the importance of local resources for the response during the emergency period. Long-term response can utilize resources from the outside which have been made available as a result of the disaster.

A major strength of this study over previous studies is that it tests the model using a large number of organizations rather than a few case studies. Statistical inferences about organizational functioning can now be made with much greater confidence than ever before. However, this study also poses new problems. There is some indication that the congregation's resources were most important during the emergency period and less important during the long-term recovery period. While it would be expected that the resources of the local com-

munity are important during the first days when outside aid is not available, what resources are important during the remaining weeks and months? Martin (1976) provides an important part of this answer through his study of the response of a denomination to disaster. Other studies have looked at the functioning of ecumenical disaster relief organizations (Ross and Smith, 1974, and Ross, 1976). The question remaining is "How do all of these elements of the religious community combine to provide an overall church-related disaster recovery effort?" In the future more comprehensive studies will have to be attempted.

NOTES

1 Theology is measured using a question asking pastors what term best describes their church. Terms are scored from conservative to liberal: fundamentalist = 1, conservative evangelical = 2, neo-evangelical = 3, neo-orthodox = 4, and liberal = 5.

2 Community orientation is measured by counting the number of community activities in which the congregation had participated the year preceding the tornado. Alpha = 0.87.

3 Spiritual vs. social role is measured by three items asking whether the church sees its role as spiritual or involved with social, economic, or political aspects. Items are scored so that strongly agree with a spiritual role = 1, agree = 2, undecided = 3, disagree = 4, strongly disagree = 5. Alpha = 0.67.

4 Active disaster role is measured by asking whether the church sees its disaster role as directing rather than active. The item is scored strongly agree = 1, agree = 2, undecided = 3, disagree = 4, strongly disagree = 5.

5 Particularism is measured by asking whether believing in Jesus Christ, being a member of their particular religious faith, and being knowledgeable of Jesus is absolutely necessary for salvation. The particularism score is created by summing the number of items that are absolutely necessary for salvation. Alpha = 0.55.

6 Centralization of the decision-making structure is measured by asking whether policy, programming, financial, and property decisions are made by clergy or laity. The score is calculated by summing the number of decision-areas handled by clergy. Alpha = 0.73.

7 Complexity of decision-making structure is measured by the actual number of church decision-making positions and decision-making leaders.

8 Emergency recovery activities include the following: provided emergency shelter, provided emergency food, provided emergency clothing, held special worship services, provided care and counseling for individuals, dug out church facilities, located church members, provided money for individuals, provided money for community emergency activities, provided volunteer labor and provided space for emergency organizations. Congregations received a score of 1 for each activity they provided for the community in general. Scores range from 0 to 22 with a median of 10. Alpha = 0.82.

9 Long-term recovery activities include the following: provided money to individuals, provided furniture, provided food, provided clothing, provided household items, provided loans, provided volunteer labor, collected special disaster offerings, helped locate employment, helped locate housing, coordinated and/or housed outside work groups, helped individuals in their dealings with relief agencies, provided day care facilities, provided summer camps for youth, provided space for use by relief agencies, provided worship facilities for use by other churches, worked with the Spirit of '74 Committee, worked with problems of the elderly, helped organize the Xenia Thanksgiving Memorial Service and participated in mental health training programs. Congregations receive a score of 1 for each activity they provided for members only and a score of 2 for each activity provided for the community in general. Scores range from 0 to 38 with a median of 8. Alpha = 0.88.

10 Throughout this study multiple item scales are used to measure single variables. To provide an indication of the reliability of these indexes Cronbach's alpha, which is the mean of all split-half reliabilities, is presented along with the discussion of each index. For a discussion and computal formula for alpha see Armor, 1974.

Pearson's r is used to measure the association between the congregational variables and disaster response. While some researchers feel that it is permissible to use parametric techniques only with scores that are truly numerical, some recent writers conclude that even though some error in inference may occasionally be made by using nominal or ordinal data with parametric techniques, the increase in power makes the risk seem small (Bohrnstedt and Carter, 1971: 131–132). As a result of its robustness, its ease of statistical elaboration with a small sample and its ease of interpretation, correlation analysis is used as the measure of association for interval, ordinal and dichotomous nominal data. After determining which variables are significantly associated, stepwise regression analysis is used to determine the variables with the greatest independent effects on congregation response.

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Mass Emergencies 3 (1978) 143–160
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EARTHQUAKE PREDICTION VOLUNTEERS: WHAT CAN THE UNITED STATES LEARN FROM CHINA?

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The well-documented success of the People's Republic of China in pinpointing the time and place of the Haicheng earthquake of February 4, 1975, facilitating massive evacuation of the population to safe locations, is without parallel in western society. In spite of failure to predict the tragic Tangshan quake of July 28, 1976, other less well documented successes in earthquake prediction, such as the Western Yunnan quake of May 29, 1976, and the Szechwan quake of August 16, 1976, lend credibility to the Chinese achievement. Chinese and American earthquake prediction enterprises are not greatly different in their scientific foundations or in the way they make long-term and medium-term predictions, except for a more pragmatic emphasis in China and more concern with theory in the United States (American Seismology Delegation, 1975; Haicheng Earthquake Study Delegation, 1977). The striking differences are the Chinese success in pinpointing the prediction within a day or two and their extensive use of amateur observer groups in achieving this end. The massive organization and effective use of volunteers, as yet missing from United States earthquake prediction efforts, raises many interesting questions for sociological investigation.

No meaningful analysis of the use of volunteer groups in earthquake prediction can be made without considering the broader use of volunteers and the relationship of volunteerism to the larger social structure. Western stereotypes of socialist society often depict a sort of regimentation that leaves little room for spontaneity and volunteerism. An influential study of volunteer services in hospitals (Institute for Directors of Volunteer Services in Mental Hospitals, 1961) seems to promote this view with the following assertion: "It has been observed that in countries where there is complete state medicine, as for example in England, there is little volunteering" (p. 236). Similarly, Chinese stereotypes of capitalist society make it difficult for the Chinese to believe that millions of Americans volunteer their services for worthy causes on a regular basis. When the author explained to a group of Chinese how Americans used volunteers in many important arenas of service, he was quickly prompted by their leader with the remark, "Of course, they are paid for their work!" The author's assurances on this score were received politely but with obvious disbelief. The misunderstanding was not restricted to the Chinese. On two occasions the author heard American earthquake scientists explaining to their Chinese counterparts that the nature of American social structure precluded the use of volunteers, so it was necessary to organize our earthquake pre-

diction enterprise differently from the Chinese.

In spite of the misconceptions, Chinese and American society are surprisingly alike in the willingness of the people to volunteer their time and effort in support of community service. The American failure to use volunteers in earthquake prediction is in marked contrast to the widespread use of volunteers in other realms, such as weather forecasting and health care. Nevertheless there are important differences in the way volunteers are used in the two countries. In light of steps that have been initiated by the United States Geological Survey under the leadership of Peter Ward (1978) for trial use of volunteers, a broad examination of sociological dynamics of volunteer participation should be useful at this time.

The specific objectives in this paper are three: to describe the Chinese system by which amateur observers are incorporated into the earthquake-prediction enterprise; to seek to understand the dynamics of the amateur program – how it deals with the problems of organization and function that are inherent in such an effort; and to explore the applicability of the Chinese program of amateur observation to the American scene and to other western societies. For at least two reasons these objectives cannot be achieved without also examining the broader experience with the use of volunteers in the United States. First, it has not yet been possible to penetrate intimately enough into the working of Chinese amateur groups to diagnose the problems in the system through direct observation and to identify at first hand the crucial mechanisms that make them effective. American volunteerism, by contrast, has been subjected to a good deal of searching investigation. To a considerable extent the findings from these latter studies can suggest what to look for in the study of Chinese amateur groups. Second, some exploration of the current extent and nature of volunteer service in the United States is needed as a basis for judging whether a program of amateur observation might succeed in the United States and in similarly constituted western societies.

The discussion will be organized in five steps. First there will be a brief description of the organization of Chinese amateur groups and their part in the total earthquake prediction program. Second will be a review of some evidence on volunteer service in the United States, especially for the purpose of ascertaining readiness to volunteer in a program of earthquake prediction. Third will be an examination of the dynamics and problems of programs making extensive use of volunteers, related to the ways in which the Chinese appear to have dealt with these problems. Fourth will come analysis of the amateur–professional–client relationship as an integrated system, in which the volunteer tends to be replaced with the true amateur. A brief statement of conclusions will complete the discussion.

AMATEUR GROUPS IN CHINA

The technical organization of earthquake prediction activities in China centers in the State Seismological Bureau in Peking, in provincial seismological bureaus and brigades, and in a variety of seismological stations, offices, and observatories. Responsibility is largely decentralized to the provincial bureaus. The Institutes of Geophysics and Geology in Peking are major research centers, but do not participate directly in prediction. Reporting to the local seismological stations and observatories are the amateur groups. They range in number from one person to several. The Chinese estimate that more than 100,000 amateur groups are busy making daily observations. In late June, 1976, we were told that about 200 groups were operating around Peking. The term "amateur" conveys a triple meaning. Amateurs are not professionally trained as geologists or seismologists, though they may have technical training for the

specific kinds of observations they are making. Amateurs are not full-time professionals, but make their observations in addition to carrying out their main vocations. And amateurs are volunteers, who receive no pay or work credits for the time they devote to earthquake prediction (for an account of the use of amateur groups based strictly on published Chinese sources, cf. Gimenez, 1976; and for a typical English-language report from a Chinese source, cf. "A Report from an Earthquake Area," 1976).

State Seismological Bureau officials divide amateur groups into three types. The largest and most sophisticated are known as *backbone groups*. Apparently these groups fill much the same function as seismological stations, thus extending the professional network. Backbone groups are equipped with sophisticated seismic instruments and have teams of personnel. The equipment and the presence of technically trained personnel make it possible for these groups to conduct some research. Backbone groups receive reports from less sophisticated groups and help them verify and interpret their observations. With access to a panoply of data these groups are sometimes able to formulate earthquake predictions.

Around Peking there are about twice as many *ordinary groups* as backbone groups. These groups may consist of several people. They have instruments of simplified design. They take considerable pride in manufacturing their own instruments and in trying out innovative designs. Electrodes to measure telluric current and devices for recording changes in the earth's electromagnetic field are commonly used. Anyone can purchase a book that describes some of the most popular devices and gives instructions for making them. These groups make regular observations and compile records and exchange information with other ordinary groups and with professionals. Both backbone and ordinary groups play a part in diffusing knowledge about earthquakes to the general population. A typical ordinary group would consist of middle school (high school) students working under the supervision of a high school teacher; or factory employees making use of some of the equipment and technical expertness available in the factory setting.

By far the largest number of groups consist of persons without specialized training, and are referred to as *macroscopic observation* groups. These groups are small, consisting usually of from one to three persons. They make regular observations, but keep no records and only report to the nearby seismological station if they observe some anomaly. Although officials we talked to from the State Seismological Bureau could give us the number of ordinary and backbone groups around Peking, they could not hazard a guess concerning the exact number of macroscopic observation groups. The typical macroscopic group would consist of peasants who made daily measurements of water levels in local wells and watched for muddying or bubbling of water, looked for unusual animal behavior and earth lights, and listened for unusual earth sounds. The observations they make require no specialized instruments and are rooted in folk wisdom.

Ordinary groups fit best the Maoist ideal of amateurs whose enthusiasm leads them to gain technical knowledge which is integrated with folk experience so as to produce insights of interest to professionals. The much advertised record of suddenly decreased telluric current just prior to the Haicheng quake was produced by such groups (Muller, 1976 pp. 17–18; Haicheng Earthquake Study Delegation, 1977, pp. 249–251). But the macroscopic groups conform most closely to the ideal of peasants applying traditional folk wisdom.

While the amateur enterprise is often referred to as a people's war against earthquakes, it is in some ways a far cry from the western notion of a grass-roots enterprise. First of all, each amateur group is a unit within and subject to control by a civil unit. Most amateur groups are

units established within rural brigades or communes, factories, and schools. A few are lodged in urban street units. In effect, each amateur group is a "committee" of the sponsoring group. The amateur group membership is determined by the factory committee or the commune or brigade committee, and each amateur group functions under the authority of the revolutionary committee in charge of the civil unit. Second, amateur groups are established at the instigation of either the local civil unit (commune, factory committee, etc.) or seismic station personnel. The latter visit factories, communes, schools, and other units where reports from an amateur group would be useful in order to request the establishment of groups. The result is that groups are in operation where they are expected to be most useful or where the equipment and technical expertness are available.

The relationship between civil units and seismic stations incorporates a strict line–staff distinction. The seismic station receives observation reports and provides technical advice to the amateur group, but holds no authority over it. Authority comes from the civil unit. While the primary responsibility for interpreting and relaying the observations lies with the seismic station, the amateur group also reports to the civil leadership.

The amateur groups have a well-identified part to play in the eventual production of an imminent earthquake prediction. Although some groups are in operation continuously, their chief function is fulfilled after a medium-term or short-term prediction has been issued. The amateur groups then provide much more intensive coverage of the area at risk than would be possible using only scientific personnel, and their observations concentrate on premonitory signs that are expected shortly before a serious earthquake. This complementarity can be illustrated with a chronology of the Haicheng prediction. At a national conference in 1970 the southern Liaoning region was designated as an area that warranted special observation. Three years of scientific studies strengthened the initial judgment and by 1973 some efforts to supplement scientific study with amateur observation were underway. The turning point was a meeting in June, 1974, at which a magnitude 5–6 earthquake was predicted within one or two years. Between June and November a massive effort was launched, including the establishment of many hundreds of amateur observation groups in the area at risk. Animal and well-water anomalies in mid-December appeared to presage an earthquake of 4.8 magnitude on December 22, but the prediction for a serious quake remained in effect. Amateur groups continued to report anomalies during January, and earthquake disaster information was disseminated. Anomalies intensified toward the end of January and the beginning of February, culminating in evacuations on February 3 and 4 and occurrence of the magnitude 7.3 quake centered near Haicheng at 7:36 P.M. on February 4. The crucial contributions of the amateur groups came during the last month and a half before the quake.

VOLUNTEERISM IN THE UNITED STATES

In the following brief review of volunteerism in the United States we shall first note the extent and range of volunteer service, then look more closely at some patterns of volunteer activity that occur in settings that are reasonably analogous to the earthquake prediction situation.

Extent and range of volunteerism

The extent of spontaneously offered voluntary service in the wake of a natural disaster has been extensively documented (Fritz and Matthewson, 1957; Barton, 1969). But it is not obvious that comparable enthusiasm for voluntary activity will accompany the uncertain *prospect* of disaster. Hence we must inquire about volunteerism under more routine circumstances.

In a sample survey of Americans over thirteen years of age in April, 1974, conducted by the U.S. Census Bureau (ACTION, 1975), 24 percent reported having done some "unpaid volunteer work" for a service organization during the preceding year. A more conservative estimate of service might include only the 60 percent of volunteers (or one in seven adult Americans) who contributed their time and effort at least once a month on a regular basis. For all people who volunteered in a given week the median time spent was from two to four hours. The rate of volunteer service is somewhat increased by comparison with a similar survey in 1969. Volunteer rates were higher for women than men, for married than single persons, for whites than nonwhites, for employed persons than unemployed and nonworking persons, for persons in the higher income and education categories and the middle age range (25–44 years). These findings and other evidence from the survey plainly contradict any assumption that mostly people with nothing to do seek volunteer work to fill their time.

Most of the volunteer work falls into three categories: 50 percent is in religion and 15 percent each is in education and health. The integral relation of volunteer work to the life cycle is suggested by the peaking of voluntary educational activity during early adulthood, by parents of young children, and the peaking of health volunteering in later adulthood.

When exploring the possibility of developing a volunteer program in connection with earthquake prediction, it is important to estimate the pool of potential volunteers who might respond to the call for assistance in time of emergency. This pool may be much larger than the number of persons now volunteering. A recent investigation sought to estimate the pool of potential volunteers in one area of service, namely, civil defense (Nehnevajsa, 1976). Americans over 17 years of age were asked in 1972, "If the call went out for volunteers to participate in a community Civil Defense program, would you personally be likely to volunteer?" Fifty-four percent answered "definitely" or "probably yes." Analysis suggested that civil defense would draw upon a somewhat different pool than other kinds of voluntary activity, since men, youth, and blacks were more likely to volunteer than women, middle-aged adults, and whites. Although the majority of nonvolunteers did not give opposition to civil defense as the reason, the fact that southerners were readiest to volunteer coupled with the stronger military tradition there cannot escape notice. It is also plausible to infer from a combination of findings that willingness to volunteer is positively related to belief in the need for civilian defense (i.e., the probability of war) and optimism about the possible outcome of war (i.e., survival chances).

The impression that organized volunteerism has recently increased, based on the comparison of 1969 and 1974 findings, is reinforced for a longer time span by numerous studies of volunteers in particular service areas. For example, Gillette (1968) chronicles the growth of the youth work camp movement. In 1920 the Fellowship of Reconciliation organized volunteer efforts to reconstruct the war-damaged French town of Esnes. The work camp pattern became the model for over 250 organizations in many countries that now recruit, train, and send abroad young volunteers. The United States Peace Corps, though not strictly a volunteer organization, was patterned after this tradition. Ewalt (1967) points out that the interest of college students in providing voluntary services for the mentally ill has only been manifested on a substantial scale since 1954. Naylor (1967) in reviewing the use of volunteers by private social agencies concludes that more people are willing to volunteer time and effort on behalf of communities and fellow citizens than ever before.

Whether the disposition to volunteer has increased or not, the deliberate cultivation of volunteerism by service agencies has clearly in-

creased. Routh (1972) points out that agencies are faced with the prospect of funds that are increasingly insufficient to provide needed services in health, welfare, and social services. Consequently they must make "more intelligent use of carefully selected and well trained volunteers" (p. 3). Janowitz (1965, p. 2) observes: "For years schools have used volunteers for many non-academic functions. In recent years they have begun to develop academic programs using volunteers."

Volunteerism in science

The history of volunteer involvement in scientific activity is a long one (Whitman, 1976). Two such programs merit brief description because of parallels to the circumstances of earthquake prediction. The Moonwatch program was established to provide volunteer support for professional satellite tracking from 1956 until 1975 (Cornell, 1975). Volunteers were to locate satellites visually and report their sightings so as to facilitate the more precise optical tracking by the twelve sophisticated instruments placed around the world. The call was for amateur astronomers, familiar with the use of telescopes, to work together in teams. A specially designed wide-angle telescope was provided for the amateurs, but an estimated forty percent built their own units in home workshops. The appeal for volunteers was made through *Sky and Telescope* magazine and personal appeals to astronomy groups. Over 200 teams in the United States and abroad were maintained throughout the years of peak operation. A supplemental network of airline flight officers from around the world was developed to gather data on objects seen from the air. As the program matured, more serious-minded amateurs replaced the less serious ones. Altogether it has been estimated that 400,000 observations worth more than $ 14,000,000 to the program were made by the volunteers.

While the Moonwatch program came at a time of aroused public interest in satellites, the U.S. Weather Service has had a program using volunteer weather observers since the end of the nineteenth century. The program includes two types of volunteer observers, namely, climatological observers and severe local storm spotters. An estimated 12,500 climatological observers have been supplied with sets of simple instruments with which they make daily observations and mail their records periodically to the weather service. They are supplied with a handbook (NOAA, 1972) explaining the instruments and specifying the way in which observations and reports are to be made. Another 400 observers supply the Weather Service with climatological data from their own instruments. Many of the observers are farmers, though a wide range of occupations is represented. Some of the same observers have served for several decades, and families sometimes carry on the observer tradition. However, one Weather Service official reported that many of the observers must now be handled with kid gloves, and that turnover has increased in recent years and recruitment has become more difficult. Fulltime Substation Network Specialists are hired to recruit volunteers to the program. The Weather Service gives special service awards as recognition for loyal service over extended periods of time.

While climatological observers work continuously, tornado spotters in the *Skywarn* program are on standby duty only during the tornado season each year, and are alerted as needed when tornado watches are in effect. The average tornado watch lasts about three hours, but may run as long as six to eight hours. Each spotter has an assigned location to which he reports when called. A tornado watch is announced when meteorological data indicate that conditions are favorable for the development of a local tornado. But only direct visual observation can establish the existence and pinpoint the location and trajectory of the destructive funnel cloud in time to warn people who are in greatest danger. Weather Service handbooks show the observer what to look for

(NOAA, 1973 and 1975). The most essential aspect of this arrangement is the capability for quick communication. Hence two requirements for volunteers are that they have ready access to a suitable outside location such as a hilltop or the top of a tall building, and that they have facilities for quick communication, such as police or "ham" radios or Civilian Band equipment. More people volunteer for this corps than can be accepted, so the Weather Service is able to be selective. National amateur radio and CB organizations encourage their members to volunteer as tornado spotters. Recruitment is decentralized under the heads of local weather stations, who determine the needs in their areas.

Review of the Moonwatch and Weather Service programs suggests that volunteers can be recruited to make observations ranging from crisis sightings to routine record keeping, and from obviously life-saving information to the collection of research data. In each of these programs the observer is or becomes more expert than the average person in the use of some equipment and in knowledge of some phenomenon of public concern.

Grass-roots prediction activity

Although a serious effort to organize volunteers into the earthquake prediction program in the United States is only now in the planning stage (Alexander, 1978), at least two "grass-roots" volunteer groups have sprung up in the Los Angeles metropolitan area. "Earthquake Forecasters" consists of approximately 25 amateur radio operators who have discussed earthquake forecasting among themselves by radio. The key figure is an amateur student of earth sciences who purchased a tiltmeter at a government surplus sale and installed it in his basement, and reports that he observed dramatic tilt anomalies preceeding the 1971 San Fernando-Sylmar earthquake. The group has made unsuccessful efforts to get technicians from a local university to install tiltmeters in all of their basements, with a plan to report anomalies immediately to the university seismological laboratory.

In 1976 another local resident with talents as a gadgeteer and an interest in earthquake dynamics developed a twelve-inch spirit-level "tiltmeter" and organized a group of volunteer observers under the name of "Quakewatchers." Membership was advertised in the local press, with a membership fee that included the price of a tiltmeter. Members were to keep records and turn them in periodically, and were given a "hot-line" number to call in case of any striking anomalies. Quakewatchers received some television coverage, mostly subjecting the supposed tiltmeter to ridicule. Perhaps because of explicit disparagement by local seismologists, Quakewatchers reached fewer than 100 members, and few of the members have cooperated in the organization's reporting procedures.

While neither of these groups has made a significant impact on earthquake prediction, they incorporate the same interests in amateur science, technical equipment, and public service found in Moonwatch and Weather Service programs. Although abortive in the absence of support by recognized scientists, and naively conceived, they suggest the existence of interests that could be tapped in an appropriately sponsored program. At least one California legislator has publicly sought to promote the establishment of an amateur network following the Chinese example (Quakewatchers Network Proposed, 1977).

THE DYNAMICS OF VOLUNTEERISM IN UNITED STATES AND CHINA

In an early study of the use of volunteers by the National Foundation for Infantile Paralysis, Sills (1957) identified two broad organizing problems: "Maintaining the interest of members and preserving organizational goals." To these, which we shall call the problems of *incentive* and *control*, we add two others. The problem of *recruitment* includes locating nonprofes-

sionals with suitable skills and interests and involving them in the activity. The problem of *communication* has special significance for an activity like earthquake prediction in which timely and selective transmission of information is critical.

Recruitment

The image of uneducated Chinese peasants watching their animals and their water wells appeals to a western mystique of volunteerism as an expression of self-reliant initiative requiring only good intentions and common sense. While there are volunteer tasks in America that require no training they are often viewed as menial. Short periods of training are included in some volunteer programs. But many of the best known organizations using volunteers seek recruits who already have technical skills and equipment. Moonwatch recruited people who were already amateur astronomers, and Skywarn seeks ham radio and CB operators with their own equipment. The American Red Cross uses 80,000–100,000 volunteers a year but looks for people with professional skills that are directly useful in their disaster operations. Actual practice in Chinese amateur groups is closer to American experience than to the mystique. At the Tankangtzu Spa, staff physicians man the amateur unit that keeps daily records of radon content in the Spa waters, using sophisticated equipment already available there. At the Metallurgical and Geological Exploration Company in Liaoning Province, a professional geophysical exploration specialist supervises a group of telephone operators in making magnetic field observations and other tests using equipment on hand for metallurgical exploration. Middle School students who are studying science serve as volunteers under the supervision of science teachers. Only the "macroscopic" groups rely principally on untrained personnel. But here intimate familiarity with particular animals or terrain is needed to recognize anomalies.

The fear of having to accept whoever walks in is often mentioned by American scientists as a deterrent to launching a volunteer program. But American experience indicates that volunteer units are like social movements in recruiting new members through the social networks in which existing members are involved (Bolton, 1972, p. 557; Gerlach and Hine, 1970, pp. 79ff.). The rule is not mass appeal but referral from established volunteers who informally preselect the new recruits for the appropriateness of their interests and skills. Here, too, the Chinese rely much less on mass appeals than on a selective approach to communes, factory committees, and schools. Recruitment through schools, Four-H clubs, amateur science groups, and senior citizen organizations rather than mass appeal would be consistent with the experience of the most successful organizations using volunteers in the United States and of the Chinese earthquake prediction program.

Incentive

The motivations for engaging in volunteer activity in the United States are diverse but generally come to a focus through the desire (a) to be of service, (b) while engaging in interesting activity, (c) in the context of gratifying social relationship, and sometimes (d) with the prospect of more tangible personal benefit. These broad motives only become effective as they acquire more specific meanings from the potential volunteers' social settings and the social organization of the enterprise into which volunteer activity is incorporated. Examples of the former include the possession of underutilized skills and, sometimes, equipment, so that many retired persons and amateur radio operators and Civilian Band radio equipment owners are anxious to engage in relevant interesting work; a restricted social life which has in the past induced many traditional housewives to seek volunteer activity for the sake of the social relations involved; an interest in career development which often leads young

people to seek what they hope will be an apprenticeship experience in volunteer work; and a personal stake in the program which leads the parents of school children to give volunteer service in the schools. It seems evident that the pool of such potential motivations for participation in an earthquake prediction is more than adequate in both China and western nations. But potential motivations alone are not sufficient to sustain dedicated participation. As Schindler-Rainman and Lippett (1972, pp. 53–54) remark:

> The unreal expectations given in recruitment are a frequent cause of 'motivational shock' later on. Discrepancies between expectation and reality may be discovered in the amount of time required for the activity, the type of work, the amount of support from professionals, the type of clients, the available facilities, and many other areas.

The critical question is therefore whether the volunteer activity can be organized so as to foster rather than undermine personal incentives for participation.

An important aspect of the organization of volunteers is the autonomy accorded them. Sills (1957) noted that one of the early crises in the National Foundation for Infantile Paralysis was resolved by returning a fraction of the funds gathered to local chapters for disbursement at their discretion. Chinese amateur groups are not permitted to make earthquake predictions and are directly under control by both the local civil authority and the seismic station. Nevertheless the dual lines of authority undoubtedly enhance the *de facto* autonomy of the amateur groups because of the possibilities for coalition formation and discretion in the relative use of the two lines of communication. Ordinary and backbone amateur groups also have some discretion in the types of observations they will make and the equipment they will acquire. The autonomy motive is conspicuous in the two grass-roots prediction groups in Los Angeles already described. The problem of finding a suitable formula for assuring reasonable autonomy will undoubtedly be critical to the success of any earthquake prediction volunteer program. We will return to this problem again under the discussion of control.

Social recognition by clients, professionals, and the community is crucial in sustaining the incentive for participation. Practically all of the analyses of volunteerism in the United States stress the lack of appreciation (e.g., Routh, 1972) or the lack of appreciative feedback (Schindler-Rainman and Lippett, 1977) as a principal reason for loss of volunteer interest. Typically it is the professionals rather than the volunteers who receive credit for the success of a joint enterprise. Artificial devices such as the Weather Service certificates of recognition are widely used, but are probably less effective than sustained relationships providing for continuous recognition. The Chinese system establishes such relationships with both the community and the professionals. Because the amateur group is the agent of a civil unit and not merely of the earthquake prediction establishment, the local revolutionary committee is continuously apprised of the group's activities and the entire brigade, commune, or factory can take pride in the accomplishments of their amateur group. Although American society has few civil units as close to the community as the Chinese communes and brigades, a similar effect may be achieved through organizing volunteer groups in schools, Four-H and scouting organizations, local chapters of labor unions, and similar units. Community recognition available through such an arrangement is much greater than would be available if the U.S. Geological Survey were to organize its own groups.

The Chinese pattern of decision by conference also probably contributes to social recognition by both the community and the professionals. Some American scientists have already informally advanced proposals for volunteer observers to report their observations periodically by mail to the scientific laboratory, without any provision for the volunteers to participate with scientists in the discussion of their data

nor to receive feedback concerning the use made of their reports. This sociologically naive proposal is in contrast to the Chinese practice whereby the decision to forward potential crisis information to the seismic station is made in a face-to-face conference between community leaders and amateur group members, and the decision as to further disposition is made in a face-to-face conference involving professionals from the seismic station, members of reporting amateur groups, and representatives of local civil units. Some such element included in any American plan would clearly facilitate the sustained incentive of the volunteers.

The sense of importance and service may be both the most important and the most precarious element in the volunteer incentive complex. Stanton (1970) underlines the disillusionment felt by volunteers as they come to view the programs in which they participate as mere ritual and as ineffective in contributing toward their stated objectives.

> . . . many of our conventional philanthropic associations have become the producers of a kind of modern morality play – a civic drama – in which community leaders and would-be leaders are provided a context for the presentation of a well-publicized altruistic self (pp. 19–20).

The sense of importance is affected by the available cultural values into which the activity can be fitted, the nature of the work, and the time span of the activity. The major Chinese revolutionary value of self-reliance figures largely in explaining and justifying the amateur group program. Through amateur groups, local communities can do for themselves what the centralized organization could not do alone. A similar value of community self-help has been important in giving meaning to charitable volunteer activities in the United States (Sills, 1957). But there is also a populist value in American society, often expressed in the belief that the people can accomplish the same things more simply and less expensively than the experts. This theme is evident in both of the grass-roots groups in Los Angeles. Populist values can quickly lead to polarization between volunteers and the scientific establishment and to disillusionment. There is, however, a parallel in Chinese society in the stress on folk wisdom, which we shall examine further in a later portion of this paper.

The often routine and intrinsically uninteresting nature of the observations required, coupled with the necessity for sustained observation over extended time periods in the absence of obviously urgent need and effect, may pose the crucial problem for earthquake prediction. The problem of sustaining a fairly routine kind of activity is dealt with in two ways in the Chinese program. First, the most concentrated use of amateur groups occurs after a medium-term prediction has been issued, so the work of the amateur groups is usually critical for only a few months. We do not know how frequently and for how long the Chinese amateur groups have remained effective after a significant earthquake or the cancellation of a long- or medium-term prediction. Second, the Chinese have made use of high school students who serve during a period of personal learning and growth and then graduate and are replaced by other students. Similar principles can easily be incorporated into the organization of American amateur groups.

Earthquake prediction poses still another difficulty in maintaining the sense of importance. Because the Chinese predict earthquakes on the basis of a preponderance of evidence of all kinds and because the information about amateur groups made available to western observers has been selective and illustrative rather than representative or comprehensive, we cannot yet say with certainty that the amateur groups have made a decisive contribution to valid prediction of earthquakes in China. It is always possible that anomalous animal behaviour and well-water variations may be shown either to be unreliable as earthquake precursors or mere epiphenomena of such precursors as foreshocks that can be identified more reliably through networks of scientific

instrumentation. As the usefulness of amateur reports is debated publicly, volunteer morale may suffer. The Chinese have not publicly admitted this possibility and have forestalled the diffusion of the idea by linking skepticism to politically abhorrent leanings and by carefully controlling communication. In American society it will be essential that the possibility be openly acknowledged from the start and that incentives be shaped accordingly.

Along with the sense of importance comes a sense of expertness which gives the volunteer activity special meaning. Sills (1957, p. 237) observed that the volunteers "feel they are the equals of doctors," in a society in which the relationship between professional and layman is normally quite hierarchical. The sense of expertness is cultivated in the Chinese program, especially for backbone and ordinary groups, by using the groups to carry on earthquake education programs in the community and by encouraging groups to manufacture and sometimes even devise their own equipment. The same pattern can be followed in the United States, and some of the earthquake prediction activities can be scheduled as part of a broader science education program.

In recent years the emphasis on service in volunteer activity has been partially displaced by a concern for personal development and even career development. Volunteer activity has been valued either as a stepping stone to more significant volunteer activity or as apprenticeship for eventual paid occupational work. Women have questioned whether unpaid volunteer work is not exploitation, unless it serves as a stepping stone to paid employment (Loeser, 1975). Integration of Chinese amateur groups into the community structure, so that they are comparable to specialized committees in American organizations, may have lessened the potential sense of exploitation in China. But we saw evidence in China of a transformation of what had previously been women's volunteer work in education into paid vocational activity, paralleling developments in the United States. At least in western nations it will surely be important to design volunteer programs specifically to provide for personal growth rather than simply repetitive service.

Control

The problem of control involves dependability, accuracy, and following instructions precisely, and it also means dealing constructively with a tendency for volunteers to be "carried away" by their own enthusiasm and overconfidence. The control problem exists at two levels, namely, control of the individual and control of the volunteer group.

Control of the individual is achieved in China through the dual lines of authority. By making the amateur officially responsible to the local revolutionary committee the system institutes considerably more effective discipline over the individual than could be exercised directly by seismic station officials. The individual's reputation among his neighbors is at stake rather than his standing in a segmented relationship with a remote group of professionals. In the United States the same effect can be achieved by working through existing organizations that are central to people's social lives at the time.

Control of the amateur group poses somewhat more of a problem, both in the United States and China. Official policy is for professionals to go into the field with amateur observers to verify any anomaly which serves as the basis for issuing an earthquake prediction, though it is doubtful that this is possible except by sampling when there is a flood of reports. The very establishment of autonomy, important in fostering incentive, often impairs control. The Chinese are indeed ambivalent over the proper balance between autonomy and control. While the normal rules provide that earthquake predictions should only be issued by the provincial seismological bureaus, the theme of self-reliance is illustrated with examples of a local brigade or commune leadership in collaboration with the amateur group

issuing a prediction on which the community acted with resultant saving of lives.

Adequate resolution of the problem of balancing autonomy and control probably depends upon conceiving the volunteer group as a quasi-professional group, according to the meaning of *amateur* which we shall address later.

Communication

In addition to the usual problems of two-way communication and feedback, earthquake prediction requires that there be prompt communication of information about potential premonitory signs, that there be effective procedures for signalling those bits of information that merit immediate and extraordinary attention, but that emergency signalling be highly selective. Although the Chinese have a highly rationalized communication scheme, there are hints that it does not always work perfectly. In an unguarded moment one Chinese professional referred to the constant interruption of their scientific work by peasants bringing in reports of anomalies. And there have been unconfirmed reports from China that accounts of anomalies observed up to a week before the disastrous and unpredicted Tangshan quake had been forwarded but not yet analyzed in the higher-echelon decision centers.

To the extent to which issuance of an imminent prediction is preceded by increasingly immediate and localized designations of earthquake risk, comparable in principle to issuance of a tornado watch, the problems of selectivity and of signalling critical information are minimized. But until we have reached a stage of confidence that earthquake predictions will develop in this phased and progressive fashion, the problems can be serious. Even with computerized scientific information, lags of a few weeks in processing data may have prevented issuance of timely predictions of minor quakes in the United States. The Chinese have simply not requested their macroscopic observation groups to forward information except when anomalies are observed. But anomalies are relative, and they often occur for reasons not associated with earthquakes, so a great deal of data not indicative of an earthquake must still be scanned promptly. Furthermore, it is essential that detailed and current records of animal behavior, well-water level and quality, and similar phenomena be maintained and transmitted regularly so as to be sure that the crescendo of expectation based on other seismic indicators does not artificially create a corresponding increase in volunteer observations of anomalies.

It is essential that the system of routine reporting be supplemented by an arrangement for immediately forwarding and scanning data that could signify an emergency. For this to be effective reports must come from trained and disciplined observers rather than be volunteered from the public at large. The observers must be able to draw upon intimate experience and understanding to identify the data that should be forwarded immediately. In China the use of zoo keepers whose intimate familiarity with the habits of their animals enabled them to recognize true anomalies of animal behaviour and of peasants observing their own animals satisfied this requirement. In the United States Four-H Club members who own and care for their own animals and study their health could make such discriminating observations. Volunteer observers could also be taught, as macroscopic observation group members in China were not, how to compare current data with immediate and longer term trends on the basis of the daily record they keep in deciding what information to forward on an emergency basis.

A quickly mobilizable filter unit is probably the other essential element if selective communication of emergency information is to be attained. The Chinese use the conference with local community leaders as the first stage filter and the conference with seismic station professionals as the second filter before observation

reports are forwarded to the provincial seismological bureau. The seismic station is critical because many amateur groups report to it. A report from a single group can be discounted at this level, or confirming reports from several groups can become the basis for alerting the provincial bureau. Perhaps the ideal filter group for an American program would consist of experienced representatives from the organization sponsoring the volunteer group and one scientist from the U.S. Geological Survey or university seismological laboratory to which the reports are finally sent.

PROFESSIONAL, AMATEUR, AND VOLUNTEER AS A SYSTEM

Thus far we have looked at the dynamics and problems of using volunteers, or amateurs, without attempting to examine the relationship as a whole system. There are two contrasting ways of conceiving the system. From one perspective the scientists and their clients constitute the system and volunteers are merely resources at their disposal. Volunteers have no unique contribution to make other than their service. From the other perspective the amateurs and scientists are equally essential parts of the system, along with the clients. Besides their service the volunteers contribute distinctive wisdom and sometimes technical proficiency that complements the knowledge and skill of the scientist.

There is a tendency to think of the volunteer in the former sense in the United States. Many of the incentive problems in American volunteerism arise from the volunteer's peripheral status, devoid of intrinsic importance and excluded from significant decision making by professionals. The peripheral status may also contribute to control problems, since it fuels a populist tendency to rebel against professional hegemony and to denigrate expert knowledge in favor of common sense. When volunteers have their own areas of expertness, like medical volunteers for the American Red Cross or expert amateur radio operators for the Weather Service, a relationship of greater mutuality can be developed and many problems of incentive and control recede.

The Chinese view is epitomized in the phrase from Mao Tse-tung that "science walks on two legs."

> . . . ancient traditional knowledge together with more modern advances made through regular scientific channels are one leg. The broad masses of ordinary people who have always been denied access to scientific developments have become the other leg. Basically, the idea of walking on two legs means to exercise the underdeveloped one, rather than putting all resources into the stronger one. It does not mean cutting off the stronger one in favor of the weaker . . . (Science for the People, 1974, p. 6).

This philosophy means an effort to blur the distinctions between experts and ordinary people and to encourage scientists to work with peasants and laborers and learn from them.

> Underlying the encouragement of mass participation in science we may recognize two assumptions. First, the Chinese leaders assume that practical work experience may provide scientifically-relevant insights which specialists not involved in practical work do not share. Second, they assume that knowledge accumulated through trial and error by millions of common people over many generations constitutes a precious scientific resource which should not be arbitrarily subordinated to theoretical ideas formulated by elite specialists (Richter, 1976, p. 15).

Like western ideals, Maoist ideals are probably converted into practice most effectively when implemented through a congruous social structure. Within the limits of our experience, scientists and peasant leaders treated each other respectfully. But except for the serious attention to traditional wisdom on such matters as animal behavior and earthquakes, we saw no clear evidence that peasant input significantly affected the way in which scientists think about earthquake dynamics. The mutual respect requires more than the doctrine. It flourishes in situations like those described by Joshua Horn (1969), a British physician who worked in China with medical teams in which he learned from nurses and paraprofessionals

whose experience with Chinese diseases, with improvising in the absence of western medical resources, and intimate familiarity with the Chinese people complemented his own more advanced medical knowledge.

The Chinese system also incorporates a political theme quite foreign to American science. The theme is expressed through the authoritative designation of scientific priorities by political leaders, the constant effort to show that scientific theories are extensions of ideological dogma (scientists find that there is dialectic in the physical dynamics of earthquake as well as in society), the active involvement of political personnel in scientific as well as policy decision making, and the scapegoating of political figures for limited scientific achievements. A visitor to China is given the impression that the high priority assigned to earthquake prediction by national political leaders is a major incentive for participation in amateur groups, but American experience has demonstrated that volunteer programs involving thousands of people can be maintained without this kind of sponsorship. While the political presence is employed in China to control elitist tendencies among scientists that might otherwise diminish their attention to the work of amateur groups, this is an artificial and often precarious way of accomplishing this end. A program for collaboration between professionals and volunteers in American society is often helped at the start by political interest, but evolution of a constructive and stable relationship is probably fostered by the maintenance of appropriate detachment from the volatile political process.

While our analysis has stressed the similarity of social process and the transferability of experience between China and western nations rather than the differences, here is where we encounter the crucial difference affecting the organization of professional–volunteer collaboration. Because all organized aspects of Chinese life are integrated into the political structure, only that political structure is available as a means for lodging the earthquake prediction effort securely in the community and making the system work as a whole. In our western "multigroup society" (MacIver, 1947), similar community grounding and utilization of broadly based coordinating structures can be achieved through organizations that are not links in the political sector. Thus the benefits in community support for incentive and control, in facilitating recruitment, and in making preexisting communication networks available that the Chinese achieve by lodging their amateur groups in civil units can be equally well secured, and without the risks from politicization of science, by working through schools, youth programs that involve entire families, and age cohort organizations.

We have been using the term amateur in referring to the Chinese pattern and the term volunteer in referring to the American pattern without examining the difference and similarity of meaning. Stebbins (1977) has described the pattern of *modern amateurism* which has developed in parallel to certain vocations that were formerly exclusively avocations. Sport, entertainment, science, and the arts are the major spheres in which the amateur in this sense plays a significant part. The concept of amateur is more familiar in reference to amateur athletic teams and amateur theatrical groups than to amateur scientific teams, yet the resemblance is illuminating. Some of the Chinese amateur groups fit into this pattern surprisingly well. The amateur has several distinguishing features besides being unpaid and less technically proficient and polished than the professional. Three that we shall stress are the amateur's love of the activity, often valuing it for its intrinsic features even more than the professional, for whom it is a living; the amateur's level of proficiency and understanding of the activity that are well beyond those of the "hobbyist" or "dabbler;" and the fact that the amateur is like the professional in serving a public, and unlike the hobbyist who is performing for himself and selected others. The amateur, then, is much more than

just a volunteer. While amateurs admire and defer to professionals, they perform in their own leagues, patterned after the leagues of the professionals. If we are talking about developing a cadre of volunteers who will develop a certain amount of technical proficiency, sufficient understanding to make reasonable judgments of which observations merit emergency attention and which do not, and the dedication of aficionados, the model of the amateur sportsman and thespian can be helpful.

Stebbins pointed out that the amateur could only be understood as part of a professional–amateur–public system in which each performed certain functions. First, the amateur is like the professional in serving the public. Amateur athletic teams stage events for the enjoyment of spectators; Chinese amateur groups carry out much of the person-to-person and group education for earthquake survival, as well as reporting observations to scientists. Second, the amateur is often able to contribute perspective and even new directions to the field because the circumstances of his activity are less standardized and the cost of unsuccessful experimentation is less. Thus the Chinese amateur groups' improvisation with measures of telluric current, which may turn out to be a blind alley, are nevertheless of interest and potential importance to the scientist. Third, as the amateurs attain sufficient knowledge in the field, they are able to evaluate the performance of professionals and consequently play an important role in maintaining standards of professional performance. Amateurs in integral relations with scientists might reinforce the scientists' attention to the immediately practical concerns of earthquake prediction. And finally, amateur status may be both the stepping stone to a professional career, as the middle school amateur seismologists go on to the university, and the role through which former professionals continue to utilize their skills.

Clearly when we think of an integrated team of professionals and amateurs we evoke a rather different picture than when we think of a call for volunteers to relieve physicians or nurses from some of the more menial aspects of their work. But we also describe a pattern which has highly significant parallels in American amateurism and the more stable segments of the Chinese amateur–professional system. It also seems apparent that many of the difficulties characteristically associated with the use of volunteers in the United States are less significant when we envision an integrated professional–amateur–public social system.

Assuming that units of the scientific establishment are willing to try out a collaborative relationship of this kind, two problems must still be resolved if a stable system is to be evolved. First, the arrangement must take account of the interval of years and even decades that will usually intervene between the onset of amateur observation and the payoff in prediction of a significant earthquake. The amateur activities Stebbins is describing lead to fairly frequent events before audiences. The experience with climatological observers indicates that sustained cooperation may be secured without dramatic payoff. But at least the contribution of climatological records to daily weather forecasts gives the activity meaning that may be harder to find in daily reports for an earthquake prediction that is never issued. There are at least two approaches to dealing with this problem.

One approach is to recruit amateurs as apprentices on an explicitly temporary basis. The amateur role becomes part of a learning experience which calls for intense dedication for from one to a few years, with planned rotation out of the role by the time that the learning opportunities from the role have been exhausted. One important advantage of working through schools and youth organizations is that interested participation can be programmed along with provisions for a succession of amateurs. The more advanced amateurs in such an arrangement can play a large part in training and supervising the novices, and can assume major responsibility for the filtering of

emergency communications.

The other approach is to incorporate earthquake prediction into a multi-purpose activity that is sustained by the several functions it performs in the amateurs' lives. This proposal is similar to the recommendation by Fritz (1960) concerning a national fallout shelter program, namely, "Every effort should be made to incorporate multiple peacetime uses into shelter construction, so that the shelter is not viewed simply as a place of refuge in the event of attack but as a place that has value in current life" (p. 144). The Four-H Club member who keeps daily records of his animals' behavior should do so in a program under which earthquake prediction is but one of several uses for the observations.

The second problem arises from what may be discrepant goals between professionals and amateurs. R. Popkin (personal communication) observed that in a U.S. Geological Survey conference on the use of volunteers in earthquake prediction (Menlo Park, February 2 and 3, 1978) the agency representatives came inspired to join in a life-saving earthquake prediction enterprise but were offered principally the opportunity to contribute to a long-term research program. There is a volunteer mystique that casts the volunteer in an unrealistically heroic role, and produces a disposition to believe that uneducated peasants single-handedly predicted Chinese earthquakes. Nevertheless the prospect of contributing to the prediction of an earthquake with consequent saving of lives will undoubtedly be a paramount incentive even for sophisticated amateurs. The scientist's career rests more on the long-term record of research than the chancy prediction of a single earthquake. The maintenance of sufficient mutuality to produce a stable working system between professionals and amateurs will require that communication systems be geared to predicting earthquakes as well as conducting research. The provision for detecting and forwarding reports of potentially critical observations and for amateur participation in the filtering of these reports and briefings on the nature and grounds for final decisions are the minimal requirements for accommodating amateur goals.

CONCLUSIONS

The major theme of our discussion has been the transferability of insights concerning the use of volunteers in such science-related activities as earthquake prediction between the People's Republic of China and the United States and other western nations. In spite of recurrent problems, the penchant for sustained volunteer service in a worthy program is high in the United States. Contrary to journalistic characterizations of a "people's war against earthquakes," the Chinese program is a far cry from the unregulated grass-roots movement often feared by western scientists. Although the dynamics of the Chinese program have not yet been exposed to searching social science investigation, the organization and procedures are well – though not perfectly – designed to deal with the problems of recruitment, incentive, control, and communication in the special forms they take in the use of volunteers in an earthquake prediction program. In most instances the Chinese solutions can be adapted to the nature of western societies in developing a model for use in the west.

At least five features of the Chinese program merit serious consideration in devising a plan for the United States.

(1) The organization of the program around *amateurs* rather than mere volunteers. The example of recruiting from established groups of sophisticated amateur astronomers in the Moonwatch program or of the Chinese middle school student who has learned enough to be able to try out different ways of measuring telluric current is more suitable than that of a collection of novices filling their free time by blindly following instructions from scientists.

(2) The organization of the amateur experience as an apprenticeship, designed to foster personal growth and in some instances to serve

as a stepping stone toward a vocation.

(3) The integration of the amateur activity into already established broadly-based organizations rather than the creation of a new and independent organization. Rather than broadcasting an appeal to the public to establish or join groups that report strictly to the local seismic station, the Chinese ask that groups be established in communes, factory committees, and schools.

(4) Incentive, control, and communication are all facilitated by the maintenance of dual lines of authority and communication, so that amateurs communicate both with the sponsoring unit and with the seismic specialists.

(5) And finally, the Chinese practice of using participatory filtering units in order to select those reports that should be forwarded on an emergency basis for prompt study by the professionals is crucial in resolving the problem of communication overload while strengthening both incentive and control.

On the other hand there are important contrasts in the way an amateur program can be most effectively designed for the United States.

(1) The Chinese make political motives paramount in recruiting and sustaining amateur participation. American experience has shown that political or national concerns can be powerful incentives in periods of crisis, but that the service-interest–personal development motivation complex is quite adequate and probably more dependable as the incentive for volunteer and amateur participation in useful programs.

(2) While the Chinese work through the local civil units in establishing their amateur network, autonomous and semi-autonomous organizational sectors in American society constitute a more appropriate medium.

(3) While the Chinese program is chiefly crisis-oriented, an American program will, at least for the present, have to be organized on the basis of more sustained and less crisis-motivated activity. The critical contributions of China's amateur groups come after intermediate- and short-term predictions have been issued. No doubt the report of an anomaly such as the southern California Uplift in February, 1976, would create the incentive for crisis observation. But the long period without an earthquake and the intermittent and conflicting reports on its significance might render any such motivation quite unstable. Until American scientists are confident that they can issue reasonably reliable intermediate- and short-term predictions in time to organize crisis-observation groups, the need is rather for sustained observation and disciplined record keeping.

(4) Finally, the Chinese plan conceives of earthquake amateur groups as single-purpose units. Since it will be difficult for people to feel deeply the importance of years of record-keeping without a significant earthquake, an amateur program is more likely to be effective if the earthquake-prediction observations are combined with other meaningful activities. Thus multiple-purpose activity is more likely to be effective than the single-purpose Chinese pattern.

ACKNOWLEDGEMENTS

The author participated in the Haicheng Earthquake Study Delegation's visit to the People's Republic of China, June 13–30, 1976, under the auspices of the U.S. National Academy of Sciences Committee on Scholarly Communication with the People's Republic of China and the Chinese Scientific and Technical Association. Work on this topic was continued under grants from the U.S. Geological Survey, Grant No. 14-08-0001-G-347, and the National Science Foundation (RANN Division), Grant No. NSF-ENV-76-24154. Charles Fritz was especially helpful in locating relevant information. Donald Eberle (ACTION), Herbert Lieb and Raymond Richardson (National Weather Service), and Roy Popkin (American Red Cross) were generous with time and information. Joanne Nigg and Barbara Young secured information on grass-roots activities in

Los Angeles. Robert Stebbins made helpful suggestions concerning the manuscript.

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THE MOORGATE, LONDON, ENGLAND TRAIN WRECK: A CASE STUDY FROM A POLICE PERSPECTIVE

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In the following we describe a train wreck incident in London, England. The perspective is primarily that of the police who played a major role in responding to this major accident. Some of what is described is undoubtedly unique to such situations in Great Britain, but much is similar to what would be involved in this kind of rail disaster anywhere.

THE INCIDENT

At Moorgate Underground Station on Friday, 28th February, 1975, a six-car underground train crossed over points leading to the station platform at a speed estimated to be 39 to 41 miles per hour instead of the regulation 15 miles per hour. The train did not stop at the platform but continued at speed into a 69 foot long dead-end tunnel. In doing so, it demolished a central track stop signal, ploughed through a 40 foot "sand drag", demolished a central buffer stop and struck the solid concrete end wall of the tunnel.

The resulting scene can be compared with that of a wall plug being expanded by the insertion of a screw, the train virtually "exploded" and all metalwork was forced out onto the tunnel lining plates. The first two carriages and half the third carriage had entered the tunnel. These three carriages were occupied by 130 passengers at the time, a few escaped injury but 42 were killed and 82 seriously injured.

THE RESPONSE

The signalman in the platform signal box alerted the ambulance service stating that a driver had been injured. Being at the opposite end of the platform he was unaware of the seriousness of the incident. Police first heard of the incident through a pedestrian speaking to a police car crew some 200 yards from the station. At the same time the police control centre, having been alerted by the ambulance service, sent three motorcycle patrolmen to investigate and report on the occurrence.

On arrival at the station, police and other emergency services found nothing unusual at street level, 51 feet above the platform. They went down to the platform and saw what to them appeared to be one carriage of the train smashed into the tunnel and informed their control accordingly. Police and ambulance personnel started to assist casualties from the third carriage. It was some ten minutes later that, on hearing shouts for help from further down the tunnel, they became aware that there were further carriages ahead of this damaged one. They had difficulty in getting

further forward due to the expansion of the carriage onto the tunnel walls. Having got past this obstruction they found the remainder of the train – the two front carriages. The second carriage was flattened and the first carriage was rammed against the tunnel wall and roof. There were many living survivors, some seriously injured, in the first two coaches, the last living casualty was released after being trapped for 13 hours. In the early stages the train and platform were in almost total darkness. Personnel had a few torches, but they would have liked much more lighting right from the outset. From this experience, it was decided that officers should always carry some form of emergency lighting with them for immediate use. Those officers likely to be first on scenes of accidents are now equipped with cold chemical lights. These are like a pen and when required for use are activated by being flexed, thus allowing two chemicals to mix and provide a bright fluorescent green light. This light enables personnel to see for about 15 feet all around them.

After 25 minutes the scope of the disaster had been appreciated and the three coaches initially investigated for casualties and victims. 118 feet of train had been compressed into 69 feet of tunnel.

Contingency Plan Proved

This type of underground incident had not been foreseen and it was extremely gratifying after the incident to see that the police joint services emergency plans had been so flexible as to have been capable of immediate use in dealing with such an unexpected type of accident. London has a Joint Services Planning Committee and in the past three years there have been many meetings to delegate tasks and to plan an adequate control and coordination intervention plan for such occasions.

Our purpose-designed incident control vehicle had been despatched to the scene and established a joint services control point opposite the station entrance, being joined by the fire, ambulance and post office communications vehicles.

Communications

Although all police officers are equipped with personal radio sets, it was known, through previous experience, that these radios did not work well underground. We therefore had foreseen the problems that would arise and had emergency field telephone sets and cables on our incident control vehicles. On our arrival, these sets had been installed to facilitate verbal communication between the platform and ground control units. This means of communication had remained in full working order throughout the incident and furthermore the small batteries providing power to the telephones lasted throughout the six days of the incident without replacement.

Removal of Casualties

By use of our emergency plan, an ambulance loading point was established at the station entrance. A one-way traffic system was implemented and *all* vehicles were instructed by radio to approach from the north whilst all ambulances left the scene in a southerly direction, although one of the hospitals was north of the incident. By adopting this procedure we ensured that the roadway never became blocked and the removal of casualties was therefore not delayed. Ambulance routes to hospitals were policed at every junction so as to ensure a smooth and uninterrupted passage for the casualties.

Most of the activity took place at platform level and, whilst police had, as human nature dictates, initially become involved in the rescue operation, as sufficient specialist fire rescue personnel attended so police officers were withdrawn from the rescue effort and reallocated to other duties. As with many disasters, there was initial chaos at the scene, but, by

adopting our contingency plans, a controlled and coordinated intervention was established within one hour.

The fire incident officer in charge of rescue operations was always located at the entrance to the train, behind him there was always a police property officer to receive property recovered from the train and to ensure its safe custody.

As casualties and victims were removed from the train they were handed over to ambulance personnel and placed on stretchers, being taken to a triage area for assessment by a doctor and nurse. Dead bodies were certified as dead by the doctor and removed, by agreement with the Coroner, direct to the mortuary. Casualties were assessed into two categories – those able to withstand the 3 minute journey to hospital without supportive treatment (these were placed directly into ambulances) and those requiring supportive treatment before transportation (these were treated at a medical aid station established on the adjoining platform). Refreshments for rescue personnel were available from an early stage on the opposite platform.

Whilst the medical aid teams' equipment was initially very tidy, the taking of articles from the stockpile in a haphazard fashion soon produced an unidentifiable pile of equipment. The need for a "Medical Equipment Officer" at equipment stockpiles was learnt from this disaster and such a person is now part of the team.

Life support was provided by the use of 35 lb oxygen cylinders. Smaller 10 lb cylinders were available from ambulances but these are not fitted with flow meters and medical staff were unfamiliar with and not satisfied with them, thus these large cylinders had to be carried up to the surface alongside the casualty by one of the medical staff. A total of seven persons had to accompany each casualty. The Medical Services are now establishing further training sessions to ensure that medical staff know the capabilities of the smaller ambulance oxygen cylinders.

Stretcher-bearers are always in demand at accidents. Thirty ambulance personnel were, unfortunately, sent down to the platform together, although their immediate presence was not required, thus they became "sightseers" and obstructed movement. After a while this was realised and they were then kept at surface level until required for duties.

After 13 hours' activity all known living persons had been taken from the train. During this time cold cutting equipment had been used by the rescue services, but even then there was a temperature of 100 degrees Fahrenheit at the scene. Compressed air cylinders added to been used to reduce this temperature and provide essential oxygen and air to the rescuers and trapped casualties. With the removal of all living casualties, hot cutting equipment was used and created even more problems. The heat of the cutting equipment raised the working temperature to 120 degrees and this coupled with fumes from cut metals made further discomfort and health risks for the rescuers. Tunnel conditions were very dirty, the presence of rats gave rise to the possibility of disease and the lack of good hygiene facilities added to the discomfort of rescuers.

Health Hazards

Medical advisers directed that personnel working in the tunnel and on the platform must wear protective overalls, gloves and masks. Work in the tunnel was to be limited to 20-minute shifts and on the platform to 40 minutes, after which time they were to go to the surface for 40 minutes to breath fresh air. Stockpiles initially provided protective equipment for personnel and further supplies were obtained from commercial concerns. Two types of breathing masks were used – a single filter lasting 20 minutes and a double filter lasting 40 minutes. Police kept records of the times personnel were engaged at platform and tunnel levels. Any person not

reporting out on time was ordered out by his supervising officer, even though on occasions a rescuer wanted to continue to finish a particular part of his work. Even Senior Executives visiting the scene had to be protected by masks.

By Sunday, the third day of operations, all services were running short of stockpiled equipment. In order to standardise supplies and avoid duplication of equipment, the police were appointed quartermasters and obtained equipment on behalf of all services, issuing it as required to each individual.

To reduce the risk of infection a decontamination procedure was established at street level. All personnel leaving the station had to pass through foot baths which removed loose dirt on their footwear. They handed in their gloves and masks which were disinfected by police cadets and then reissued to other personnel. On leaving the footbath, personnel went to their support coaches, stripped off all their clothes and were given a hot shower before dressing in clean clothing prior to leaving the incident for their normal work location. Adoption of this rigid routine avoided the possibility of the spread of infection and disease.

CASUALTY INFORMATION BUREAU

The police established a casualty bureau at nearby police premises for documenting all persons involved in the incident. During the first 12 hours this bureau dealt with over 2,000 enquiries from anxious relatives and friends. It remained in operation for seven days before all enquiries were satisfactorily concluded.

The press and news media have a duty to accurately report facts surrounding an incident to the public. The police therefore appoint a Press Officer whose task is to ensure that accurate information is disseminated. The presence of such an officer avoids the necessity for the press to glean information from other working personnel which is often incomplete or inaccurate.

WELFARE OF RESCUERS

The rescue services need refreshments whilst working. Two voluntary organisations, the Womens Royal Voluntary Service and the Salvation Army provide such facilities. Although local councils are responsible for the welfare and feeding of survivors and homeless persons from an incident, these two organisations provide refreshments for the rescue personnel and additionally assist the local councils.

After six days and five nights of rescue work the final victims were removed from the wreckage and the driver's body reached. Removal of victims requires special procedures. Each is labelled and photographed in the location where found before they are removed. In the hot atmosphere of this incident the bodies had become decomposed and therefore firemen in full breathing equipment carried out this very unpleasant task.

When the driver was reached it was essential to the official investigation into the causes of the incident that he be photographed in situ so as to establish his actions at the moment of impact. Other photographs of the mechanical and electrical control in the driver's cab were also obtained. The driver's body was then removed to the Mortuary and, like the other victims, it was medically examined by a pathologist, each step of the examination being documented and photographed.

LESSONS LEARNED BY THE POLICE

1. This type of incident could not have been foreseen. By having kept contingency plans

for disasters as simple as possible and capable of instant adaptation to suit any situation, this situation was dealt with effectively.

2. All command and control systems must be mobilised quickly after an incident so as to become available for operational use in as short a time as possible.
3. Each service should appoint a "quarter-master" to ensure adequate supplies of back-up equipment. There should be a general co-ordinator of such facilities, possibly the police officer should act in this capacity.
4. Plans must include a scheme for reallocation of everyday duties so as to ensure that non-essential everyday tasks are curtailed so as to benefit the incident with the maximum resources.
5. Any pre-planning arrangements by services must be made in discussion with all other services.
6. Immediate availability of flexible filed telephone communications ensures that there is no breakdown in essential communications at any stage of the operation.
7. Contingency Planning must allow for the natural human reactions of intervention personnel and their automatic activity that will always ensue must be brought under operational control as soon as possible.
8. All casualty and incident information *must* be chanelled through one bureau so as to obviate differing stories circulating to the press and news media.
9. Regular training of emergency services organisations will not only ensure that each organisation knows its role in a disaster situation but will also ensure that all services know what their counterparts will do at an incident.

Mass Emergencies 3(1978) 167–184
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PUBLIC SUPPORT FOR SEISMIC SAFETY: WHERE IS IT IN CALIFORNIA?

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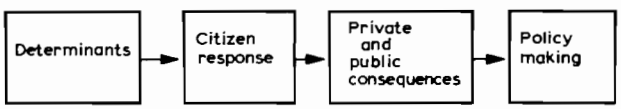
INTRODUCTION

The area of seismic safety policy is a public problem without much of a public. The citizens of California appear not to be much worried about earthquakes. They do very little to protect themselves or their property from the earthquake hazard. They are not organized to insist that their government do something about it. Even people in the insurance business do not purchase earthquake insurance.

> My own broker has tried to get me to buy it – I have never bought it. I live one and one-half miles from the San Andreas fault. It's just one of those things. I have a wood frame building built on concrete piers, and I don't know how it would survive a quake but I'm like the average Californian – the average American. I don't think it is going to happen to me [1].

A while ago an earthquake specialist told an assembled group of experts that local officials needed a popular mandate before they would use "rational" decision-making techniques with respect to seismic safety. In hope of the unlikely, if not the impossible, this specialist opted out of the problem of coping with reluctant officials. Waiting for the mandate means waiting until just after the next earthquake, but even then an active constituency of citizens will likely be short-lived and be asking for relief rather than preparation for a future earthquake.

To understand the quality and extent of public support for seismic safety policies, let me outline two crude "models." Each model has the following components:



Model I, Indifference

In this model citizens are indifferent to earthquakes in general and to seismic policies in particular. The citizen develops this indifference during the many years between major earthquakes. The determinants of such a response are obviously complex and include, among others, such factors as: personal experience with past earthquakes, length of residency, age, and having other concerns besides earthquakes. Regardless of the particular determinants, the indifferent response is translated into a number of private and public consequences. The citizen wearing his private hat, for example, seldom buys insurance and is more likely to resort to prayer than making his house resistant to earthquakes.

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Because of prevailing indifference, the citizen is not likely to wear a second or public hat, and thus as a consequence is not a potential source of political support. Experts and public officials, therefore, attempt to change or implement existing policy without the direct political support and expression of interest from large numbers of citizens.

Model II, Concern

In this model, citizens are also usually indifferent, but this indifference, for some of them, turns to concern immediately after experiencing an earthquake. For the concerned citizens, the earthquake has acted as the primary determinant of their response. Privately, a few concerned citizens may buy insurance or prepare for a future earthquake. The public consequences of the citizen's concern, in terms of political support, may or may not be directed to seismic safety. In the aftermath of the Long Beach 1933 earthquake, for example, there was an expression of citizen interest in enhancing the safety of public schools. On the other hand, after the 1971 San Fernando earthquake, much of the concern of citizens was directed to non-seismic safety issues, such as securing relief and financial assistance. In both the Long Beach and San Fernando situations, public officials and their experts passed legislation aimed specifically at the issue of seismic safety.

In some ways the model of concern is a variant of the model of indifference. First, even after an earthquake, many citizens remain indifferent. Second, for those who are concerned, their concern rapidly disappears as time passes. Third, the concern of citizens after an earthquake is not necessarily directed at seismic safety issues. And, fourth, in both models policymakers operate on an assumption of public concern and support. That assumption may be valid in some cases, but in others it may prove to be illusory. It is true that the occurrence of an earthquake provides policymakers with an opportunity for action, but it does not necessarily follow that such action is based on the direct expression of political support from citizens.

The existence of citizen indifference will come as no surprise to seasoned students of emergency preparedness and seismic safety. Nevertheless, it is a primary characteristic in the making and implementation of seismic safety policy. A fuller understanding of citizen participation, or more accurately the lack of participation, in the seismic safety policy arena can help us direct research efforts and assessments of the adequacy of present policy and the policy process.

In this essay it will not be possible to develop such a complete understanding by demonstrating the connection of citizen attitudes and behavior to the making of policy – in a sense to validate empirically the models of indifference and concern. For one thing, it is not particularly easy to demonstrate something which may not exist. For another, I have to rely on secondary analysis and anecdotal reports from newspapers and other sources. Instead, I will illustrate the extent of citizen indifference, discuss some of the determinants and consequences of citizen concern and indifference, and make some conjectural leaps in order to question the process of public policymaking and the role of citizens.

CITIZEN RESPONSE

Great expectations

Most Californians seem to accept the possibility of a serious earthquake in their area. In a survey taken seven months after the San Fernando earthquake of 1971, over 75 percent of the respondents felt that a serious earthquake was at least somewhat likely, while less than 20 percent felt that such an earthquake was not possible (see Table I).

TABLE I

Californians Accept the Likelihood of a Serious Earthquake in Their Area

	No.	%
Certain to happen sooner or later	112	22
Very likely to happen	166	33
Somewhat likely to happen	107	21
Not too likely to happen	84	17
Not at all likely to happen	12	2
Don't know, no opinion, no answer	19	4
	500	99

Source: *California Field Poll 71-04*, August, 1971, question 24: "As you understand it, how likely is it that a serious earthquake might strike here?"

Although earthquakes are infrequent and localized events, this poll indicated that at least a majority of California's citizens – including residents of the major population centers in Northern and Southern California, such as Los Angeles and San Francisco – believed that a serious earthquake was likely to happen where they lived. Unfortunately, as we shall see, expecting an earthquake is quite different from wanting to do something about it.

So far we have been discussing expectations, but what about actual experiences with earthquakes? Over the centuries earthquakes have caused thousands of deaths – for example, the 1556 earthquake in China, the 1923 earthquake in Kanto, Japan, and the 1976 earthquake in Guatemala, with estimated death tolls of 833,000, 143,000, and 22,000, respectively. If we consider the cumulative effects of earthquakes, we are talking about millions of lives lost and billions of dollars of property destroyed. Yet California, despite an image of being "earthquake country," has been fairly fortunate.

While Table II shows that California has had its share of property damage, the death figures certainly have not been as extensive as those in other parts of the world. As long as earthquakes in California continue to occur in the early morning, when most people are at home, or in locations of low population density, Californians may maintain their luck. To expect that earthquakes will choose an appropriate time or place to occur seems foolish, but it is a policy that many citizens and officials implicitly follow. A few even follow the policy

TABLE II

Selected California Earthquakes

Year	Location	Richter Magnitude	Lives Lost	Dollars of Property Damage*
1868	Hayward	7	30	$ 350,000
1872	Owens Valley	8.2+	27	$ 250,000
1906	San Francisco	8.3	800-1300	$ 1 billion
1915	Imperial Valley	6-7	6	$ 900,000
1925	Santa Barbara	6.3	13	$ 8,000,000
1933	Long Beach	6.3	115	$ 60,000,000
1940	El Centro	7.1	9	$ 6,000,000
1952	Kern County	7.7	14	$ 55,000,000
1954	Eureka-Arcata	6.5	1	$ 2,100,000
1969	Santa Rosa	5.6-5.7	0	$ 10,000,000
1971	San Fernando	6.5	64	$511,000,000

Sources: California Legislature, Joint Committee on Seismic Safety, *Meeting the Earthquake Challenge*, January 1974, pp. 205–211. San Fernando figures are from the California Division of Mines and Geology, *San Fernando California Earthquake of 9 February 1971*, Bulletin 196, 1975, p. vii.

*Figures given are estimated total losses in dollars valued at time of occurrence.

explicitly, and one taxpayer association official, for example, argued on the day of the 1971 San Fernando earthquake that a bond election to build earthquake resistant schools should be defeated because no earthquake in California had occurred when school was in session.

DETERMINANTS

Experience and other concerns

One would expect that actual experience with an earthquake would be a primary determinant of citizen response, but the relationship is not clear as yet. Many Californians, of course, have never experienced a serious earthquake – for them, an invisible hazard which is easily ignored. Low-magnitude earthquakes are frequent enough in certain parts of California to be taken for granted, even regarded complacently as one of California's many exotic phenomena. Richard L. Humphrey (1907), an engineer, made the following observation after the 1906 San Francisco earthquake:

> The average Californian becomes accustomed to the earthquakes which produce 'temblors' of sufficient intensity to rattle windows. Prior to the great earthquake of April 18, 1906, these temblors were of frequent occurrence, but occasioned no alarm and, indeed, scarcely excited a passing interest. Over two hundred earthquakes were recorded during the period from 1850 to 1886, being more prevalent in the vicinity of San Francisco Bay than elsewhere (p. 16).

After the 1971 San Fernando earthquake, the *New York Times* interviewed a number of citizens who lived along the San Andreas fault and was confronted with indifference and fatalism. One individual who had lived close to the fault for twenty-five years said "he would stay on the San Andreas for the rest of his life. His house was knocked down in an earthquake in 1952. Asked if he had rebuilt, he said: 'Nope, didn't own it. But there's no sense in being scared of earthquakes. It's natural for them to happen. People in a flood area seldom move away. Why should I? Why, it's probably been this way for centuries.'" (29 April 1971, p. 32).

Despite attempts by public utilities, museums, and governmental agencies to alert the public to the potential hazard, citizen interest is slight. The University of California Extension, for example, recently offered a one-day seminar on building and investing in earthquake country and had to cancel it because only four people signed up. And as *San Francisco Chronicle* columnist, Herb Caen, remarked, "If there's one subject San Franciscans are completely fatalistic about, it's quivers and tremors" (10 March 1976). This lack of interest does not extend, of course, to movies, popular books, and newspaper stories. Earthquakes make good entertainment. To prepare for them is another matter.

Peter Yanev (1974), an engineer, has written a book suggesting some sensible and inexpensive steps property owners should take for their own protection. In his preface he comments on the public's ignorance of such safety precautions.

> As ill-informed and ill-prepared as most Californians are regarding their earthquake problem, they are at least aware that there *is* a problem. The citizens and officials of the other seismically threatened states in the West seldom even know of the high risks they face. . . . Despite the long history of earthquake damage . . . and despite principles of earthquake-resistant construction and property location which have been known to builders and available to governments for at least three generations, the individual property owner and indeed most governing bodies remain blithely ignorant of the factors that determine earthquake risks and of the simple, relatively inexpensive corrective steps that could be taken (pp. 7–8).

One premise of Yanev's excellent handbook is that if you tell people what they can do to mitigate a potential hazard, they will do it. Experience would indicate otherwise. Information and education, while necessary, are not enough without motivation.

Many Californians living near fault lines believe that one part of "earthquake country" is about as safe as another and see little point

in moving. Besides, the fault zone area provides "nice flat depressions in otherwise hilly grounds – perfect spots for building." Or, as one woman said, "We know the fault runs through here . . . but we don't care. It's nice here. There are not as many people here. The air's clean, and there's no smog. That's reason enough to be here." (New York Times, 29 April 1971, p. 32) [2].

Which brings us to another determinant of indifference: citizens have enough to contend with besides the possibility of destructive earthquakes. Getting the kids' teeth straightened or dealing with congestion on the freeways are more pressing concerns. Indeed, more people in California worry about various forms of pollution (42 percent) than about earthquakes (25 percent), if we can judge by a 1971 statewide poll (see Table III). In the Los Angeles area 37 percent were afraid of air pollution, while only 23 percent feared a possible disaster from an earthquake. Fear of race riots or campus disturbances was five percentage points higher, at 28 percent, than fear of earthquakes.

Well over 90 percent of the Field Poll sample had felt an earthquake. In addition, over 50 percent of the sample had been in a position to experience an earthquake in which there was visible damage to the surrounding area. Yet such experience with a "damaging" earthquake did not affect their relative fear of earthquakes in general. Twenty-four percent of 261 respondents who had "seen" earthquake damage feared earthquakes over other disasters, which was quite similar to the 25 percent of the 234 respondents who did not have the benefit of such an experience and still feared earthquakes over other disasters (such as pollution, floods, mudslides, and riots).

From the above anecdotal evidence and survey data, I suspect that the relationship of experience with earthquakes to fear or concern over earthquakes is curvilinear. Consider a shallow U-shaped curve, with experience plotted on the horizontal axis and fear or concern on the vertical axis. Towards the top of the left side of the U are those citizens who have experienced not even a tremor and are not "accustomed" to them. As newcomers to California, perhaps, all they know are rumors, and they are afraid and concerned about earthquakes. At the top of the right side of the U are those citizens who have personally witnessed loss of life and experienced a major loss of property; they are as concerned as those without experience but perhaps not as afraid. At the bottom of the U are the bulk of citizens who have experienced tremors and maybe observed damage to somebody else. Having lived with the phenomena of earthquakes for a number of years, they are indifferent.

One might expect that if citizens were ever

TABLE III

Citizens Have Other Concerns Besides Earthquakes

Disaster Most Feared	Total		San Francisco Bay Area		Los Angeles Area		Other California	
	No.	%	No.	%	No.	%	No.	%
Earthquake	123	25	29	29	49	23	45	24
Air pollution	151	30	17	17	78	37	56	30
Water pollution	60	12	18	18	19	9	23	12
Riots	138	28	28	28	59	28	51	27
Floods	16	3	4	4	3	1	9	5
No answer	12	2	3	3	5	2	4	2
	500	100	99	99	213	100	188	100

Source: *California Field Poll 71-04*, August, 1971; Question 23: ". . . which of these possible disasters do you most fear?"

motivated to prepare, it would be right after a credible warning or an actual earthquake. Yet another survey of Los Angeles residents conducted in the spring after the 1971 San Fernando earthquake found that only 11 percent of them had made any preparations before the earthquake – in spite of various warnings from time to time, including the alarmist one about California "falling into the sea." What is more relevant, "only 16 percent of the sample report making preparations since the earthquakes". A higher percentage of those living closer to the earthquake reported making post-earthquake preparations (Table IV), but 16 percent is still a small fraction of the total residents of the Los Angeles area (Bourque, 1973) [3]. The ones who got hit on the head, literally and figuratively, learned a bit more than their neighbors, who unfortunately did not benefit from the experience. An ironic touch is that over half of the sample believed that an earthquake was likely to strike Los Angeles within twelve months.

Yet from the viewpoint of residents of the Los Angeles area these predominantly indifferent responses make some sort of sense: earthquakes occur rarely, and they had had theirs. A mixture of horse sense and nonsense, therefore, characterizes citizen response to earthquakes. Earthquakes, when they do infrequently occur, are localized events which affect only a small part of the population; whereas smog, for instance, has become a daily menace affecting almost everyone in the Los Angeles area. Burning eyes and difficulty breathing are immediate and frequent experiences for many Angelenos. For the majority of Californians, a disastrous earthquake – which is likely to affect someone else's life and property – is too ephemeral a threat to distract them from other preoccupations (Wolfenstein, 1957, p. 3) [4]. It is all too easy to discount not only someone else's experience with an earthquake but one's own experience as well, particularly as time passes and the memory of the disaster fades. As I will suggest in the next section, the passage of time, coupled with continuity of residence in an area, contributes to citizen indifference.

Relaxed residents

Another, perhaps independent, determinant of citizen response is length of residency. Residency encourages citizens to accept their region's natural hazards. Thus a Californian is likely to be concerned about encountering a tornado when visiting the Midwest and tourists and other newcomers to California are often surprised by the nonchalance about earthquakes which they find here. Back East the spectre of an earthquake disaster was vivid and real. Out West one's neighbors and friends are not agitated about the prospect of an earthquake. They are advocates for California and downplay their concern, if any, about

TABLE IV

Proximity Motivates Preparation

Post-Earthquake Preparation	San Fernando and Sylmar %	Rest of San Fernando Valley %	Rest of Los Angeles Basin %	Total No.	Total %
Yes	46	24	11	127	16
No	54	76	89	652	84
Total No.	70	135	574	779	100

Source: L. Bourque et al., *The Unpredictable Disaster in a Metropolis: Public Response to the Los Angeles Earthquake of February, 1971* (Los Angeles: UCLA Survey Research Center, 1973), Table 3.12, p. 28.

earthquakes. After a while the nervous newcomer becomes the old-timer who is a little cynical about the whole thing. Indeed, as Table V suggests, many long-term residents of fifteen years or more even begin to believe that earthquakes are less likely to occur. About half of the long-term residents thought a serious earthquake was likely to happen, while over two-thirds of the newer residents had similar feelings; 22 percent of the long-term residents thought that a serious earthquake was unlikely, as compared to 10 percent of the newcomers. The percentages are about the same for those residents who have lived in the state from five to fifteen years and for less than five years.

TABLE V

Long-term Residents Consider Serious Earthquakes Less Likely

Opinion	Length of Residence			
	Less Than 15 Years		15 Years or More	
	No.	%	No.	%
Likely	90	68	187	51
Somewhat likely	26	19	81	22
Unlikely	14	10	82	22
No answer	3	2	16	4
	133	99	366	99

Source: *California Field Poll 71-04*, August 1971; question 24: "As you understand it, how likely is it that a serious earthquake might strike here?"

Of course the differences indicated in Table V are not overwhelming, but note that the proportion of long-term residents who probably feel safe from serious earthquakes is twice that of the newer residents. If a person feels that an earthquake is unlikely, he probably also feels safe. That length of residency in California contributes to feeling safer about earthquakes was also partially supported by an analysis of what aspects of earthquakes most frightened the respondents. By grouping their responses into fear of "casualties" and fear of other effects such as noise or loss of electricity (Table VI), I found that those

TABLE VI

Long-term Residents Fear Casualties Less

	Length of Residence			
	Less Than 15 Years		15 Years or More	
	No.	%	No.	%
Fear casualties	83	62	200	55
Fear other results	50	38	166	45
	133	100	366	100

Source: *California Field Poll 71-04*, August 1971; question 25: "What things about an earthquake frighten you the most?"

residents who had lived in California for fifteen years or more tended to fear "casualties" less (55 percent) than the relative newcomers (62 percent). Once again the numbers are more suggestive than conclusive of the general point. The numbers, however, do run in the appropriate direction; for example, 81 percent of the residents who had lived in the state for less than one year feared "casualties" or loss of life. Unfortunately the number of respondents in this resident group, sixteen, was too small to arrive at definitive conclusions.

Length of residency also seems to affect the respondents' evaluation of their city's preparations for coping with a possible earthquake disaster. As shown in Table VII,

TABLE VII

Long-term Residents Are More Critical of Earthquake Preparations

Rating of Preparations	Length of Residence			
	Less Than 15 Years		15 Years or More	
	No.	%	No.	%
Good	25	19	50	14
Fair	50	38	107	29
Poor	40	30	148	40
No answer	18	14	61	17
	133	101	366	100

Source: *California Field Poll 71-04*, August 1971; question 22: ". . . which of the statements on this card . . . best describes what kind of job you feel the responsible authorities in your city are doing to prepare for possible disasters such as . . . reducing potential damage and hazards from a major earthquake?"

approximately 40 percent of the long-term residents rated preparations as poor, as compared to 30 percent of the newcomers. This criticism of local preparation may be due to awareness that local officials are not doing much, or it may be a projection of futility or indifference: nothing can be done, so local efforts are pointless.

Other variables might affect the influence of residency on citizen response. One is age, which in other instances has been connected with cynicism and apathy. For example, older respondents feared casualties less than the younger ones. They were more likely to be concerned about noise and shaking from earthquakes than about death. Forty-seven percent of those sixty or older feared casualties rather than other results of an earthquake, and this percentage increased as age decreased down to those respondents under twenty-five, with 65 percent. When age was controlled, however, the effect of residency was still apparent [5]. Nor did geographic location change the results. Long-term residents, for example, did not live in areas with perceived poor preparations and low earthquake likelihood. The residency groups were spread throughout the state, and opinion on preparation and likelihood did not differ much between regions. The proportion of respondents who had experienced a "damaging" earthquake did increase slightly with their length of residence. Yet, as previously noted, experience does not necessarily lead to greater concern about earthquakes.

What can we conclude about length of residency as a determinant of citizen response? Obviously a secondary analysis of a single Field Poll cannot provide definite conclusions. Not many surveys of earthquake response have been previously conducted with standardized questions, and as is typical with survey data, much depends on the question and its wording. When judging the likelihood of earthquakes, for example, does the respondent perceive a "serious" earthquake to be one in which his roof may fall in, or is "serious" just a slight shaking feeling? Do long-term residents have a higher or more severe test of a serious earthquake?

Despite such reservations, it does seem to us, as a working hypothesis, that the longer one lives in California, the less one is likely to care about earthquakes. Long-term residency provides information and experience to the citizen. It provides the opportunity to experience earthquakes and then to discount that experience. He sees that after 15 to 20 years not much has happened to him. Indeed the experts tell him that a great earthquake only happens once in 50 to 100 years. He may have felt a tremor, observed damage in his area, but still not experienced severe personal damage. Then as he gets older, there are other perils to his health which he must confront, and his fear of dying from earthquakes diminishes. Cynicism creeps in, and the long-term resident soon feels that neither he nor the government can do much about earthquakes. So why not just relax?

PRIVATE CONSEQUENCES

The uninsured

If Californians wanted to take some action against a future earthquake, they could at least insure their homes and property. In 1975, according to the Insurance Information Institute, $13.8 million in premiums, about two-thirds of the earthquake insurance written in the United States, was in force in the State of California. This appears to be a large amount of premiums but actually is quite small. As one insurance executive put it:

> Less than 5% of the California property which is presently insured against fire is also insured against earthquake. This is true in spite of all the noise that has been made about the need for earthquake insurance in California. This is true in spite of the fact that companies have recently introduced improved earthquake insurance products and advertised them widely (Syfert, 1972, pp. 14–18).

Most of us have to buy fire insurance because the people who lend us money to buy our homes insist on it, but we don't have to do the same for earthquake insurance, and evidently not many of us do. Nor is our reluctance a recent phenomenon. Judging by the data presented in Table VIII, Californians have usually spent only a small fraction of their other property insurance dollars on earthquake insurance – about 3 to 4 percent, from the 1930s to 1960. From the 1960s to 1975, the figures declined to about 1 percent as more property owners insured themselves against multiple perils (such as liability) and took advantage of homeowner policies.

TABLE VIII

Investment in Earthquake Insurance as Opposed to Other Property Insurance (In Millions of Dollars)

Year	Other Property*	Earthquake	Earthquake as a percentage of other property
1922	$34	$0.061	0.2%
1923	40	0.214	0.5
1924	41	0.298	0.7
1925	42	2.0	4.8
1926	45	2.4	5.3
1927	44	2.8	6.3
1928	43	1.8	4.2
1929	46	1.6	3.5
1930	42	2.0	4.8
1931	34	2.0	5.9
1932	31	0.7	2.3
1933	28	0.9	3.2
1934	28	1.0	3.6
1935	29	0.9	3.1
1936	28	0.9	3.2
1937	28	0.9	3.2
1938	29	0.8	2.8
1939	27	0.9	3.3
1940	29	1.0	3.4
1941	31	1.1	3.5
1942	34	1.2	3.5
1943	39	1.4	3.6
1944	48	1.7	3.5
1945	53	1.4	2.6
1946	75	2.4	3.2
1947	91	2.8	3.1
1948	92	2.7	2.9
1949	99	3.4	3.4
1950	106	3.3	3.1
1951	118	3.4	2.9
1952	120	3.9	3.3
1953	124	4.3	3.5
1954	109	3.8	3.5
1955	121	4.1	3.4
1956	125	4.3	3.4
1957	137	5.2	3.8
1958	170	5.5	3.2
1959	197	5.3	2.7
1960	216	5.5	2.5
1961	242	5.7	2.4
1962	265	5.0	1.9
1963	281	6.2	2.2
1964	316	4.9	1.6
1965	346	4.9	1.4
1966	381	5.3	1.4
1967	428	5.3	1.2
1968	475	5.2	1.1
1969	525	5.8	1.1
1970	597	5.8	1.0
1971	694	4.6	0.7
1972	807	8.9	1.1
1973	884	10.9	1.2
1974	959	12.9	1.3
1975	1088	13.8	1.3

Source: *Underwriters Report* (San Francisco: Underwriters Report of California).

*Includes: Fire and, from 1955 on, homeowner's multiple peril and commercial multiple peril.

To put these figures in perspective, a $20,000 house, in the 1970s, might have a homeowner's policy premium of $150 a year, with an additional $40 for earthquake insurance – or 27 percent (Baker, 1971, p. 31). A homeowner's policy for a $60,000 house might be about $300 a year, with an additional $120 a year for earthquake insurance – or 40 percent. Generally, earthquake insurance is sold at flat rates, such as $2 per $1000 for a wood frame dwelling in the San Francisco Bay Area. California's rates vary with the type of construction and its location by zone. The state is divided into three zones depending on the degree of seismic risk.

Many of the present earthquake insurance rules and rates were established in the aftermath of the 1925 Santa Barbara earthquake.

Only a small part of the losses then were covered by insurance, and after the earthquake the demand for insurance increased dramatically (U.S. Dept of Commerce, 1969, pp. 19, 75–76). We can see the effect of the earthquake on the demand for earthquake insurance clearly in Table VIII; earthquake insurance premiums shot up to $2.8 million in 1927, or 6.3 percent of other property insurance premiums. This was roughly a tenfold increase in the figures for 1924.

During the depression, premiums for both earthquake insurance and other property insurance declined; thus the effect of the 1933 Long Beach earthquake on earthquake insurance was not pronounced. Earthquake insurance premiums increased only $200,000 from 1932 to 1933. This low level of earthquake insurance premiums continued throughout the depression and most of World War II. After the war, premiums started climbing with the growing prosperity of California. During the 1950s, a number of earthquakes occurred which may have facilitated the slowly rising trend in earthquake insurance premiums. Besides property damage and some loss of life, shaking was felt over a large part of the state from a number of these earthquakes. In the San Francisco area in 1957, for example, a small earthquake (5.3 Richter Magnitude) resulted in the strongest shaking since 1906 (California Legislature, 1974, p. 210). Statewide earthquake insurance premiums increased slightly, from $4.3 million in 1956 to $5.2 million in 1957. A more dramatic increase started with the 1971 San Fernando earthquake: premiums were at a low of $4.6 million in 1971 and have increased every year, so that by 1975 earthquake insurance premiums were $13.8 million.

While we have seen that increases in the level of earthquake insurance premiums occur after an *observable* earthquake, we should also remember that the overall level of insurance protection is still relatively low. Less than one-tenth of the losses from the 1971 San Fernando earthquake – about $46 million – were covered by insurance (Baker, 1971, p. 31).

Moreover, the demand for earthquake insurance is not simply related to the occurrence of earthquakes. Other factors are involved: the level of economic activity, the form of the insurance itself, the willingness of insurance companies to sell it, and the awareness of citizens as to potential risk and availability of insurance. Consider those citizens who have directly experienced an earthquake. They may realize that the damage they are likely to suffer in the future is well within the 5 percent deductible feature of most earthquake insurance policies and may decide not to purchase insurance. From his survey of California homeowners, Howard Kunreuther found that "in earthquake-susceptible areas prior losses showed a negative relationship, if any at all, to the purchase of insurance (1976, p. 248). He concluded that prior damage has to be relatively high before there is an effect on the decision to buy insurance. He also found that friends and neighbors provide information on earthquake insurance, perhaps serving as examples or as a reference group for an individual making up his mind about whether to purchase earthquake insurance (pp. 246, 249).

If one can believe the trade publications, insurance companies have been making an effort to sell earthquake insurance. One company reported that, after a promotional campaign in southern California using newspaper advertisements, television, and mail announcements, it sold 125 earthquake insurance endorsements from November 1971 to June 1972. People were just not interested, although the company had made its effort shortly after the San Fernando earthquake. As the insurance company executive concluded:

> It seems obvious that people would rather gamble on there being no earthquake disaster in their lifetime. Even after having survived one, the normal person rationalizes there will not be another. People also seem to prefer to gamble on incurring only minimal damage if, in fact, there is an earthquake in their lifetime . . . . Consequently, it often seems to be unwise to be prudent (Syfert, 1972, p. 16).

An insurance agent who worked the San Fernando Valley area sent out a flyer informing his clients about earthquake insurance. He sold two policies before the 1971 earthquake and, with the aid of his partner, about ten policies after the earthquake. Since the San Fernando earthquake, they get more inquiries but few buyers (Taney, 1971, p. 25). A chief deputy insurance commissioner for the State of California, however, does not believe that the insurance industry as a whole has been as aggressive in its marketing of earthquake insurance. Even when an agent goes all out, however, he is not likely to sell much. An aggressive agent in the San Francisco area, for example, found that less than 6 percent of his clients were interested in earthquake coverage. (Baker, 1971, pp. 31–32). This number squares fairly well with a survey in the Bay Area which showed that 7.5 percent of the respondents had insurance (Jackson and Mukerjee, 1974, p. 164) [6].

In short, since the purchase of insurance is a consequence of concern, the California earthquake insurance situation is simply more evidence of citizen indifference to the hazard. Once again I want to suggest a U-shaped curve as a tentative explanations, with purchase of insurance plotted on the vertical axis and experience with earthquakes on the horizontal axis. Towards the top of the right side of the U are those small groups of citizens who in the past have experienced major property damage from an earthquake and therefore buy insurance for protection in the future. Towards the top of the left side of the U are those citizens who have had little or no personal experience with earthquake damage but who either have greater fear of an earthquake or are influenced by what their friends and neighbors are doing. If their friends buy insurance, they will too. At the bottom of the U are most of California's citizens, who do not purchase earthquake insurance and who keep total premiums at a low level. Some are probably unaware of the future hazard or are unaware of the availability of insurance or both. Some do not want to take the trouble to find out about insurance. Some because of prior experience feel that they can handle the future hazard without insurance. Some do not find it in their interest to insure: the costs may be perceived as high relative to the risk. In any event, most Californians do not take this minimal step to protect their homes.

Leave it to God

Because earthquakes are perceived as uncontrollable natural events, many citizens, as a private consequence, feel it appropriate to put themselves in the hands of a supernatural being. Such surrender of human responsibility may be a result of indifference. It may also indicate a measure of helplessness and reflect notions about the causes and religious meaning of destructive natural phenomena which community leaders have sometimes encouraged.

Those of us who have been reared on a diet of science and technology find it difficult to appreciate that people once believed earthquakes to be caused by the behavior of mythological animals or gods. Gigantic frogs, hogs, tortoises, and catfish have had their share of the blame. Nor has it been only the restless heavings of Poseidon the sea god which have made the earth tremble. Indeed, as David Niddrie points out:

> The earthquake has been used by all kinds of moral and religious leaders as the heaven-sent opportunity to warn the community that all is not well, and that it was time to mend its ways. . . . Furthermore as recently as 1930 the Archbishop of Naples declared that the Italian earthquake in July of that year was a visitation from God provoked by the immodesty of women's clothing and the general immorality of the people (1962, pp. 13–14).

During and after the 1906 San Francisco earthquake, religious leaders around the world interpreted the disaster as a sign from heaven that their own parishioners might expect a similar fate because of their sins. In Oakland,

a Roman Catholic priest, Father Peter Yorke, observed the burning city across the bay and declared: "There has been no town in the world, in modern times or ancient, in which vice has been so naked and unashamed. Its people made it a merit when a stranger came to show them how wicked they could be. The town turned its face away from God. San Francisco has received her warning. Let us hope it has received purification." (Thomas and Witts, 1971, p. 217).

Whether San Francisco is as "sinful" as it once was is a debatable point, but at least some of its citizens believe in the efficacy of prayer as a means of coping with the earthquake hazard. In a recent survey, 36.7 percent of the respondents reported praying as a means of adjustment to the hazard. Prayer evidently was as effective as doing nothing (also 36.7 percent), and the two were the "most practiced adjustments. . . . Adjustments of a more substantial nature, requiring preparation, time, and investment, were adopted by few respondents" (Jackson and Mukerjee, 1974, p. 164).

Whatever the reasons, for centuries people have viewed earthquakes as a problem requiring the intervention not of human beings but of gods. Today, some citizens still believe that if an earthquake is an act of God, then God should take care of it and them. And it follows that if earthquakes are God's problem, they are not government's – obviously the separation of Church and State must be maintained! Because public officials can all too readily anticipate that citizens will not blame them for an act of God, they may have little incentive to do much about the potential hazards of a future earthquake (Abney and Hill, 1966, pp. 980, 981) [7]. Whether officials will have such an incentive depends on the presence of political support for seismic safety, an important public consequence of citizen response to which we now turn.

PUBLIC CONSEQUENCES

Political support?

In the making of public policy, political support can come from a number of sources. Sometimes a small concerned segment of the public, an attentive public, provides the requisite support (Key, 1964, p. 544) [8]. Other times the mass of citizens is the source of support. To be a source of support, however, citizens have to be concerned and pay attention to the public issue. Yet we have seen that citizens in their private behavior are indifferent to the seismic safety issue. Of course, the lack of attention of citizens to the earthquake problem is not unique. Citizens usually do not pay attention to many public policy problems at the same time, and they are more likely than not to pay only sporadic attention to a few problems. "American public attention," according to Anthony Downs (1972), "rarely remains sharply focused upon any one domestic issue for very long – even if it involves a continuing problem of crucial importance to society. Instead, a systematic 'issue-attention cycle' seems strongly to influence public attitudes and behavior concerning most key domestic problems. Each of these problems suddenly leaps into prominence, remains there for a short time, and then – though still largely unresolved – gradually fades from the center of public attention" (p. 38). Downs identifies five stages of the issue-attention cycle:

1. The pre-problem stage. The problem exists but only experts or interest groups are aware of it.

2. Alarmed discovery and euphoric enthusiasm. A dramatic event occurs and the public believes the problem can be "solved".

3. Realizing the cost of significant progress. Costs to solve the problem are high and involve "major sacrifices by large groups in the population".

4. Gradual decline of intense public interest. Either threatened or bored by the problem, the public turns its attention to another problem.

5. The post-problem stage. The institutions and their programs that were directed to the problem continue to work on it (pp. 39–41).

Let us see how well the earthquake problem fits these five stages. Before a major earthquake, certainly the experts, chiefly engineers and seismologists, are most aware of the potential danger from building practices and land use. Some of these experts may even have suggested that citizens buy earthquake insurance and brace their water heaters. After the earthquake, surely a "dramatic event", the public does pay attention. The papers are filled with pictures of damage and stories of human interest and expert advice. According to the *Los Angeles Times*, Dr. Charles F. Richter, (as in "Richter scale") is reported to have "behaved in human fashion" during the 1971 San Fernando earthquake, because "he jumped up screaming and scared the cat" (14 February 1971). People visited the scene of destruction because, as one Burbank resident put it, "I thought it would be a wonderful experience for the children" (Shaw, 1971, p. 1). People wrote letters to the editor of the *Los Angeles Times* praising volunteers who provided relief (18 February 1971), and criticizing public officials who flew around the scene of the disaster as sight-seers (23 February 1971). Two days after the earthquake, the *Los Angeles Times* printed an editorial, "To Cope with Future Quakes", stressing the importance of building codes (11 February 1971). Others suggested that we direct our national priorities from Apollo missions to earthquake research (13 February, 1971).

These newspaper accounts did not indicate much feeling on the part of citizens that the earthquake problem could be "solved." There were some voices, more likely to be experts than citizens, urging some action, but after three weeks to a month, the newspapers lost interest, and the general public found other entertainment. In a relatively short period of time, the general public jumped from stage 2, alarmed discovery, to stage 4, decline of interest.

The attention span of the experts and of the earthquake's victims was longer than that of the general public. The experts saw the earthquake problem in terms of seismic safety and emergency preparedness. For its victims, the San Fernando earthquake took on other personal meanings. These citizens were able to express their frustration and concern when their congressional representatives came to town to hold hearings on how well the Disaster Relief Act of 1970 (P.L. 91-606) had worked and, of course, to show these constituents that they cared. From my reading of the testimony, the citizens of the San Fernando area saw many problems, only a few of which, however, had anything to do with preparing for the next earthquake. They had formed new attentive publics and used existing interest groups for expressing such concerns as: getting loans or grants to rebuild houses and businesses, obtaining food stamps, urging the need for improved public transportation, highlighting unemployment and the necessity for using local people in debris removal, demonstrating that the government should have more minority and Spanish-speaking disaster personnel, and pointing out that private hospitals should be given the same financial assistance as public hospitals [9].

Most of the hearings contained testimony from experts and public officials about the adequacy of current disaster policy, the need for additional relief, the problems with non-earthquake resistant buildings and dams which were not earthquake-resistant, and the need for research to increase understanding of earthquakes. The testimony of citizens or representatives of community groups seldom dealt with seismic safety issues. One notable exception concerned the future safety of the Van Norman Dam.

> My name is Betty Whirledge, and I am a housewife and a resident of the evacuation area below the dam. We have already gotten together approximately 5,000 – perhaps more – signatures so far requesting that the Van Norman Dam be relocated. We have facts; we have talked to the Department of Water and Power; we have talked to our local officials; we have read reports by the geologists and the scientists questioning the safety of building in this area and that it is questionable geologically (U.S. Congress, Senate, 10–12 June 1971, p. 682).

Usually citizens were concerned about post-earthquake emergency procedures and financial problems.

> My name is Bob A. Wiser. I am a representative of the Sylmar-North Foothills Home Owners. We formed right after the earthquake because we were having problems with the disaster service. It took over 48 hours to get water into our area and over 72 hours to get chemical toilets . . . . Another problem that is facing us right now is that the city is going to stop clearing all of the debris, the reason is the funds were cut off. However, the SBA [Small Business Administration] loans are just coming through for our people and that means that debris is going to be pushed into the street. We need 60 or 90 days debris clearance in our area. We are having our biggest problems, of course, with the mortgages being held by the savings and loans. We have one savings and loan called Fidelity and they have given us all kinds of fits. Up until the past week, we understand that they are foreclosing on three to five homes a week just in our area (ibid. p. 829).

David Geml substantiated the foreclosure problem.

> I am one of the homeowners that everyone refers to. I suffered over $14,000 in damage to a $37,000 home and over $2,000 in personal property loss . . . . Initially, I thought that I would attempt to repair my home using a combination of the SBA funds and cooperation of the Mortgage Holder. However, my loan is guaranteed by the Veterans' Administration and the lender would not co-operate since they would benefit from these guaranteed funds. Cooperating with me would cost them a good bit of money. Therefore, before I could even obtain an estimate on the damage from the contractor, they proceeded to foreclose on my loan. In fact, they even entered my home and repossessed all of the permanent fixtures including the kitchen sink. (ibid. p. 826).

Businessmen also needed help, as Bob Sprouls, president of the Sylmar Chamber of Commerce, made clear.

> I feel that the hearings are coming a little bit late. They should have been some time in March or at the latest in April. We feel this lack of special attention from our State and Federal Government is one of the weakest parts in the whole disaster. Why should we, the people, who placed the representatives in office, beg for assistance when 1 week after the disaster, India was loaned $165 million for 4 years at an interest rate varying from 2 to 4 percent? (ibid. p. 807).

H.E. Howard, a businessman from the San Fernando Valley, lost $35,000 on his house and $172,000 on his business. He described the plight of a number of his neighbors, including the owner of a small grocery store.

> Here is a man lying with a heart attack crying, 'I have lost everything. I am broke.' I said, 'Don't worry. The Government understands your position.' Did they? After he got through looking it over he is through. He lost $87,000, all he had. You see his debt is more than he can repay under the circumstances . . . (U.S. Congress House, 24 February 1971, p. 210).

For some citizens, particularly the poor and minorities, the San Fernando earthquake not only created new problems but exacerbated old problems. Edward Kussman, for example, stressed the unemployment problem and the importance of hiring local people for post-earthquake reconstruction.

> I am the honorary chairman of the NAACP . . . . We have the job opportunity to come into the area, to put some of the men in our area to work on the clean up project. But instead of that it seems like the Corps of Engineers will hire a contractor from Los Angeles and he will bring in laborers from Los Angeles or the Los Angeles area and then we have the 18- to 50-percent unemployment in the area in which they are working. It seems unfair for this to happen continually . . . under the circumstances that the local people need work . . . . (U.S. Congress, Senate, 10–12 June 1971, p. 851).

At the time of the hearings, most victims appeared to be still at the discovery stage of the issue-attention cycle: they expected that something could be done about their problem. But, as I have shown, their problem for the most part was not seismic safety. One difficulty with the notion of an issue-attention cycle is the assumption that the definition of the issue

will more or less stay constant throughout the cycle. Unfortunately a dramatic event, such as an earthquake, acts as a projective test for all sorts of definitions. A serious earthquake does gain the attention of both the general public and the victims, but the political currency of that attention is not likely to be focused on a single definition of the earthquake problem.

After the San Fernando earthquake, the state legislature responded, in part, to some of the problems of the victims – for example, by passing a resolution urging state agencies to employ those who had lost their jobs as a result of the earthquake by passing statutes which provided tax refunds for damaged cigarettes and alcoholic beverages and retroactive insurance assistance for veterans. At the same time, experts and their colleagues on the California Legislature's Joint Committee on Seismic Safety, with a skillful use of timing and, I would suggest, relying on an illusion of general public support, introduced and secured the passage of several important seismic safety bills, including a strong-motion instrumentation program which encouraged the installation of accelerographs throughout the state and a requirement that the general plan of local governments include a seismic safety element. In short, political support for legislation came from small attentive publics of victims interested in *relief* and from a small attentive public of experts interested in *safety*.

In 1971, according to geologist James E. Slosson (1975), the San Fernando earthquake

> . . . stimulated great interest and the subsequent introduction of bills. The public and press were both very emotional as a result of this earthquake and, in turn, this emotion was transmitted to the elected officials. Of the 47 earthquake-seismic bills introduced, 23 were passed and 24 failed (p. 37).

Whether the general public was emotional and legislators knew it, as Slosson claims, remains an open question. I suspect that for most legislators their support was less a matter of transmitted emotion and more a matter of the possible personal costs of opposition. In the aftermath of a crisis, it is easier to go along than to appear as an isolated impediment to progress. In any event a few years after the San Fernando earthquake, the batting average of the experts and legislators declined, and Slosson concludes that "there is generally a lack of action during the lulls between disasters . . . ." (p. 37). Without the benefit of some public attention, the experts have to slug it out by themselves in Downs' "post-problem stage".

To summarize, as a consequence of public indifference, no broad-based political support exists for preparing for future earthquake hazards in the lulls between earthquakes. While waiting for the next earthquake, only small attentive publics of experts continue to press for safety and deal with interests (such as developers and builders) that may be adversely affected by seismic safety legislation [10]. Fragmented political support, mostly in the form of attentive publics, does develop after a serious earthquake, but it is not likely to be interested solely in preventive measures. Whatever broad-based political support that does exist soon disappears as memories of the disaster fade.

Rational citizens

Having learned that citizens do not prepare themselves for earthquakes, what can be said? When citizens seem indifferent to their seismic safety, are they being irrational? Ironically, the answer is probably no. Citizens do pursue their own self-interest in their avoidance of taking action against the earthquake hazard. Their indifference is a form of limited rationality – more a matter of having other concerns and not as a conscious choice based on complete information about relative risks. We must remember that earthquakes are events of low probability. Most Californians will never experience a serious earthquake in their lifetimes.

Those who have, are less likely to do so in the future. Californians are more likely to suffer property damage from termites than from earthquakes. They are more likely to die from disease or from driving on the freeways than from earthquakes. So it is quite rational for many of California's citizens to ignore the earthquake hazard.

CONSEQUENCES FOR POLICY-MAKING

But what is rational from the point of view of an individual citizen may not be rational from a public point of view. Granted citizens are indifferent, but this is no excuse why government should be. Certainly the government is in a better position than citizens to gather and disseminate earthquake information. Similarly, governmental regulation (e.g., through building codes) may reduce risks associated with day-to-day decisions that individuals make and protect us when those decisions are not in the direction of enhancing the safety of the community. Many facilities, both public and private, can affect the lives of citizens and the well-being of the community. Dams, fire stations, hospitals, schools, and theaters immediately come to mind. We would not want a dam to break and inundate a city because of an earthquake. We expect our fire-fighting systems to function after an earthquake and our hospitals take care of the injured. When we go into a public place such as a movie theater, we assume that it has been built so that we can enjoy the movie in safety. We don't want to have to check the theater's foundations. But suppose that the builders of such public facilities did not take the earthquake hazard into account because of the extra expense; suppose that our public officials did not insist that they do so – then what?

One essential problem with the public response of indifference to earthquake hazards is not that individual citizens decide, one way or the other, to live on the fault in a house without earthquake insurance and appropriate bracing, but that such indifference contributes to the lack of political support for effective social action. When citizens are not aware of or concerned about a potential hazard to themselves, what is the likelihood that they will be aware of or concerned about the hazard to others? If the earthquake hazard is not to be believed on an individual basis, why should the hazard become any more credible on a community basis?

From a policymaking perspective, perhaps it would be preferable to accept the premise that citizens are an ephemeral, uninformed source of support and proceed from there. Not all public policy problems have to involve the public. The quality of public attention, however, does have important implications for the conduct of policymaking and politics. The attitudes of citizens toward a particular problem explains, in part, the failure of policy or the neglect of issues. An informed and concerned citizenry can contribute to the debate on important issues of seismic safety. Citizens can compensate for the narrow-based, and sometimes conflicting, criteria of experts. They can act to provide incentives for public officials to act. Without the attention of citizens or groups who perceive a community stake in the resolution of a particular problem, that resolution may never occur or may be deflected by other concerns. As a policy issue, seismic safety seldom will get on the public agenda, and when it does it will be controlled by experts and modified by fairly narrow interests. Public officials and their experts, who are in a position to stipulate the risks citizens must assume, will then be in the peculiar situation of trying to establish standards of safety without much public support and certainly with even less public understanding.

ACKNOWLEDGMENT

With thanks to Dan Smith and Karen Dolmatch Shaw, who helped gather data for this paper.

NOTES

1 Testimony of Mr. V. Slevin, American Insurance Association, in: California Legislature, Assembly Finance and Insurance Committee, *Transcript of Assembly Committee Hearing on Earthquake Insurance Hearing* (Sacramento: 1971, p. 5).

2 An extensive survey of over 1400 residents who live along the fault in northern San Mateo County also found this notion of not moving. About three-fourths of the respondents in 1976 knew that the San Andreas fault was within one mile of their residence, and a similar amount felt that they would not be any safer five miles away. (See Sullivan, 1977).

3 Table IV suggests a linear hypothesis: the closer to the earthquake (i.e., the greater the experience with the earthquake), the greater the preparation. These responses could also represent the right segment of the previously discussed U-shaped curve.

4 Martha Wolfenstein has examined the relationship of "denial towards remote threats" such as earthquakes. In her opinion: "We may exclude various threats from awareness. We simply do not think about them. Or if we think about them, we do not believe that they will happen, or that they can affect us."

5 With this particular sample (*California Field Poll 71-04* August 1971), the independent effects of length of residence and of age were not always consistent. For example, when I controlled for age and examined the effect of length of residence on opinions about preparations for an earthquake, I found that for age groups over forty-five, length of residence still made a noticeable difference, but for the younger age groups the differences were slight. When I controlled first for age and then for length of residence and examined attitudes on the likelihood of an earthquake, both variables seemed to be at work. When I did the same for fear of "casualties," both variables had an effect, but age had a stronger influence than length of residence.

6 There are some problems with their small sample of 120 San Francisco residents because of a 78 percent refusal rate. This high refusal rate itself is suggestive of the general public avoidance of the earthquake problem.

7 With respect to the aftermath of a hurricane, Abney and Hill found that "to blame mortal politicians for their deficiencies in hurricane protection was largely futile and seemed irreverent to many"; these citizens did not consider the hurricane a "legitimate political issue but rather an act of an inscrutable God".

8 In discussing public opinion and political behavior, social scientists generally refer to these segments as special or attentive publics to distinguish them from the general public or entire citizenry. For example, V.O. Key points out that "there exists a complex population of special publics whose attentions center more or less continuously on specific governmental agencies or fields of policy .... The most obvious attentive publics consist of those with a direct concern in particular policies or actions."

9 For a concise overview of these concerns, see Fried, 1973, pp. 220–229.

10 There are also amateur groups, such as the Quake Watchers Club in Glendale, California, where for $30 a member gets a tiltmeter and instructions for recording anomalies, but it is not likely that such groups would be politically active.

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Mass Emergencies 3 (1978) 201–207
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SOME CONDITIONS FOR THE SOCIAL PERCEPTION OF POLLUTION IN ENVIRONMENTAL DISASTERS

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INTRODUCTION

I would like to begin this article by proposing a distinction between socially visible and invisible pollution. This difference may be very important when dealing with the reactions of citizens to polluting agents. It is possible to speak of the social psychology of pollution whenever a case of environmental damage occurs which can be perceived by some members of a society and selectively ignored or underestimated by others. The pollution may be present, detected by scientists, but lay people in the polluted area may believe that it does not exist or that it is not important. Therefore, if "men define situations as real, they are real in their consequences" (Merton, 1957), then self-deception can lead to overexposure to polluting agents when people do not believe that the case affects their lives.

In order to support this point of view, two facts can be briefly noted. It is much easier for governments to prevent industries, by law, from producing goods damaging to health and the environment than it is to persuade citizens not to use the products, once they are distributed. The continued failure of smoking prevention campaigns shows how difficult it can be to deter people from taking health-damaging cigarettes, once the social habit is established. In autumn 1976 during demonstrations, the former inhabitants of the dioxine polluted area of Seveso, Italy, who were compelled to leave their homes contaminated by a poison which was invisible and could not be detected by human senses, were encouraged to cross the same area from which they were banned (Alberizzi, 1977). They were willing to do this because they refused to accept the gravity of the situation. The same people would have more likely avoided the unpleasant sensation of a swamp odor, which, on the contrary, is not dangerous to humans.

This article is aimed at demonstrating that there are cases of pollution which are characterized by a high sensitivity and evident social perception, and which cause a social reaction and political involvement; and that there are other instances where there is a low sensitivity, self-deception and apathy toward polluting agents. It also wants to identify the conditions which may determine and emphasize social perception, and other conditions which instead reduce it. It is hoped that this will be useful in formulating social policies which are enacted to avoid pollution. People will not support an environmental program unless they have a subjective perception of the dangers which threaten them.

*I wish to thank Eng. Mauro Salvemini of the Dept. of Architecture, University of L'Aquila, and Prof. Carlo Mustacchi, Dept. of Chemical Engineering, University of Rome, for having read this paper and for the suggestions given to me. I also thank Dr. Ronald Fillippelli for editing the English text.

SOCIALLY VISIBLE POLLUTION

By socially visible pollution we mean every deterioration of the environment which can be detected by the human senses, vision, smell, taste and feeling. Socially visible pollution can be temporary or long-lasting. An example of temporary visible pollution is an oil spill in the sea, caused by damage to an oil well or by the shipwreck of a tanker. This pollution can extensively affect a large part of the coast by ruining life in the sea and on the beaches. It is also quite visible. Cases of this type of pollution have attracted the attention of newspapers and of public opinion (Molotch, 1975): it has been possible to organize and request ample volunteer work to remove oil traces from the beaches. Also, the visible pollution was temporary; in a matter of months, the effects of oil on the coast had disappeared, even though it had accumulated in the deep sea. In substance, this type of temporary visible pollution is able to create a crisis in some sectors of our society and leads to a reaction strong enough to initiate work on the rehabilitation of the environment.

Lake pollution is also socially visible. Wastes from urban and industrial activity are slowly poured into the lakes, causing increasing biological or chemical damage (Anderson, 1973). Citizens can see the visible phenomena of lake eutrophication such as the abnormal growth of algae, the death of large numbers of fish, waste and dirt in the water, but do not necessarily do anything to remedy them. First, they might consider the pollution of their lake a commonplace occurrence ("it is just the price we must pay for industrialization"); second, they might feel that it is not in their range of competence ("it is a matter for the local government"); third, they might not feel directly affected by the lake pollution. Being a chronic phenomenon, lake pollution is much more likely to be tolerated or ignored than oil spills in the sea. It is also more difficult to fight, since it requires the existence of groups of concerned citizens. Some social categories might be directly interested because they depend on the lake for their livelihood: e.g. the lake fishermen; business people may start worrying when they see that tourism is negatively affected -- (this usually occurs at a later stage of lake pollution). Other citizens may feel involved only when they are told that the water they are drinking may be contaminated.

In this case, we see how a long-lasting phenomenon may become more *insidious* than temporary pollution. Most of the best Italian lakes have become polluted without either the concern of the inhabitants or the action of local authorities. And when the issue was finally raised, the deterioration of the environment had acquired such extensive proportions as to make local government action economically unfeasible (Sebastiani, 1976).

There is a point at which pollution becomes *socially visible*, a threshold of indifference is overcome and people begin to perceive the danger. This *alarmed perception* causes the news to be spread throughout the community, beyond it, and even to a national level, until a point of saturation is reached which is followed by a decline in interest. This final stage can be defined as *chronic adaption.*

This social phenomenon can be described mathematically by a logistic model of social diffusion in its growing stage (Pitcher, 1978). The shape of the curve of diffusion can change according to the time taken by the community to perceive the pollution (which is not necessarily commensurate with the growth of pollution itself). If not contrasted in its natural tendency, the rate of chronic adaptation to pollution can be approximated by a negative log curve. If the phenomenon takes a short time to become noticeable, the stage of indifference will be shorter and people will become alarmed more quickly. It is likely that a social reaction will occur (1) because there is a definite perception of the damage, and (2) because the sudden and

rapidly growing danger makes people foresee that it could reach greater proportions unless some repair and prevention is undertaken. On the other hand, in the case of slow growing pollution, indifference will last longer, and chronic adaptation is more likely to come early on. Policy-makers and the mass media must take definite action to *lower* the indifference threshold by making the population sensitive to the hidden effects of pollution and giving everybody sufficient basic knowledge to enable them to perceive the early signs of pollution. By means of continuing coverage, the media can also slow down chronic adaptation to a deteriorated situation. When alarmed perception occurs, it is time for the government to act and to request help and funding from the community. Later on, when citizens have adapted to a certain level of environmental deterioration, it will be far more difficult to convince them to support rehabilitation programs.

SOCIALLY INVISIBLE POLLUTION

Some of the problems of visible short- and long-term pollution have now been exposed. Let us shift to the central topic of this article: the case of a *socially invisible pollution.* This is every kind of pollution which escapes direct sensorial perception, and that needs specialized personnel and equipment to be detected, analyzed and treated. This is often a product of new forms of industrialization, or of the growing power of humans to modify matter.

Invisible pollution is quite hard to monitor and to control. Agents of pollution can easily avoid their responsibility. Industries using chemical plants do not always advise the population and local authorities about the release of poisonous substances in the air and in the water; and if these losses are not great, they are unlikely to be detected. Many Italian industries using chemical processes have saved investment money by cutting expenses in monitoring and security devices. Thus, it has recently happened that dangerous elements, formed in uncontrolled processes, were released into the air, in an inhabited area. Often there are no institutionalized ways of disposing of such polluting agents. Laboratories and plants find no better solution than to discharge their wastes into the water. Precise and realistic laws must be made and equipment supplied in order to avoid the consequences of invisible pollution.

The case of Manfredonia

Two particular cases of socially invisible pollution will be examined in this context. In the month of September 1976, one chemical plant in the neighborhood of Manfredonia, Italy, accidentally released one cloud of an arsenic compound. This is a poison capable of killing both animals and human beings in fairly large quantities. The cloud, driven by the wind, crossed the town of Manfredonia and the countryside nearby to disappear in the sea. People working at the plant knew the poisonous effects of arsenic from experience. The news spread rapidly and the population was made aware of the danger. A tragedy was avoided, but still, for several weeks, the inhabitants had the discomfort of having to leave and decontaminate their homes, of not drinking water from local wells, and of not eating locally grown vegetables. Luckily, the local government was able to give the appropriate instructions.

The most difficult operation was to convince the Manfredonia farmers that their products were poisoned by arsenic and could not be sold to the public. Farmers refused to believe that their whole crop was poisoned and had to be destroyed. Many of them, in order to avoid crop destruction, mixed up the poisoned with the uncontaminated food. It is difficult to assess how much contaminated food reached outside markets. It is, however, well known that local authorities had to take a firm stand upon the necessity for crop de-

struction. That meant a loss of several million liras per farmer. The same thing happened to fishermen. They were prohibited from fishing in the Manfredonia Gulf, but they could use other fishing areas. In 1978, these same problems arose at Seveso where several farmers were prosecuted for illegal cultivation (Buzzati Traverso, 1978).

Lessons. Generally, chemical pollution involves some food poisoning either directly or because it affects the environment where crops are grown. Chemical controls of food products are not easy to accomplish (1) because it takes some time to examine samples of the suspect products which, however, must be introduced into the market within a relatively short time; and (2) because controversies about the degree of danger to consumers are not easy to avoid. Farmers and fishermen will claim that their goods are in excellent condition, whereas the health authorities must prove that this is not the case. Objective standards of pollution are needed in order to solve these controversies on the quality of the environment and its food products. The demand for "objective standards" may be so strong that "experts" above any suspicion are called from abroad in order to provide that impartial judgement which affected groups will accept (Conti, 1977; Jesurum, 1977b).

The case of Seveso

A second example of a socially stressful situation caused by invisible pollution was created by the dioxine at Seveso. The mechanisms of pollution were about the same: dioxine was emitted, as a cloud, from a malfunctioning ICMESA chemical plant near Seveso and spread in the heavily populated area north of Milan on 10 July, 1976 (Elena, 1977; Calvino, 1976; Cislaghi, 1976). People in the area adjacent to the plant were kept ignorant of the pollution for approximately one week, with the exception of some advice not to eat fruit and vegetables.

Neither the firm nor the local government authorities were willing to disclose that a case of dangerous pollution had really occurred. These organizations tried to avoid their responsibility and later to manage it to their own advantage. Interpreting the general feeling of social insecurity two weeks after the deadly event, a journalist, Marisa Fumagalli, wrote: "Everybody is in a state of alarm, but no one knows exactly why; no one is concerned to reveal the truth in explicit terms." Offical reports by the company and the governmental authorities spoke of "pollution" without specifying what kind and how dangerous it was (Conti, 1977).

In fact, it took two weeks before the bureaucracy could decide that dioxine pollution at Seveso was dangerous. From a theoretical point of view, this fact suggests that, in the case of socially invisible pollution, the identification of the danger usually occurs late, thus leaving more time for the exposure of the inhabitants. According to Laura Conti (1977) the most dangerous period was that immediately following the spread of the toxic cloud, when – in the absence of an offical warning – people continued to eat vegetables and fruit and to live normally in the heavily polluted environment.

The news was also published in the newspapers, but had little effect at first: the inhabitants were not convinced that there was anything wrong with the environment where they used to live. Besides, it later became known that other cases of mild dioxine pollution had occurred before, in 1972, without serious consequences. It was then difficult to discriminate between a mild case of pollution and a serious one, which it turned out to be in that Summer of 1976. The public declarations of scientists and experts were instrumental in alarming the population; however, only the death of animals and the illness of many children who were heavily exposed finally persuaded the Seveso families that they were in serious trouble. Yet, two weeks after

the event it took the army to force people to leave the A (most polluted) and the B (less polluted) zones, which were then fenced with barbed wire. The pollution though not visible was persistent and stable for more than two years. This situation can be reasonably compared to a zone contaminated by radioactive fallout.

The social impact of dioxine at Seveso was enormous and still remains to be studied scientifically in spite of the large amount of journalistic literature about the event. It can be summarized in four stages: (1) the occurrence of chemical pollution and the process of identification of the danger; (2) the resistance of the inhabitants to abandoning the zone and the difficulty in convincing them that some sort of invisible danger affected their lives; (2) the pain of migration and of being compelled to leave properties destined to be destroyed or abandoned for a long time; (4) uncertainty about the future, about personal health, self-deception about pollution, and the attempt to settle down again and to re-establish a normal life.

Much has already been said about the process of identification of the danger and the actual difficulties met by ordinary bureaucratic administration in dealing with such an exceptional case as Seveso. It should be added that the difficulties of identification of the pollution continued in the following years each time some kind of measurement and evaluation was made of the polluted area. The first of these was the identification of zone A (most polluted) and of zone B (less polluted) in order to determine the most affected area in which human habitation was to be forbidden. Two types of errors were possible: (a) either to judge as "not polluted" the land which in fact was; (b) or to judge as "polluted" areas which were not.

The danger of the first type of error (most likely to have occurred in the delimitation of zone A) was that of exposing the population to a danger of which it was unaware. The second type of error could only result in the economic waste of a fertile area.

Subsequent problems arose with the monitoring of the health of the exposed population. Although it was known from laboratory experiments that dioxine had powerful toxic and tetragenic effects, very little was done to verify this in human beings. According to official accounts (Bonanni, 1977), within one year from the July 1976 accident, of the 733 people who left the most polluted zone A, only 47% underwent a general medical examination, 42% completed a dermatological test, and only 19% completed the necessary blood tests. Health monitoring was also difficult with women, who were advised not to have children. It is not known how many of them followed this advice. Of the several women pregnant in July 1976, it is not known how many decided to have an abortion. According to the available literature on this topic (Ferrara, 1977; Tognoni, 1978; Todisco, 1977), there were no clearly established standards for making a decision which in most cases could only be subjective [1]. In the absence of a valid relationship between the people of Seveso and local health authorities, it will be even more difficult to ascertain the long term consequences of this chemical disaster upon the health of the inhabitants.

Further controversies could not be avoided in the measurement and evaluation of the economic damage and in ascertaining the technical means most suitable for reclaiming farmable land. In order to free this territory from chemically stable dioxine, it would have been necessary to remove and burn the surface layer of farmable land up to 20 inches of depth. The expense of eliminating dioxine from Seveso amounted to several billion liras, a budget that the Lombardy county government even with the help of ICMESA was not able to afford; and there was no guarantee that the method proposed by scientists to fight pollution would really work (Metrangolo, 1977; Jesurum, 1977a).

Today, dioxine is still present in Seveso and, from the latest analyses, it seems to have spread toward Milan, carried by rains and by wind (Calvino and Guazzoni, 1976). In the midst of uncertainty and the difficulties actually experienced, the local government was not able to monitor the situation in a satisfactory manner. No extensive anti-pollution measures have been taken twenty-four months after the disaster's occurrence in Seveso, except that of banning people from living in and using that area. From the administrative point of view, that is certainly the most economical solution – especially when the dioxine is expected to dissolve by itself – but from a technical and political point of view it marks a defeat in the face of the human and technological problems caused by a man-made disaster (Cerruti, 1977).

In this respect, community groups have been more active than the government. The population is expecting repair of the damage; citizen's committees are demonstrating against the local authorities who, since the beginning, were supposed to be legally responsible for pollution control. Groups of citizens have attempted to reclaim – at least symbolically – the lost land. This had led to several spontaneous attempts to break through the fences and settle in the polluted area. Since people were not able to estimate the danger, they rationalized the absence of it and acted as if it were not there. The lack of a realistic perception was later exploited by local political leaders who had a vested interested in underestimating the amount of danger.

In comparison to the immobility of the public administration, these represent rough and primitive attempts at self-management of the recovery program. There is no doubt that the government (local and regional) must re-establish a "dimension of reality" among citizens, by discouraging hazardous attempts. On the other hand, the rehabilitation program could greatly benefit from the cooperation of volunteers from the local population who look forward to returning to their homeland. It is up to the local government to give the best technical advice and the necessary financial means to the citizens who want to return to Seveso in the coming years.

Lessons. Disasters like Seveso are going to recur in the future. Not only chemical plants but also atomic reactors are sources of socially invisible pollution. At present there is a raging controversy over the safety of atomic power plants under construction.

Past cases of radioactive fallout have been tacitly ignored by authorities or covered by military secrety in order to solve the problem of informing the public. This, however, might not be a correct way for the companies using radioactivity to formulate social policy. If they are in any trouble, similar to that of Seveso, they will probably need a greater consensus and more political support than that which is required today to set up their enterprise [2].

(1) Abortion at Seveso became a political issue in Italy where, in 1976, abortion was still illegal. In order to allow the Seveso women to abort, special instructions were given to local hospitals. However, these administrative procedures came too late to meet the immediate need of women, many of whom chose to have abortions abroad or in private clinics. The writings of Ferrara (1977) fully document the state of anxiety and insecurity in which this decision was made by individual women, often in opposition to their husbands or to Catholic doctors. Tognoni (1978) instead reviews the ambiguous stand taken by the press and by politicians. In this social context, the few cases of malformation which actually occurred among the new-born babies in the local government area were most likely to be ascribed to chemical pollution.

(2) Many governments and private enterprises have recently tried to overcome

popular opposition to nuclear power and nuclear fuel processing plants by force, with the support of the police or the army. This, however, is not the best way to prepare for future accidents, when the collaborative support of the local population may be required. The gap between public opinion and governmental policies and business interests has been strongest in Germany (i.e. at Brokdorf in 1976 and at Grohnde in 1977) and in the United States and Sweden.

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Mass Emergencies 3 (1978) 209–216
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ASSESSMENT OF BROCHURES & RADIO & TELEVISION PRESENTATIONS ON HURRICANE AWARENESS*

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In the state of Texas, a joint effort among the Texas Coastal and Marine Council, the Texas Catastrophe Property Insurance Association and the Governor's Division of Disaster Emergency Services has resulted in a Hurricane Awareness Program to alert Texas coastal residents of the dangers of hurricanes and the preparations necessary for preventing a major catastrophe. During the 1977 hurricane season, which extends from June through October, this Hurricane Awareness Program consisted of the distribution of 750,000 brochures entitled "Hurricane Survival Checklist and Flooding Map," and the generation of radio and television public service announcements which were made available to the various coastal stations. Radio presentations included 60 five-minute interviews with the director of the National Hurricane Center and other preparedness individuals, as well as with hurricane survivors and others familiar with the potential threat of a hurricane. The television presentations consisted of three 60-second films of various aspects of a hurricane. These were also abbreviated to a series of 30-second versions.

The present study represented an attempt to assess the impact of this Hurricane Awareness Program on residents' knowledge about hurricanes, their beliefs about hurricanes, and their intended responses when threatened by a hurricane. The research was done on an American population, so extrapolation to to populations with different cultural backgrounds and social characteristics, must be undertaken with great caution.

METHOD

Subjects

Subjects studied included 1,350 residents from 22 Texas coastal cities, who were selected randomly from each city's telephone directory. City directories were not used because they were not available for all cities.

Instrument

A Hurricane Information Questionnaire was constructed to assess the impact of the Hurricane Awareness Program. This questionnaire [1] sought to determine demographic characteristics of respondents' age and sex, prior hurricane experience, whether they had obtained a copy of the brochure and seen the television and heard the radio presentations, and their information, beliefs, and intended responses to hurricanes. The information items included the residents' definition of storm surge, estimation of number of feet of rising

*This research was supported by a grant from the Insurance Information Institute, Austin, Texas, and by a grant from the Texas A & M University Sea Grant College Program.

water produced by a hurricane, estimation of number of miles of coastline affected by a hurricane, and identification of the most destructive part of a hurricane. The belief items assessed subjects' beliefs of the necessity of having flood insurance and hurricane related building codes, the probability of homes and commercial buildings on barrier islands being destroyed by a hurricane, the probability of homes in coastal cities being destroyed, the probability of following evacuation notices, and subjects' estimation of the destructiveness of hurricane winds and storm surge. Subjects answered the information items and then recorded their beliefs by checking the point, on a ten centimeter line, which most accurately reflected their beliefs. This line was anchored on each end by the extreme position of a given belief. For example, the two extreme positions for the flood insurance item were the statements "Is not necessary" and "Is definitely necessary." The intended responses assessed subjects' preparedness in terms of whether they had a pre-planned evacuation route, whether they had knowledge of how to locate a Civil Defense or Red Cross Shelter, and what their predicted response would be during a hurricane.

Procedure

On August 30, 1977, approximately the middle of the hurricane season, the Hurricane Information Questionnaire was mailed out to 1,350 residents of Texas coastal cities. One week following this mailing, subjects were sent a friendly reminder encouraging them to complete and return the Hurricane Information Questionnaire which they had been sent. Linsky (1975) has demonstrated that this is one factor which increases return rates very effectively. Of the 1,350 questionnaires mailed out, 16 percent, or 213, were returned because the selected subjects had moved, and the questionnaire could not be forwarded. One month after the mailing, 363, or 32 percent, of the remaining 1,137 potential respondents had completed and returned the questionnaire.

RESULTS

Analysis of the demographic characteristics revealed that the respondents tended to be older (68.5 percent above 34 years of age) males (79 percent) who had prior hurricane experience (84.3 percent).

Information and intended responses

To assess whether the brochures and the television and radio announcements had any differential impact on residents' information about hurricanes, the subjects were categorized in terms of whether they received the brochure, whether they had heard any of the radio interviews, and whether they had seen any of the television presentations. Each information item and intended response item was then coded [2] (e.g., the definition of storm surge was coded as being correct, partially correct, or wrong) and $2 \times K$ contingency tables were constructed for each dichotomized variable (e.g., whether they had received the brochures) by each information item and by each intended response item. Each of these contingency tables was analyzed by a chi square analysis. Table I depicts the results of these analyses.

Table I demonstrates that the television presentations had absolutely no effect on subjects' responses to either the questions dealing with the accuracy of information or intended responses. The brochures and the radio spots, on the other hand, did have an impact on selected items dealing with information. On the information items, subjects who had received the brochure versus those who had not were more accurate in their definition of "storm surge" (50 percent vs. 26 percent); in their estimate of the number of persons killed by rising water (17 percent vs. 9 percent); and in

TABLE I

Chi Square Analysis Computed on Responses

Item	Brochure	T.V. spots	Radio spots
	Information		
Storm surge			
Storm surge	22.56**(2)[a]	0.92(2)	6.35*(2)
Persons killed	5.13* (1)	0.27(1)	5.10*(1)
Coastline damage	7.12* (2)	1.02(2)	1.18 (2)
Destructive part	3.38 (2)	1.15(2)	1.21 (2)
	Intended Response		
Preplanned route	11.15**(1)	0.32(1)	0.91 (1)
Route would take	0.58 (1)	0.14(1)	0.93 (1)
Locate shelters	0.98 (1)	0.06(1)	5.84*(1)

[a]Represents the chi square degrees of freedom.
*$p < 0.05$
**$p < 0.01$

their estimate of the number of miles of coastline that could be damaged by a hurricane (79 percent vs. 69 percent). Thus, it can be seen that the brochure had a significant, positive effect toward increasing the residents' accuracy of information about hurricanes. Concerning intended responses, the residents who had received the brochure were significantly more prone to having a pre-planned evacuation route than were those who had not received the brochure (76 percent vs. 59 percent).

The radio spots had a significant impact on two of the information items. However, it is interesting to note that this was a negative impact since those who had heard the radio spots were significantly more inaccurate in their responses than were subjects who had not heard the radio announcements. Of the subjects who had heard the radio spots, only 37 percent were correct or partially correct in their definition of "storm surge," and only 10 percent were correct in their estimate of the number of persons killed by storm surge. For subjects that did not hear the radio announcements, 48 percent were correct or partially correct in defining storm surge and 18 percent were correct in estimating loss of life by storm surge.

Regarding intended responses, the radio spots had a significant effect on knowledge of how to locate a Civil Defense or a Red Cross Shelter. For those who had heard the broadcasts, a greater proportion said they knew how to locate the nearest Civil Defense or Red Cross Shelter (72 percent) than did those who had not heard the radio spots (57 percent).

Beliefs

Subjects' responses to each belief item was scored by measuring, in centimeters, the distance between the left end of the line and the point which the subject checked on the line. Since the line was ten centimeters in length, the score could ideally range between 0 and 10. However, for ease in scoring, if a check mark fell between the two centimeter readings, it was always rounded to the lower of the two. Consequently, subjects' responses could range from 0 to 9.

To assess whether the brochure and the radio and television presentations had a differ-

ential influence on the subjects' beliefs about hurricanes, analysis of variance (ANOVA) was computed on subjects' responses to each question. The main effect in each ANOVA consisted of: (a) received or did not receive the brochure, (b) did or did not hear the radio spots, or (c) did or did not see the television spots.

The analyses revealed that both the radio presentations and the brochure had no measurable effect upon the respondents' beliefs about hurricanes since none of these analyses were significant. With respect to the impact of television, significant effects were obtained for the questions relating to subjects' beliefs about the possibility of homes on the Texas barrier islands being destroyed, $F(1,269) = 6.9, p < 0.01$; homes in Texas coastal cities being destroyed, $F(1,269) = 3.9, p < 0.05$; and the destructiveness of hurricane winds, $F(1,269) = 3.7, p < 0.055$. In each case, residents who had seen the television presentations were more extreme in their beliefs about the effects of a hurricane ($M = 7.83$ for island homes destroyed; $M = 6.02$ for coastal homes destroyed; $M = 8.69$ for destructiveness of wind) than were residents who had not seen the television presentations ($M = 7.05$ for island homes destroyed; $M = 5.09$ for coastal homes destroyed; $M = 8.22$ for destructiveness of wind).

These results should be viewed in light of the fact that the influence of each of these variables (brochure, radio, and television) were not tested independently. Rather, some of the subjects in each stimulus category, e.g. those that received the brochure, were also exposed to the other stimuli. Some subjects in the brochure category received only the brochure, others received the brochure and heard the radio presentations, others received the brochure and saw the television presentations, and still others received the brochure, saw the television presentations, and heard the radio presentations. The common and dominant element in each category was the stimulus source being tested (e.g. radio) but it was potentially confounded by the addition of some of the other stimulus sources. Such confounding naturally limits the ability to attribute the observed effects to just one specific stimuli.

To determine if the significant effects noted above are in fact valid and not due to the confounding influence of the addition of some of the other stimulus sources, a comparison was made of the responses of subjects exposed to the various combinations of stimuli. These comparisons were conducted on the questionnaire items that had been found to be significantly affected by exposure to either radio, brochure, or television. Table II depicts the chi square analysis computed between these various stimulus combinations. As can be seen only one significant difference existed. The absence of a significant difference reveals that the subjects receiving the different stimulus combinations did not respond differentially. This strongly suggests that the dominant stimulus was in fact the influencial factor in creating the previously observed significant effects. The one significant effect that existed was for the various stimulus combination with radio on the storm surge information item. This significant effect is due to the enhancing effect of combining brochure with radio. Radio by itself or with just television depresses the percentage of respondents who can correctly define storm surge and therefore supports the previous analysis which suggests that the radio, as it was presented, had a negative effect.

Table III depicts the ANOVA computed on the previously identified belief responses that had been found to be significantly affected by television. For these three belief items there was no significant difference in the responses of subjects who were exposed to just television or to television and one or more of the other stimulus items. This suggests that the presence of the other stimulus items had no signifcant effect over and above that produced by television alone.

TABLE II

Chi Square Analysis of Responses to the Various Stimulus Combinations

Item	Dominant stimulus	Stimulus combinations	χ^2	df	Categories	
					Correct	Partially correct or incorrect
Definition of storm surge	Radio present	Radio	15.52*	3	7%	93%
		Radio & brochure			55%	45%
		Radio & television			28%	72%
		Radio & brochure & television			47%	53%
	Brochure present	Brochure	3.41	3	71%	29%
		Brochure & radio			55%	45%
		Brochure & television			59%	41%
		Brochure & radio & television			47%	53%
					9 out of 10	1–8 of 10
Persons killed by rising water	Brochure present	Brochure	4.71	3	40%	60%
		Brochure & television			36%	64%
		Brochure & radio			43%	57%
		Brochure & radio & television			20%	80%
	Radio present	Radio	2.72	3	11%	89%
		Radio & television			14%	86%
		Radio & brochure			43%	57%
		Radio & brochure & television			20%	80%
					Blank	Under 50 miles / Over 50 miles
Miles of coastland damaged	Brochure present	Brochure	5.11	6	14%	0% / 86%
		Brochure & television			6%	0% / 94%
		Brochure & radio			18%	0% / 82%
		Brochure & radio & television			15%	8% / 77%
					Yes	No
Pre-planned evacuation route	Brochure present	Brochure	4.37	3	86%	14%
		Brochure & television			94%	6%
		Brochure & radio			73%	27%
		Brochure & radio & television			73%	27%
					Yes	No
Civil defense shelter	Radio present	Radio	7.37	3	69%	31%
		Radio & television			68%	32%
		Radio & brochure			91%	9%
		Radio & television & brochure			72%	28%

*$p < 0.01$.

TABLE III

ANOVA of Responses to the Various Stimulus Combinations

	Homes on barrier islands destroyed by hurricane	Homes on Coastal cities destroyed by hurricane	Destructiveness of hurricane winds
Stimulus combination	Mean	Mean	Mean
Television	6.58(12)[a]	4.67(12)	8.08(12)
Television & brochure	7.78(14)	7.78(13)	8.88(16)
Television & radio	7.75(104)	7.75(95)	8.62(115)
Television & radio & brochure	7.97(111)	6.23(98)	8.72(110)
	$F = 1.53$	$F = 0.93$	$F = 1.30$
	$P = 0.21$	$P = 0.43$	$P = 0.27$

[a] N = number between parentheses.

DISCUSSION

Analysis of survey results regarding the impact of the Texas Hurricane Awareness Program reveals that radio presentations had virtually no effect in producing hurricane awareness or preparedness and may have produced a negative effect. On the other hand, the results also indicate that the brochure had a positive impact on increasing the accuracy of subjects' information about hurricanes; and that television spots were beneficial in enhancing subjects' beliefs about the destructiveness of hurricanes.

This pattern of results is not unexpected when the contents of each of these three components are inspected. The brochure gave extensive coverage to the definition and consequence of storm surge as well as illustrating in a pictorial manner the extent of damage that a hurricane could generate. According to the questionnaire, these were the items most significantly affected by the brochure. Likewise, the television presentations depicted rather vividly the force and destructiveness of hurricane winds, as well as showing that homes could be completely destroyed by hurricanes. Again, these were the items which were significantly affected by the television presentations. The numerous radio announcements, on the other hand, did not focus on a specific aspect of hurricanes, but conveyed many items of information. These were ineffective in having any overall beneficial impact on coastal residents with respect to information assessed by the Hurricane Information Questionnaire.

The present study seems to indicate that the effectiveness of a program such as the Hurricane Awareness Program is a function of the information presented to the public. Any Hurricane Awareness Program has as its goal the generation of a set of specific, appropriate responses. The results of the present study reveals that, to be effective, these specific responses must be identified, and material and information presented to the public must directly bear on these responses. To insure an increase in the accuracy of information about hurricanes, terms must be defined and residents must be told explicitly what they should know. If the goal is to generate a given type of behavior when a hurricane is approaching, residents must be informed about what they are to do during a hurricane watch and warning.

Rogers and Mewborn (1976), in support of such a recommendation, found that the primary influence on intended responses was the knowledge of a coping response that could eliminate the threat. Even more important was the fact that subjects had to believe that this coping response would be effective. Projecting this to the Hurricane Awareness Program, any recommended coping response must be presented in such a way that it will appear to minimize the threat produced by a hurricane, and its effectiveness must be believed by the residents. To do this would create the maximum possibility of obtaining the desired objective, an effective Hurricane Awareness Program.

There are several additional issues which must be considered regarding the validity and generalizability of the responses to this survey. One of these concerns self-selection (Campbell and Stanley, 1963) into the various survey groups. Since subjects could not be assigned randomly to the groups that did or did not receive the brochure, or that did or did not encounter a radio or television announcement, possibly it was not these variables but some others which created the observed differences.

While this is a possibility, it does not seem to be extremely likely – particularly with the media presentations. The radio and television broadcast times were determined by the individual radio or television stations; whether a person was exposed to them depended on whether he or she happened to be listening to the radio or watching television at that given time. The important point is that the subjects did not have total control over whether they were exposed to this information.

The brochures were a slightly different matter since residents had to make some effort to obtain them, even if this effort would seem to have been rather minimal. In most cases, the brochures were placed in display stands in retail outlets such as food stores throughout many coastal communities; subjects could obtain them while engaging in everyday activities without expending much additional effort. For these reasons, a significant self-selection bias is viewed as being rather improbable.

A second possible bias exists in that results may not be generalizable to the total population because a 100 percent return rate was not achieved. However, it is important to remember that the question asked in this study was whether a differential impact existed between individuals who had and who had not been exposed to the brochure and radio and television spots. The concern was not with the estimation of a population parameter from a sample distribution. Most of the research on the effect of non-response to mailed questionnaires has been directed toward this latter issue.

The existence of bias in survey studies that attempt to estimate population parameters when obtaining less than 100% response has been well documented and is accepted as fact. However, the crucial question in the present study is not one such as "Are there too many people with hurricane experience in the sample?" but "Does hurricane experience affect the impact of the brochure, radio, and television presentation?" As Suchman (1962) has stated "The problem there changes from, 'Is it biased?' to 'How does the bias affect the test of our hypotheses?' (Suchman (1962) investigated this very issue. He analyzed the relationship between variables where an obvious bias existed in the sample and found no effect on the observed relationship between different waves of sample data. He concluded that there was an "....overemphasis upon 100 percent response to a survey when one is concerned with the study of relationships rather than the description of frequency distributions" (p. 108).

Goudy (1976) investigated the same question and provided strong support for Suchman's conclusion. Goudy investigated the effect of nonresponse bias on variable relationships in a panel study of older Iowa residents.

In this study, he investigated the changes that occurred on the relationship between variables across three waves data. He concluded that the initial wave of about twenty-five percent of the eligible replies produced results that would have undergone "... limited changes... with the addition of later responses..." (p. 368). Such studies reveal that, although a sample may be biased, the effect of this bias depends upon the question being asked. If the research question is directed toward determining the influence of a set of variables on a given response or the relationship between a set of variables the effect of the sample bias is minimal and would influence only the magnitude but not the direction or significance of the relationship. Based on the results of such studies it would seem as though the results of the present study are valid and would have been replicated if a higher response rate had been achieved.

A third factor which must be considered is the response behavior that would occur during an actual hurricane. Any discrepancy in this area may have been minimized by the fact that Hurricane Anita crossed the Gulf of Mexico, from east to west, at the time in which the residents received the Hurricane Information Questionnaire. This hurricane was such that it threatened every Texas coastal area, and many cities were under a hurricane watch. The residents were actually having to make hurricane decisions at the time in which they were asked to complete the questionnaire. This should ensure that a maximum degree of reality is depicted by the questionnaire responses.

NOTES

1 A copy of the questionnaire can be obtained from the authors.
2 The format for coding each question can be obtained from the authors.

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Mass Emergencies 3 (1978) 217–228
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INTERNATIONAL/DOMESTIC TRANSFORMATIONS IN DISASTER ASSISTANCE: MESSAGES AND GOODS*

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INTRODUCTION

Increasing interest in international disaster assistance is testified to by the creation of an Office of U.S. Foreign Disaster Assistance (OFDA) in 1964 and an Office of the United Nations Disaster Relief Co-ordinator (UNDRO) in 1972, by meetings and reports of a UNA-USA Policy Studies Panel on International Disaster Assistance (1977) and a Committee on International Disaster Assistance (CIDA) of the National Research Council (1978a, 1978b), and by well-attended conferences like that on Disasters and the Small Dwelling held at Oxford Polytechnic in April 1978. Scholarly and professional writing on the subject is becoming more readily available – see, for example, the selective bibliographies in CIDA (1978b) – and two specialized journals, *Mass Emergencies* and *Disasters,* are largely devoted to the theme. The present article grows out of this multi-disciplinary, cross-national matrix of activity and thought. Much of what it says resembles the received folk-wisdom of the field. But here and there a somewhat different point of view is introduced.

Indeed, the term "international disaster assistance" is a bit of a misnomer, for the phenomenon in question is also profoundly domestic. The by now familiar assertion that the government of the country where a disaster occurs bears the (or a) primary responsibility for alleviating its consequences reflects this fact. It will simply be taken as given that "international disaster assistance" refers to an international-cum-domestic process.

Perhaps the easiest way to illustrate this is through areas representing the international scheme of things (I), the domestic scheme of things (D), and the "cum" which we will label T (see Fig. 1). Vague phrasing like "scheme of things" is being used so as to avoid implicit judgments about the extent of integration and mutuality obtaining: a word like "system" would have virtually settled the issue by fiat [1]. The intermediary term is labelled T, since it involves a transformation mechanism whereby domestic things are internationalized and international things are domesticized.

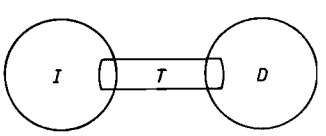

Fig. 1

*The first draft of this paper was prepared while I was a visiting research associate at the Institute of International Studies, University of California, Berkeley. At that time I was also on sabbatical leave from the University of Illinois and recipient of a fellowship from the Institute for the Study of World Politics.

The "things" referrred to can be categorized in various ways. Here it may suffice to separate messages on the one hand from material items (goods, services, personnel) on the other. The distinction is not entirely watertight. Manifests, which accompany goods, are messages; and they are also material in nature, as anyone running out of file space can testify. But generally analysts and actors have little hesitancy about assigning things to one category or the other.

Messages are discussed first. The subsequent consideration of material items is briefer. The emphasis throughout both sections is on transformations. Both discussions begin in a highly simplified way, with complications only gradually added.

THE TRANSFORMATION OF MESSAGES

For international disaster assistance, this function can be structured in many ways. One much talked about and advocated of late involves regular, habitualized communications, in both directions, between a uniquely designated disaster relief body within the affected country and a uniquely designated relief body (UNDRO is often mentioned) outside that country (Green, 1977). Such streamlining and exclusivity of channels supposedly enhance the likelihood of successful communications when disaster strikes.

From an international relations perspective, this is a familiar, even hackneyed model. Forget that disaster agencies are involved and instead generalize to a specifically authorized body within a country that has sole control over official communications passing across that country's boundaries and that communicates just with analogous authorized bodies in the outside world. One has here the standard international relations paradigm, with such communications being the responsibility of foreign offices. It is the links between *them* that comprise the links between nation-states [2].

Few theoreticians of international relations today would be at ease with so austere a doctrine. Not only may heads of governments or their special advisers eclipse "state department" operations and military leaders emit direct signals, but also officials in various subject specialties – agriculture, finance, technology, labor – may be in frequent, sometimes institutionalized, touch with their opposite numbers elsewhere. Some observers go even further and underline the proliferation of contacts across boundaries in which governments play little or no direct part at all. These include various privately sponsored person-to-person programs, a worldwide "invisible college," meetings of experts from of a number of countries, multi-national corporations practicing a kind of limited private diplomacy, and international federations of all sorts (e.g. Angell, 1969).

Those who propose the linkage of two disaster relief focal points, one inside and one outside the affected country, do not deny that there is much more to governments and politics than just this. They know that in any country there is a cacophony of governmental officials distinguishable by subject matter competence, placement within a national, state, or local network, ideology, ethnic group, and so on. They also know that there is considerable heterogeneity in the non-domestic world and that the UN, itself a diverse body, is seldom a powerful international actor. But they expect that after a disaster occurs all messages from within a country are passed upon in a consistent manner by a singular domestic disaster agency; and similarly at the international level. Such expectations are almost sure to be unfulfilled. The inability of foreign offices to retain a monopoly on interstate diplomacy presages a similar inability of disaster offices to confine messages within their channels, whether these offices are styled focal points or not.

Another elegant way of handling the message transformation process involves the cre-

ation of a body – one for each country – which would contain representatives of both the domestic scene and the world outside. Membership from the host government need not be confined to those in a disaster relief agency but may include persons in the military or in such departments as health, agriculture, and transportation. Domestic non-governmental representation is also likely in many instances. So too, membership from the international sphere may go beyond UN Resident Representatives, as the eyes and ears of UNDRO, or other UN organizations, and extend to regional agencies, administrators from other countries, e.g., personnel from the AID-mission or US Embassy, and so on. (Persons from local private organizations that have international affiliates, like the Red Cross and the churches, may be considered ambiguously international/domestic.)

Theoretically, a mixed local-foreign, governmental-private disaster relief coordination body could be instituted in advance, and independently, of any particular disasters. Interaction among its members will thereby constitute a routinized network of communications to be relied upon when an actual disaster occurs. (This statement has to be modified according to whether one conceives of membership in terms of particular persons or of the holders of particular roles; cf. Davis and Weinbaum, 1969). In practice, the body is likely to have a considerable ad hoc, case-specific component, depending for example on the magnitude and kind of the disaster. Warfare will see some agencies dropping out and perhaps others, like the ICRC, that are not otherwise relevant, becoming prominent. The response to protracted famines may well require different skills and resources than an earthquake or flood. Even so, many components of the coordinating body should remain the same, so that it retains a noteworthy regular aspect as well.

A chief virtue of the domestic/international focal points linkage described earlier or of the mixed coordination body is that it reduces the chances of a communications overload upon the affected government or its disaster agency. This assertion needs qualification. Under the first plan, message flows from within the country to the domestic focus are not diminished and may well be vastly augmented; and similarly for in-country messages emanating from the focus. The chief gain involves the transmission of information across the border. There the domestic focal point needs to speak and listen only to its external opposite member, and this of course is a major simplification. The situation of the international focal point (whether it be something like UNDRO or like ICVA or like AID/OFDA) would, loosely speaking, be the mirror image of its domestic counterpart.

The advantages of the mixed body in this respect are greater. In-country observers can use customary channels to pass along information to their headquarters; and these in turn would either be directly represented in the mixed body or stand a reasonable chance of having habitual working relations with such a group – for instance, one Protestant organization with another. Not everything need go in the first instance through the disaster relief agency; and certainly not just through it. Second, the mixed body is likely to become a negotiating forum both for action recommendations and for the assessment and enhancement of information quality. Third, messages destined for the outside world can proceed not only from the disaster agency but also from those members who have habituated contacts abroad – for example, the local Red Cross with LICROSS or Catholic agencies with CRS in Geneva or the ResRep with UNDRO or the AID mission with Washington headquarters – and similarly for messages inward [3]. The national disaster agency does not have to manage the entire communications process itself, either domestically or cross-border, and at the same time the chances of messages getting through are magnified. Yet all is not redundancy, unapplied enthusi-

asm, and confusion, since the regular meetings of the mixed body permit detailed exchanges of data and the imposition of counter-checks.

The mixed domestic/international body is, in its implications, not just a telescoping of the domestic/international focal points linkage. Its make-up is more diversified and perhaps more pluralistic. It involves face-to-face meetings, with the social-psychological connotations of that medium in preference to airwaves. In particular, the opportunities for discussion, the necessity for give-and-take, question and answer, shifting of emphases, and (sometimes) off-the-record informality enhance the potential for bargaining, compromise, or at least the specification of differences. It also involves people, all (or most) of whom have both intimate knowledge of the particular country undergoing the disaster and considerable field experience. (On the advantages of that, see Taylor (1978), among others.)

It would, of course, be quixotic to expect that a mixed body can monopolize communications any more successfully than would a foci linkage. Nor is it obviously desirable that it have this capacity. Moreover, as monitoring techniques advance, in-country exclusive management of disaster-related news and needs lessens anyway. Even now, seismographic readings, combined with vulnerability analyses, allow outsiders to make prima facie estimates of the earthquake situation to be encountered. Improvements in satellite reconnaissance will extend this capability to many other types of disasters, including impending famines (Ad Hoc Committee on Remote Sensing for Development, 1977, especially Table 4). Culture-and-personality studies generated by anthropologists and others can also help narrow the range of probabilities [4]. All these techniques involve the activation of regular communications channels that lie, in the first instance, almost entirely outside the affected country.

Other border-crossing communications may utilize regular, case-patterned, or idiosyncratic channels. For example, media reporting, may be done – particularly at first – by stringers who are regularly, if sporadically, employed by the wire press. If the story warrants, some of the larger papers may assign one of their correspondents in the area to cover the unfolding events. In extreme instances media celebrities, like Mike Wallace or the most recent Winston Churchill, may make a foray into the area [5]. Another idiosyncratic, or sometimes case-patterned, way in which reports may reach the outside world involves the interception of local unauthorized broadcasts. A message that we are all starving and no food is reaching us or that the soldiers are shooting every educated civilian in a recaptured village may be monitored by Reuters or BBC or AFP and passed along to the public (Davis, 1977).

The scientific eavesdropping and the reporting just mentioned generally involves a one-way communication flow, though this is not invariable. For example, a newspaper office may wire back, seeking clarification or further information. Other commentary is typically two-way: for instance, that between representatives of overseas voluntary agencies who are, ordinarily or in this period, within the affected country and some regional or home office. In the absence of specific authorization, such communications are less likely to use radio hookups than telephone, cable, the mails, or the movement of personnel. In many cases, the faster of these public means of communication may be disrupted or overtaxed. The slower ones, admittedly, comport poorly with the informational requirements of rapid-peaking disasters; but for disasters of a more creeping kind, like famines due to crop failures and/or inadequate transportation facilities or starvation consequent upon warfare, the old-fashioned methods can bring to light just the data and the initial responses that are needed. Indeed, it is in precisely such instances that the official judgments of an in-country disaster office or even of a mixed body are

likely to prove deficient (UNA-USA Panel on International Disaster Relief, 1977).

The reasons for the deficiency, like the reasons for disaster assistance, are less important for present purposes than the blunt fact of the deficiency itself. A few general observations, however, may be in order. Countries that ignore preventive measures, including preplanning, are more likely to fob off the implications of a disaster. Countries whose governments aspire total control within their territory and are not merely authoritarian will try to suppress disaster information, in part because they seem responsible for everything that happens. Countries with deep ethnic cleavages will downplay disasters that mainly affect areas populated by out-groups. The authorized regime of a country embroiled in a civil war will usually deny that it has any problems maintaining the population under its control, as will the rebel regime, unless its cause seems almost hopeless: to do otherwise is to admit weakness and thereby to lessen one's perceived power and supposed authority. (See, for example Green, 1977; Weinstein, 1975; Shepherd, 1975; and Davis, 1975).

Even in situations where governments put a lot of emphasis on cross-boundary communications and where many other parallel, but independent, communicative channels exist, it may be difficult to know what is going on out there and what, if any, the appropriate relief response would be. The Nigerian-Biafran War, in particular, elicited tremendous concern about intra-, inter-, and trans- national communication. Both contending regimes had ministries of information. They both retained overseas public relations consultants. Students and other nationals from both sides resided in a number of foreign countries and made their views heard. So did the governments' own embassies and special representatives' offices. There was a plethora of pressure groups, mainly but not entirely on the Biafran side. Eleemosynary agencies made many pronouncements and appeals. Foreign governments took positions and even issued brochures defending them. Legislators in these countries discussed the issue at considerable length, formed study groups, and some visited one side or the other or both, usually with much subsequent publicity. After about a year, the war also attracted considerable media attention from the print and electronic press.

The worldwide buzz that could easily be heard during the last year-and-a-half of a two-and-a-half year war was still not enough to provide useful guidance about what relief intervention was desirable, assuming it would be permitted at all. Not until the closing weeks of the war did one even have reasonable figures on how many people were living within the Biafran enclave (Western, 1970). Estimates of gross and net death rates had been wildly divergent and, as it turned out, often grossly inflated. Statements by the contending governments, their nationals, employees, hired experts, and enthusiastic backers were always discounted heavily. The executives in government had no better information than anyone else – indeed, they depended on the official pronouncements of the regime they recognized – but at least they received some of this via secret cables. Legislators were even worse off, and mainly relied on what they read in the papers or watched on the television [6].

I once asked a British MP, quite prominent in the debates about the Nigerian-Biafran War and an acquaintance of many backers of the Biafran cause, what he considered his most important source of information about the conduct of the war. He answered with the name of an Anglo-Dutch gentleman who was manager of Madame Tussaud's Waxworks. This person, it is true, had spent a year or so in West Africa some time before – not an unusual fact, given the Dutch components in Unilever and Shell – but he would hardly have been considered an expert by most African studies centers. However, (1) he kept up with what the newspapers in Holland were

saying, (2) business trips to Amsterdam (to open a branch of the waxworks there) allowed him to meet with some Dutch doctors of tropical medicine recently returned from the area, and in particular (3) he used regularly to ring up a British woman journalist who not only read *Le Monde* but also perused papers from the Ivory Coast, monitored Radio Kaduna via short wave, and was visited by many Biafrans passing through London. The manager of the waxworks would then pass some of her observations along to the MP. He would be listened to because he had credibility. Besides, he was a friend of a friend. (Cf. Aitken, 1971). The woman journalist, by contrast, was neither wealthy nor Christian, nor a man, and without the validation of an intermediary her information would likely not have been believed. It is upon such differences that communicative influence is sometimes built.

Lurking within this anecdotal material are familiar distinctions, like those emphasized in a Berkeley course on "Information for Decision," which

> deals with the problem of converting data, considered as any bit, into information, defined as data ordered according to some scheme to aid decision. Information becomes knowledge when its use makes design and implementation of policy better rather than worse. The questions of how to convert data into information, or why information does not become knowledge, are considered in the context of organizational theory and policy analysis.

In general, what is transmitted across national borders about disasters is information and not merely data, with the exception of some automatic sensing devices. The data have already been processed, worked up, evaluated, and ordered in some fashion. The ultimate result, though, may be "un-knowledge," in that policies become "worse" (according to some method of judging better and worse); or "non-knowledge," with the available information neither consistently enhancing nor detracting from previous policy levels. In the Nigerian-Biafran case, at least, despite all the information about the war that floated around eventually in the United States, Britain, and most of Western Europe, precious little knowledge was clearly demonstrated.

It is tempting to ascribe the latter shortage to conflicts in the substance of the information being received. One source would say one thing and another would flatly contradict it. The messages being transmitted by the Nigerian and Biafran governments, by newsmen, by religious leaders, and others, were simply not consonant, despite some noteworthy partial clusterings. There are two main rejoinders to this interpretation. First, in *most* disasters a heterogenous and disparate array of information is likely to be put forward. Indeed, in all wars, it is difficult to see how, even theoretically, this could be otherwise. Second, and more crucially, it is far from certain that the receipt of information from only a single source or of only similar content would in fact readily enhance knowledge.

Certainly, reliance on single or parrotting sources ensures a kind of data reliability, in somewhat the same way that voters in parliamentary systems who elect only one individual in their district are never ticket-splitters. That, however, is deductively true; it requires no confirmatory observations. Validity, by contrast, is hardly enhanced and may instead be adversely affected, for there is no way to test assertions. There are no contradictions suggesting where further investigation would be desirable. There is just an official version [7].

Most useful perhaps would be some generalization of newsmen's methods for substantiating a story. These include multiple cross-checking (incompatible, of course, with single-source models), concentration on detailed facts, skepticism toward official pronouncements, on-the-spot investigations, and attention to small inconsistencies that may be skeletal keys to larger problem areas.

Such techniques enhance the probabilities of adequate information at the top. "Knowledge," however, may still remain elusive, in part because newsmen are usually not the political decision-makers and in part because there are relevant data ranges that habitually disinterest them. Talking about relief supplies landing at a rebel airport, they would rather highlight machine gun and ack-ack fire cutting through the night sky than plumb the logistical implications of a church agency having just flown in aluminum planking for additional off-loading bays (Davis, 1972a).

The fact that reporters – or copy editors, or caption writers – frequently accentuate the negative (good news is not news just as bad poetry is not poetry) is not wholly detrimental. True, one might wish for greater balance and more attention to context in stories. Journalists also focus too much on the very earliest moments of some policy and the inevitable mistakes then, and often fail to follow through with its subsequent, regularized development. Nonetheless, the general consequences of reportage should be useful.

Let us assume that the disaster relief officials have, in the time available, assessed the physical and human damage as best they can and that – drawing upon their experience, general theoretical models, and a canvass of resources availability – they have drawn up a plan for meeting the problems. Even so, there are likely to be further difficulties from false or inadequate evaluations, from the at least partially unprecedented character of the present calamity, or from clogs and gaps in the pipelines of goods and services. A broadly conceived synoptic approach, in brief, will almost surely prove less than optimal.

Basically, there are two ways to rectify such shortcomings. One involves developing a new synoptic approach. Time constraints almost surely preclude this, though the exercise might prove helpful for the next disaster go-around. The other way involves piecemeal rectifications of the overall schema in order to obviate the more glaring deficiencies, and probably additional changes to ease the pains that some of these rectifications in turn introduce. A priori perfection is not expected; and many problems are attended to only when and as they arise.

An old political science saying applies here: "until there is noise there is no problem." The "noise" can be made by victims or their leaders, by relief workers, or by internal assessment teams. For various reasons – victims are dislocated and may speak only local tongues, relief workers are harried and do not want to jeopardize what is being done, sophisticated assessment usually comes later if at all – other methods of amplifying noise are required. Newsmen, with their instinct for snafus and unmet crying needs, are well positioned to do this. Their stories enhance the possibilities of a successfully incremental series of responses to the disaster [8].

THE TRANSFORMATION OF GOODS AND SERVICES

Messages are intricately intertwined with the delivery of goods and services in disasters. Messages go forth from the area describing the crisis and calling in whatever detail for material responses. Messages may also pass among donor nations and organizations suggesting an allocation of responsibilities and informing one another, as well as officialdom of the country experiencing the disaster, about what is actually being done. Bills of lading, cargo manifests, and other exotica of international commerce precede or accompany the shipments. (Passports, visas, and various letters of authorization fulfill a similar role for persons in transit.) Chits of all sorts are generated by goods as they move within the domestic situation, too; and it is these, rather than the physical items themselves, that are usually analyzed by internal audits and any post audits that may be permitted.

Much more, and in greater detail, could be said along these lines. The remaining comments, however, will focus on a few aspects of the transformation of physical *rather than* message components between international and domestic. Usually this involves a one-way flow into the disaster country, though carriers, e.g., ships and planes, and personnel are constantly coming and going, and after the event, some of the bigger or more expensive pieces of equipment may also be withdrawn. The general view presented here is that, while message heterogeneity is almost surely unavoidable and may well be functional for adequate disaster response, the cross-boundary movement of goods and services is enhanced by fairly tight coordination.

There is, however, no persuasively deductive reason why the goods transformation process should be in the hands of the same organization, or array of organizations, as the message transformation process [9]. In some instances this is easy to see: for example, while newsmen report, they rarely import. But even if one is speaking of an interfocal linkage or a mixed body, the same point holds. Messages to UNDRO do not in fact ordinarily lead to that agency assembling and shipping material or arranging medical assistance, but rather to its collating requests and passing them along. The actual designating of schedules and filling of them will in practice be in the hands of others. So too, the arrival and processing of goods or persons at the country's borders will probably remain within the hands of regular customs and immigration officials, supplemented as necessary by military troubleshooters to break up logjams. For the same reasons it is a virtual certainty that a mixed body of indigenous and international interests will farm out the obtaining and passing on of resources to agencies that are either connected to one or another of its members or are quite separate from any of them. (This is the typical way in which subcommittees are formed.) Still, while the core entity for transforming goods and services can be distinct from the core entity for transforming messages, the two should themselves be linked by a habituated communications channel.

There is a good deal of talk these days to the effect that the disaster needs to be filled by the international community do not require an authority structure yoking together its donor components. To some degree this represents a hypostasizing of the Joint Church Aid experience during the Nigerian-Biafran War. In the main that consortium worked via telexed and in-person exchanges of information, in which each of the more important components told the others what material decisions it had taken or was about to take, and relied on seconded leadership rather than its own cadre of officials. To stop there, however, would be to misconstrue JCA's approach. It did not simply register and talk up the spontaneous reactions of its members, hoping that somehow Hegel-like absolute freedom and absolute unity would both be maximized. Instead, representatives of the major JCA members met regularly in Geneva and, while accepting gratefully what some offered to do, would specifically assign to others the provision and shipment of this or that particular commodity (Lloyd et al., 1972). Executive committee determination was reasonably conclusive. Note, too, that such structuring was felt necessary in a protracted war, where instantaneous decisions were unnecessary, and among partners all of whom shared a common Christian heritage, in Oxfam's case at one remove, and some experience in working together. How much more necessary will an authority structure, and not just a reporting system registering laissez-faire donations and pledges, be for an international response set of far greater heterogeneity (cf. Davis, 1976).

Such an authority structure, which (depending on what the domestic regime desires,

or, in the case of civil wars of some magnitude, what the two regimes request) could either be vivified by an UNDRO-type appointment or actually designated by the disaster-ridden country, will prevent both overshipment and under-supply of resources, the former by scheduling and prohibition, the latter by direct phased assignment. Overshipment is both easier to prevent, since it does not require that any of the components do anything, just that they avoid doing it, and yet more difficult, since many countries and agencies will simply not be stopped from their good deeds (Holt, 1977).

The dangers of overshipment, however, have frequently been exaggerated, or at least not always carefully delimited. The chief problem is not the magnitude of what is moving around within the international sphere or even what is heading toward the country in disaster. The stress point is precisely at the transformation level, and is typified by such things as port congestion and worries over spoilage and pilferage of outdated or inadequately stored merchandise. Logistical considerations argue for the early movement of stuff through the pipeline; they also argue for the flow rate to the ports of entry not exceeding the absorption capacity of the domestic infrastructure [10]. The two considerations are somewhat incompatible. What is needed is the activation of intermediary assembly and consolidation points partway along the stream. These would be far cheaper to operate than ships lying for weeks or months at anchor in the harbor; and they would also permit sorting.

The principle applies not only to high bulk items like food and blankets, where tonnage would likely lead to sea- or air-port congestion. It is also relevant to medicinals, where checking, sorting, repacking, and so on often have to be done in order to lessen the demands on harried foreign and local medical workers up-country (see, e.g., de Ville de Goyet et al., 1976). Glimmerings of the procedures advocated here are discernible in the use of offshore island storage facilities (Fernando Po and São Tomé, neither of them Nigerian territory) by the Red Cross and the voluntary agencies before trans-shipment by night aircraft into Biafra. The simultaneous attempt to consolidate medical supplies via Copenhagen had similar implications.

One should also recognize that there may on occasion be advantages or at least no marked detriment in the supply of goods contributed exceeding the domestic needs capacity. Consider money. International over-contributing, such as to a Welsh town ravaged by a collapsed slag heap, may increase personal jealousies and societal stress; but ordinarily the results are far more favorable. For example, during the closing half-year of the Nigerian Civil War the ICRC received far higher governmental and private contributions than it was able to expend. Some of the surplus between inflow and outflow went to pay off earlier small but crucial deficits that the ICRC has run up in prior months (Davis, 1975a). The rest eventually found its way into other ICRC projects. And who is to say this is unfortunate? Indeed, agencies may go into disaster relief in order to raise money more easily for other purposes, too.

It is important not to blunt the spirit of generosity, either. During the Sahel crisis, Operation Push in Chicago raised money to purchase grain, with the proviso that the US Government underwrite the costs of shipping. The government never assented to this, and the organization in fact felt rebuffed. The wisdom of the decisions either to purchase grain or to deny a shipping subsidy will not be assessed here. Instead, the point to be emphasized is that this is one of the few recent examples of Black-American leaders being interested in ameliorating a non-domestic issue that had no direct material impact on them. In order to diminish isolationism, it might well have been advisable to underwrite the transport costs, whatever

the efficacy of that cache of food [11].

It is hardly a secret that this is a complicated world with all kinds of things going on. Whenever one undertakes a study, however, whether of a person or an event or a process, there is a tendency to see the study object by itself and to reduce most other matters to the level of possible contaminating extraneous factors. From many perspectives – for example, cybernetic or logistical – simpler and more elegant models of domestic/international transformations of messages and goods could have been developed. These models would, however, have ignored many important aspects of the real political world as it exists today, and almost surely will exist during the next few years.

NOTES

1 Cf. the comments on certain international communications as a quasi-system in Davis (1972b).
2 This resembles the state-centric model critized by Nye and Keohane (1972).
3 The third set of points is recognized by Green (1977) in Figure 1 (pp. 52–53), and to a slight extent (p. 49) in his text.
4 A useful short list of works in this genre may be found in Almond and Verba (1963, pp. 13n–14n).
5 For a somewhat similar analysis see Ingram (1977).
6 The preceding two paragraphs derive largely from Davis (1972b).
7 A national organization may issue the sole "authoritative" assessment of damages, casualties, and relief requirements (Green, 1977, p. 49); but does "authoritative" necessarily imply valid as well as reliable?
8 Much of the terminology and reasoning in the last three paragraphs is borrowed from Braybrooke and Lindblom (1963).
9 Per contra, according to Green (1977, p. 49), "UNDRO should serve as a disaster relief traffic policeman, controlling the flow of information, supplies, and equipment."
10 The latter theme is stressed in the report by Peat, Marwick, Mitchell & Co. (1970). But the report also provides data on the former.
11 These are my reactions to a presentation by the Reverend Jesse Jackson of Operation Push before a plenary session of the African Studies Association, held in Chicago on October 31, 1974.

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Mass Emergencies 3(1978) 229–237
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ISSUES FACED IN PROGRAMMING GUATEMALA DISASTER REHABILITATION ASSISTANCE: VIEWS AND IMPRESSIONS OF AN AGENCY PROGRAMMER*

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INTRODUCTION

The Guatemala earthquake of February 4, 1976 occurred at 3:15 a.m. It registered an average intensity of VII on the modified Mercalli scale throughout a 33,000 square km area encompassing the Western Highlands and Motagua River Valley regions. The greatest devastation was caused by the collapse of traditional *adobe* (sun-dried bricks) and tile roofed houses on their sleeping occupants, resulting in the instantaneous death of over 23,000 people, and injury to 60,000 more. Over one million people (1/6 of the total population) were left homeless, and public service infrastructure (schools, markets, water systems, roads, churches, etc.) were severely damaged or destroyed. Indian, Ladino, urban and rural communities were equally damaged, yet the most affected were the rural and urban poor whose subsistence level resources can scarcely bear the additional demands created by reconstruction needs.

This essay examines some important factors that almost all assistance agencies faced in the Guatemalan post-earthquake period and analyzes the different ways these were taken into consideration in programming each agency's response. The arguments summarize actual experiences drawn from the whole gamut of programs and their results. As such, this is not a report of a systematic social science study but a synthesis of observations and impressions of an agency program participant on the scene for two years after the earthquake. Specific agencies are mentioned and their programs are discussed in order that those not familiar with the scenario can more clearly vizualize the discussion, but no criticism or judgment is intended of the organizations or activities. A situation identical to the Guatemala 1976 earthquake will never reoccur, however, the key issues entertained in this disaster are relevant to other disasters as well as to developmental programs. The application of the lessons learned and experiences gained remains a potential exercise for future disaster relief programmers.

*The views presented in this paper do not necessarily represent USAD's official position, but are personal observations of the author.

DEFINITION OF DISASTERS

There are two vantage points for examining and understanding a disaster situation: from within the disaster (i.e., the victim's perspective), and from without. From both perspectives, the conditions resulting from loss of life, physical and emotional suffering, lack of food, and shelter are readily comprehended

and identified. Common perceptions and greater sympathy are more likely where there are natural social or economic affinities between the two groups. Therefore, the question arises as to how close was the mutual comprehension in the situation where the victim was a rural traditional peasant, and the non-victim (i.e., assistance provider) was middle class urban elite? And one step farther removed, did outside assistance agencies understand the disaster in the same terms as the victims and nonvictims?

There are several key points to be aware of when examining a disaster situation to clearly assess what occured, to whom, and what needs to be done about it. I would suggest the hypothesis that the basis for a real definition of disaster must be in terms of the affected people themselves. Outsiders (national and foreign) clearly may not recognize shock or imbalance to a traditional cultural activity, economic factor or social pattern. It is important that these hidden material and human factors be identified and considered by assistance agencies in determining the extent of the disaster. Victims automatically develop extraordinary coping mechanisms for dealing with their own problems and can suggest what is most needed to alleviate the suffering, in a way that compliments existing capabilities for recuperation.

In its own right, the outsider's perspective is important because it is more rational and analytical, and it is that through which official assessments are made. Outsiders may clearly appraise the overall extent of damages, but are conceivably capable of overstating or understating the disaster's impact. A problem or contingency may be overstated in order to obtain funds and resources, even though a serious need may not exist. Several cases were experienced. Of more than 100 tons of medical supplies shipped to Guatemala, approximately 30% was immediately useful in the disaster. Over 60 tons of food stuffs were donated, but no major food shortage existed; the previous year had provided an abundant harvest and food was not damaged in the earthquake. Likewise, understating the extent of the disaster is possible. For example, the aerial photography carried out immediately after the earthquake did not expose the true extent of damaged rural homes, because in peripheral areas where roofs appeared intact, severely cracked walls went undetected. Also, simply a lack of sensitivity to the affected people can be the basis of an indifferent or incomplete assessment of the disaster.

At best, a gap exists between the victim and outsider. To define the disaster in order to provide effective assistance that meets real needs, it is necessary to bridge differences through open-minded dialogue between the victim and the assistance provider.

TYPES OF RELIEF AGENCIES

The over 200 agencies who worked in Guatemala after the earthquake had the common goal of providing well intended charitable assistance to the disaster victims. Otherwise, each agency was a unique entity characterized by its own set of goals, priorities, available resources, past disaster experiences, working relationships in Guatemala, personnel, ideology, etc. Each of these characteristics alone suggests a wide range of quantifiable and qualifying variables. A detailed analysis of these factors is beyond the scope of this paper, but it is possible to categorize the majority of the disaster relief agencies in the following manner:

A. Socio-political institutions are those with a long-term commitment to change and development. They are professional development agents who expanded their regular activities to include a disaster relief component. The size of their resource base is variable; they can be governmental or private; local or international; they have a well defined position on how to accomplish social change; they generally have ongoing association with local target

groups; and have easy access to technical expertise. This category includes, International Development Bank, the United Nations, Agency for International Development, Canadian International Development Agency, some of the private volunteer organizations (PVO) such as CARE, OXFAM, Save the Children Federation, Penny Foundation, to name a few. In general, they are motivated by a desire to promote development through social and economic change.

B. Commercial agents are basically motivated by finding a taker for the item or idea they are pushing, working from very little actual knowledge of disaster situations. They had no genuine commitment to the victims' welfare, and their efforts were primarily devoted to developing arguments on the benefits and utility of their product or service. This category included agents selling things such as cardboard geodesic domes, manufactured building materials, sophisticated medical equipment, used mobile homes, etc. To a lesser degree, consultants and "instant experts" who tried to generate support for their particular solutions also fell in this category.

C. Altruistic groups comprise the most colorful and varied category of the disaster relief agencies. These groups were motivated by a genuine desire to help out, flavored in some cases with a religious orientation or other unique organizational characteristic. For many of these groups in Guatemala, this was the first time they launched disaster relief programs or operated in that country. A lack of experience in and knowledge of Guatemalan ways frequently caused extra problems for these groups. On the other hand, these problems were frequently minimized because due to limited budgets, they generally established smaller scale programs in well defined geographic areas. These groups often developed exceptionally good rapport with the communities where they worked, and were flexible and adaptable to making changes and adjustments in their programs. This category includes groups such as Plenty, the Mennonites, missionary groups, the YMCA, *ad hoc* committees, service clubs, etc.

Local government agencies are the major exceptions to these general categories. They are treated under a separate heading below.

EMERGENCY VERSUS REHABILITATION PROGRAMS

Two distinct phases of a disaster are the emergency phase and the rehabilitation phase. There is no precise moment at which the emergency ceases and rehabilitation begins, but each phase has certain definite characteristics which require specific and different programming.

The emergency is essentially a set of unforeseen circumstances that calls for immediate action. During this phase, life's normal activity ceases to function and people are suffering in the extreme. Basic human needs of food, clothing, and shelter are critically lacking. The victims are incapable of adequately helping themselves. In Guatemala, the emergency period was over within 3 to 4 weeks of the earthquake.

Emergency programs are a reaction to the immediate situation on a short-term basis. They address the symptoms and not the cause. Outside assistance intervention is almost blindly accepted by the victims because they are unable to satisfy basic needs themselves. There is little time for in-depth analysis and there is inadequate information available on which to make deliberative decisions. Responsibility for and success of emergency programs lie in the hands of those who are decisive and responsive in the moment.

The rehabilitation phase gets underway as conditions return to normal. Victims focus on the long-term situation and begin to see what solutions are available. Social and economic activities resume functioning and people

are able to fend for themselves. The situation in the wake of the disaster has stabilized, and there is no increased suffering or side effects such as starvation, migrations, epidemics and social unrest which are generally feared but rarely occur. The rehabilitation period can last an indefinite length of time, depending upon what was destroyed. It has been suggested that the Guatemalan reconstruction period will last 10 years, based on an assumed upgrading of the physical infrastructure. However, if rehabilitation is defined as construction of minimal shelter, the time period would be considerably less.

Rehabilitation programs address a grey area between emergency needs and developmental objectives. A rehabilitation program cannot deal with only the needs caused by the emergency, but must also take into consideration all relevant pre-existing conditions. By their nature, they resemble developmental programs carried out in a medium-term time frame. Problem solving processes follow procedures used in normal times. Issues are necessarily addressed in a slower and more methodical manner. Experts can be consulted and adequate information obtained on the situation. Most importantly, the disaster victim community can be incorporated in the planning and implementation of the rehabilitation program.

An agent responding to a disaster may initially be interested in addressing immediate emergency needs. If the problem is strictly undertaken as a short-term endeavor there is relatively high probability of success. When the emergency ceases to exist, so does the program. On the other hand, there is the danger that a program designed to meet emergency needs will continue into the rehabilitation phase. Due to rapidly changing conditions, the program can become inappropriate in terms of meeting the real needs of the victim since the original assumptions are no longer valid. This problem may be compounded if the agency's leadership is distant and unresponsive to field perceptions, or if the program continues functioning primarily because funding and resources are available. The following two cases illustrate this point:

1. Hospital California was planned as an emergency medical center, under auspices of a group of Guatemalans living in the United States. Their initial objective was to provide immediate medical attention for disaster-related injuries in the town of Comalapa. However, during time it took to organize and establish the hospital, most of the earthquake emergency medical cases had been attended. So, after the hospital staff arrived, they found themselves treating the normal range of illnesses. Nevertheless, the program continued in order to utilize the resources provided, thereby upgrading the medical care available in the community. This subsequently created a serious problem of how to withdraw outside support while maintaining improved medical care which the community had come to depend upon.

2. In another case, a major international relief agency began a massive program for the construction of small temporary shelters of *lámina* (galvanized metal roofing) and wood. However, due to an international bureaucracy which was unresponsive to field perceptions and the large size of the program, a momentum was created which continued operations beyond the period when temporary housing was a critical need. In this instance, temporary shelters were still being constructed more than a year after the earthquake when most victims were attempting to reconstruct permanent housing. In fact, within three months after the earthquake, some form of temporary shelter had been constructed by most victims.

While it is possible to begin organizing a rehabilitation program during the emergency phase, there are factors which inhibit effective programming. During the emergency, issues are confused and priorities frequently change suddenly. Resources are difficult to identify, and communications and logistical capabilities

are limited. Moreover, it is difficult to anticipate the emergency/rehabilitation phase transition.

The transition between phases does eventually occur in the minds and actions of all agencies at some point. Generally, smaller groups can make the change easily because they are flexible and close to the action. Other agencies developed programs which could address both the emergency needs and long-term rehabilitation, such as through the distribution of building materials (*lámina*) for both temporary shelter and permanent house construction. Still others consciously avoided becoming involved in the emergency phase but instead initiated programs which addressed permanent reconstruction needs from the start.

IMPLEMENTATION STRATEGY

The major issue which came into play in programming the Guatemalan post-disaster rehabilitation concerns alternatives in timing, in attitudes, decision-making procedures and levels of commitment. The success or failure of a program depends more often on these factors than on specifically material details. One point is whether to adopt a short-term or a long-term disaster assistance commitment. The agency may, because of limited resources, undertake a creative short-term endeavor which yields the most aid with the least amount of investment. In contrast, others may inappropriately perceive the devastation a purely physical problem and limit their program to the delivery of material aid over a longer time period.

The author contends the most effective disaster rehabilitation programs are those that develop slowly and incorporate goals beyond merely improving physical conditions. They can embody characteristics which closely resemble developmental programs based on a long-term commitment to solving a specific problem. These programs represent a more dedicated and sensitive approach which deals with the complexities of human factors. Disaster rehabilitation program goals which incorporate long-term development concepts are defined in terms of both the primary and secondary effects the program may obtain. For example, in Guatemala a primary goal for many agencies was the provision of shelter – adequate dwellings for a rural, agrarian, subsistance level population. Beyond this, however, there were a number of agencies which consciously incorporated additional program elements, which involved the victim in the decision-making process, of designing and executing the program, and in organizing community groups to address vital issues. This process reinforced self-sufficiency and enhanced certain aspects of their socio-economic fabric.

SHELTER RECONSTRUCTION – TEMPORARY VERSUS PERMANENT

What size house do the victims need? How soon? What materials? How much will it cost? Should shelter be replaced as it existed beforehand? How should seismic-resistant design be incorporated? Does shelter also imply public utilities? These and other similar questions were considered by the agencies in designing their programs, and represent innumerable variables upon which decisions were made.

Temporary shelter has several specific attributes. More units can be provided at the lowest cost per beneficiary. Generally, it is technically easier to construct, and a large number of shelters can be mass produced quick quickly. In Guatemala, temporary shelter construction fell in three distinct categories:

1. Essential construction materials such as *lámina* (galvanized metal roofing) were distributed to the victims in order that the individual could construct his or her own shelter. This was particularly effective in isolated rural areas where people traditionally build their own homes and housing is dispersed. If these

materials were of high quality, they could be used once for a temporary shelter, and then reused in constructing the eventual permanent home.

2. Temporary shelters were also constructed for the disaster victims by assistance organizations. These addressed the barest shelter needs, were small, often poorly suited to the climate, and allowed little opportunity for the recipient to modify or incorporate his or her own materials or design. In some instances, basic utilities such as community latrines and water taps were included. On the whole, this approach represented a larger cost-per-beneficiary investment than category 1, and carried with it a certain assumed responsibility for the people's welfare.

3. A third form of temporary housing was provided by other than assistance agencies. Instead, displaced families invaded open spaces and established squatter settlements, particularly in Guatemala City. These shelters were the result of individual initiative and were constructed of materials salvaged from numerous sources. At this writing these settlements lack legal rights, living conditions are very poor, and services remain non-existant except what the people are able to provide themselves.

From the point of view of the victims, permanent housing is the desired alternative. However, given the magnitude of the need (an estimated 250,000 homes were destroyed) it was a practical impossibility for the government and assisting agencies to provide the necessary resources within any reasonable time frame. The extent to which these programs could be implemented depended upon such issues as: size of the structure, quality of the design, cost versus the ability to pay, all of which limited access to the poorest victims and created complications due to greater infrastructure requirements.

Inevitably an unfilled gap exists between providing permanent homes or temporary shelter. Because resources are insufficient, neither alternative will meet all the minimum basic housing needs and yet satisfy the existing demand completely. Furthermore, both alternatives can create serious secondary complications. For example, the construction of low-cost permanent urban housing can stimulate immigration of rural peasants, and thereby aggravate the social and economic problems in the cities. Low-cost permanent housing competes with resources of land and building materials, which are more profitably invested in commercial buildings or middle-to upper-class housing. Temporary housing, in contrast, more often than not refers to the durability of the materials used rather than the length of duration of the settlement. Other post-earthquake temporary housing experiences in Guatemala, Nicaragua and elsewhere corroborate that temporary shelter programs in urban areas generally become permanent settlements. However, lack of title, and no intiatives to invest in improvements and maintenance results in temporary housing rapidly deteriorating to substandard living conditions. Once the temporary shelters have *de facto* become permanent, it is doubly more expensive and difficult to install public utilities, or to improve the structures with people living on site.

It is clear that the rehabilitation process in Guatemala, as particularly applied to housing, is not a short-term matter because the present situation is aggravated by and reflects pre-existing conditions. A realistic examination of construction rates indicates that the demand for new housing created by demographic growth and natural obsolesence in addition to the deficit created by the earthquake is scarsely being met. According to some expert sources the total number of housing units needed per annum in 1978 is 75,000; in 1983 this figure will reach 85,000. Nevertheless, the present rate of construction is approximately 50,000 units per year in 1977, or 66% of the 1978 demand. However 20,000 of these units constructed in 1977 were built by special one-time programs which will not con-

tinue functioning in the future. It is impossible to address only the problems created by the disaster. Furthermore speed in post-disaster assistance delivery may not be as critical as actually finding the means which do indeed address the complete issue.

OUTSIDERS VERSUS LOCALS – WHO DOES THE WORK?

The outside agency must determine the degree of direct involvement it wants in carrying out its program's objectives. Decisions focus on whether to become completely involved in the details of the field operation or whether to remain removed from the field and channel resources through local organizations. The agency gauges the amount of public exposure it wants in relation to sensitivities aroused by a high foreign profile. Some feel it is necessary to maintain strict control over the deployment of assistance resources to avoid loss, pilferage, etc. Often the experience of directly being involved in the field and seeing first hand results of efforts is of utmost importance. On the whole, the outside agency must determine whether it is the most capable and appropriate vehicle for executing the program at the community level, with the attendant need to address cultural and language barriers.

Although it is difficult to develop specific guidelines, the author's opinion is that there are considerable advantages to channeling as much assistance as possible through local organizations. Because rehabilitation and not emergency programs are undertaken, there is time to search out, incorporate or even create local groups. The principal benefits to using local groups over foreign is their knowledge of the area, customs, traditions, taboos, resources, etc. Incorporating the victims in the planning process for a program helps to insure that the assistance is acceptable and is something they want, as opposed to what the outsider feels they need. Local groups are excellent brokers between the agency and the disaster affected community at large. They translate and incorporate assistance resources on terms which effectively compliment local assets. They are responsive to local needs because they identify more closely with the community. Locally staffed operations are less expensive than foreign staffed programs, and provide the secondary benefits of employment and experience to the community itself. In general, if the program is appropriate to the situation, the capability potentially exists among the local people to execute it, even though an institution or specific experience may be lacking.

Guatemala assistance programs varied in terms of sensitivity to these factors. In some, outsiders did practically all the work at the local level. Various organizations sent groups of volunteers to build churches and homes without any significant local input. The most common scheme was one where the outsiders held the principal leadership and decision-making roles, and the local groups had various levels of responsibility for implementation. Another variation was where a large number of locals were directly hired into the program. Their responsibility was very high in these programs where they were given fiscal responsibility for building materials distribution, determining program parameters, and managing funds for small infrastructure projects.

PATERNALISM

The question of paternalism was a heatedly discussed topic concerning disaster relief programming in Guatemala. Some agencies embarked upon programs with the well-intended traditional attitude of taking charge and doing as much for the victims as possible. In contrast, other agencies recognized there were better approaches which rejected the idea that charity and good will are sufficient justification for a program. Instead of assuming the full responsibility for remedying the situation

for the incapable victims, the non-paternalistic outlook intentionally left responsibility for rehabilitation with the victims themselves.

A non-paternalistic approach assumes the victims are the most interested parties in their rehabilitation process, that they are motivated and capable of finding solutions to their own dilemma. It basically assumes that people are responsible for their own lives. In terms of disaster assistance, it is defined as providing resources which are lacking to the victims, while maximizing self-help initiatives and the victims' own resourcefulness. Attention is paid to avoid disrupting delicate social or economic patterns.

There are various examples which demonstrate how this philosophy was incorporated in the relief programs in Guatemala. One policy was to provide construction materials or housing at a subsidized price, rather than giving it away free of charge. This policy was based on the belief that free hand-outs have serious negative effects. Charity makes a person doubt his self-reliance and discourages self-initiatives. It raises expectations that other things should be free. Give-aways distributed in an arbitrary fashion cause resentment in those who did not receive them which is further compounded by the perception that some people not in need of assistance, unnecessarily participated. In general, doling out welfare puts the recipient in a passive and subservient role which is counterproductive to almost any improvement plan.

Paternalistic orientations were successfully avoided in programs in which responsibility for construction was left with each family. People contributed real and substantial portions of the resources necessary for the reconstruction process including raw building materials, labor and construction skills. Program decision-making included an equal voice for the beneficiaries, particularly on matters related to types of materials, how to equitably distribute the assistance, and when and how to construct to best suit the individual family. This strategy provides experiences which accrue to the community and create new awareness of methods and problems related to project administration and social organization.

LOCAL GOVERNMENT'S ROLE

In any disaster situation the local government has an automatic mandate to assume the principal role in assisting the victims. The local authority has final responsibility for any actions within its domain, so therefore should determine policy and programs, not international agencies. Several important factors determine the effectiveness of the government's role, which are the following:

1. Whether or not the disaster has affected the government's operational capabilities;
2. What resources are available to the government in comparison to the magnitude of the disaster;
3. The degree to which the government is willing to take extraordinary measures to increase its resources;
4. The influence and wishes of outside agencies who are interested in seeing the most effective use of their resources; and
5. The extent to which government agencies are willing and able to incorporate the disaster-striken community into the assistance delivery mechanism.

An important role the Guatemalan Government assumed was to coordinate incoming assistance provided by the foreign agencies and national organizations. The National Reconstruction Committee (NRC) was especially formed to facilitate programs and formulate policy, but did not finance or execute reconstruction programs. Emphasis was given to assuring equitable coverage and avoiding duplicated efforts. The NRC established guidelines for reconstruction, such as: rebuilding only permanent shelters and buildings, avoiding paternalistic approaches (i.e., give-aways) and promoting self-help initiatives. These pre-

cepts were largely ignored by government agencies carrying out reconstruction activities, as the traditional top down directive methods were employed by these bureaucracies. Clearly, there remains a large untapped potential for more fully utilizing community initiatives and capabilities for the long-term reconstruction process.

CONCLUSION

Success in disaster relief programming depends less on resources or size of program but more on sensitivity to culture and economic structure, the levels of integration and community participation, and leaving the responsibility for rehabilitation with the affected people themselves. Understanding the differences between emergency and rehabilitation phases, programs should embody many of the same concepts applied to long-range development activities. The Guatemalan experience illustrates this thesis. Many international and national agencies had enough foresight to adopt integrated disaster relief programs which go beyond physical reconstructions to include developing permanent human resources, strengthening community level social organization, bolstering self-reliance and reinforcing normal local economic structure. Many agencies have remained to continue longer-term development programs, capitalizing on their successful disaster programs and positive involvement in the communities.

Mass Emergencies 3 (1978) 239–250
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POST-DISASTER HOUSING IN HONDURAS AFTER HURRICANE FIFI: AN ASSESSMENT OF SOME OBJECTIVES*

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Research on natural disasters has generally neglected the issue of permanent reconstruction or, as Kates and Pijawka have termed this period of response, the "Replacement reconstruction period" (Kates and Pijawka, 1977, p. 3). As Mileti indicates, "Proportionate to relief activities, there has been little research on rehabilitation" (Mileti, 1975, p. 12). With reference to housing Bates observes, "... agencies which have contributed to the rebuilding of homes know such things as how many homes were rebuilt and how many families housed, but they usually do not know how well the new housing serves its function..." (Bates, 1977, p. 15). This paper purports to fill part of this gap by reporting the results of research conducted on five housing projects constructed for disaster victims in Central America.

Specifically, this research measures how well a sponsoring organization realized its implicit objectives in constructing permanent post-disaster housing. This is accomplished by identifying the objectives utilized by the organization responsible for constructing the housing projects and measuring them against the outcomes. In doing this we have utilized what has been termed an "ad hoc comparison" wherein, "... units who were exposed to a program are compared to units who were not..." (Houston, 1972, p. 61). Thus, we have surveyed four projects built by a relief organization for Hurricane Fifi victims, a Honduran government sponsored housing project for victims, and a pre-disaster housing project sponsored by the Honduran government. By selectively using the comparison projects (the pre- and post-disaster Honduran government projects) we are better able to assess the housing and construction objectives of the relief agency. The six projects are described later in the paper.

The data reported herein was collected primarily during the summer of 1977 via interviews, but some demographic information collected in 1976 is included. Interviewers were Honduran nationals with at least a high school education. The net interview completion rate for all projects was in excess of seventy-five percent.

PHYSICAL SETTING

"LaCosta" as it is known by Hondurans forms a distinct region on the north or Caribbean coast of Honduras. Geologically, this coastal area is composed of a series of mountain ranges east-west in orientation, and

*Funding for this study was provided by the Church World Service, although the opinions and views expressed are our own and not necessarily those of the Service.

separated by deep valleys filled with rich alluvium. These valleys open northward to the coastal plain. The largest of these are drained by the Ulúa and Chamelecón river systems. (See Fig. 1.)

The Sula Valley, as it is referred to by inhabitants, is extensively developed throughout its approximate sixty by twenty miles serving as the focus for extensive commercial banana plantations. It has a long history of human settlement as it was occupied and cultivated during the pre-Columbian period.

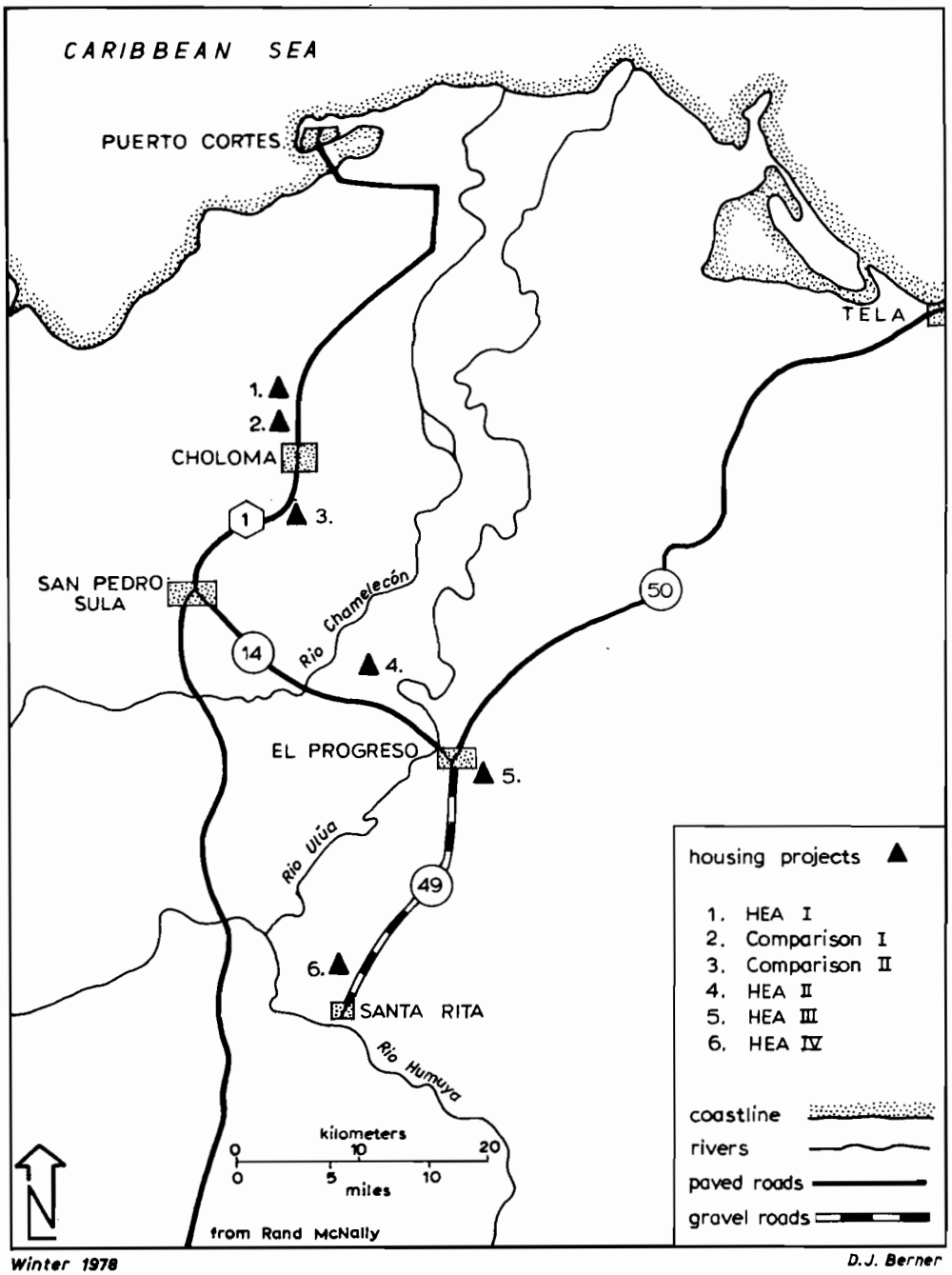

Fig. 1. Map of Sula Valley, Honduras, showing housing projects discussed in the text.

European occupancy merely changed the ownership and land-use patterns. The climate of the Sula Valley is tropical. Due to the valley's exposure to trade winds it experiences higher rainfall and temperature averages than regions immediately to the south. Rainfall averages 203 centimeters annually and the temperature, approximately eighteen degrees Celsius. The dry season, shorter than that for the country as a whole, extends from February to May. The heaviest rainfall period is during September, October, and November. There is marked variation in rainfall and temperature regimes within the valley. More eastern and interior locations within the valley are hotter and receive less rainfall, some as little as 127 centimeters in the most westerly part of the Sula Valley. Rainfall is the primary determining factor for agriculture.

THE DISASTER

Hurricane Fifi struck the northern coast of Honduras on September 18, 1974. Despite repeated early warnings that this was to be a very large, strong storm, few people moved from their homes. Both the U.S. National Hurricane Center in Miami, Florida and the United Fruit Company in Honduras issued repeated warnings of the oncoming storm. Perhaps too many residents felt that hurricanes were a known entity. Certainly too few remembered the heavy rains and serious flooding experienced during the severe hurricanes of 1954, 1934, and 1914.

The worst damage was experienced in the Sula Valley, the most productive portion of the country where the bulk of Honduras' food and export crops are grown. (Riding, 1974a, p. 22) Total agricultural damage was estimated at 200 million dollars. In addition, approximately one hundred thousand people were made homeless and the Organization of American States' mission estimated that five thousand people were killed (Riding, 1974b, p. 1). The greatest loss of shelter and life was experienced in the smaller, rural villages. A score or more were totally obliterated, many of these had formerly occupied the banks of rivers draining the Merendon mountains.

Damage was caused both by the rapidly rising water and the disastrous landslides which scarred both flanks of the steep Merendons. The thin soil and earth layers were already saturated when Fifi came ashore and the hard rains accompanying Hurricane Fifi simply caused great sections of the mountainsides to break loose and slide into the swollen waterways. When the water, sand, trees, and houses reached the flat valley floors, the river banks were overrun and the housing occupying the flood plain was either inundated or damaged. In most cases, the housing destroyed and/or damaged was among the poorest quality and belonged to those least able to replace or repair it after the storm.

PROJECT PROFILES

Following are brief profiles of the four housing projects sponsored by an organization we will refer to as the Honduran Ecumenical Association (HEA) and the pre- and post-disaster projects sponsored by the Honduran government. Included in the descriptions are physical site, construction characteristics, selected social characteristics, and a collective description of the residents' previous housing. Fig. 1 gives a general orientation of the site locations.

HEA Project I. This project contains 121 houses and is located on the primary highway between San Pedro Sula and the north coast near the city of Choloma. It has an excellent location with reference to the existing transportation net. Proximity to the highway permits easy access for the interior street system. The portion of the project near the highway is quite flat but considerable slope exists at the extremities of the site. Serious erosion has already affected the streets within the project.

Houses are constructed of either concrete block or concrete panels which were poured on the ground and lifted into place and subsequently bolted together. The latter construction was found to be problematic, and abandoned. Houses contain approximately twenty-five square meters of space. Lots (approximately twenty by twenty-five meters) are large enough to provide space for gardens. Water and sanitary facilities are provided externally. The provision for a piped external water supply to each yard alleviates some of the potential health hazards posed by pit latrines.

HEA Project I household heads have the lowest mean age (33.2) and have the second lowest mean formal educational level (1.9 years). The large majority of the residents formerly lived in "champas" (83%) and only one in three had hard floors. (A "champa" is constructed by the owners and utilizes indigenous materials such as thatch, bamboo, and mud plaster.) In their pre-disaster houses they had fewer basic services than other project residents (only two percent had electricity, four percent had baths, and ten percent lived in houses with water). Thus, compared to the other projects, residents of HEA Project I come from poor backgrounds, but have received very good houses in a well sited location.

HEA Project II. This project contains 127 houses and is approximately two kilometers off the old San Pedro-El Progreso highway on an unimproved road. While this distance might not appear excessive, from a relative distance point-of-view it is perceived as being poorly sited by the residents. The site is completely flat, occupying land formerly used for banana cultivation. It is often flooded during the rainy season and was inundated by two to three meters of water during Fifi. All houses were constructed of wood with earthen floors and contain approximately twenty-four square meters of interior space. The project provides ample space around the houses for garden plots, plus considerable farm land (held in common) available to the residents. Water was provided by eight wells and sanitary facilities were provided externally. Poor drainage characteristics, high water table, and the use of pit latrines pose a potentially serious health problem. This project was established to house persons from the general area as no village existed here prior to Fifi.

Our survey found that HEA Project II had the highest percentage of single household heads and that more were engaged in agriculture (40%) than any of the other projects. It also had the lowest educational level per household head which is undoubtedly related to the large percentage in agriculture. More than eighty percent of the residents formerly lived in houses lacking hard floors and classified as champas. Over ninety percent lacked electricity and bathing facilities and only thirty-seven percent had water. Thus, the families were poorly housed prior to Fifi and have received comparatively small, minimal housing at the poorest site.

HEA Project III. Located within the corporate area of El Progreso, this is the only urban site and contains city water, sewage, as well as electricity at each house. The project has a street network and is serviced by existing public transportation facilities. Twenty-six concrete block, concrete floored houses were constructed that provide approximately sixty-one square meters of living space. Ample space was provided around each house for a garden plot.

In the 1977 survey we found that this project had the largest number of residents per household (7.2), the largest percentage of female household heads (17.4%), and the largest Protestant contingent (46.2%). Only three percent of its residents were engaged in agriculture, unemployment was at seventeen percent, and its household heads had the highest average level of formal education.

Prior to moving to this site the residents lived primarily in block or wood houses with

hard floors. Large numbers also came from houses containing water, electricity, and baths. Thus, residents of HEA Project III came from the most advantaged backgrounds and have received the most modern houses in the most urban location.

HEA Project IV. This project contains ninety-two houses and is the most remote project from the regional urban center, San Pedro Sula. It is located on a poorly maintained gravel road which provides regular bus transportation to El Progreso during all but the worst part of the rainy season. The project is adjacent to the town of Santa Rita which provides most urban functions (excluding water). The site is relatively level and the lots are adequate for garden plots. The most serious physical problem is the low water table. It is impossible for the residents to reach water by hand-dug wells. The availability of a regular market located at the edge of the project alleviates most of the transportation needs. All houses are of concrete block with concrete floors and contain approximately forty square meters of floor space. Sanitation facilities are provided externally, but no water is provided. Some of the pit latrines have proven inadequate due to poor construction; approximately one-fourth have been rendered useless due to collapsing of the pits' walls. This is the only project where a community center was built as part of the project.

This project has the highest rate of unemployment (19.4%) and contains the lowest percentage of female household heads. Compared to the other projects resident characteristics were very average. Prior to Fifi, residents lived primarily in champas with dirt floors. They also came from houses that rarely contained water, electricity, and baths. Thus, residents came from rather poor housing and have received good housing with mixed advantages (adjacent to city services and market, good housing, but lacking an adequate water supply).

Comparison Project I. This project is adjacent to HEA Project I, contains thirty-three houses, and enjoys the same excellent transportation advantages as HEA Project I. The portion of the site nearest the road is flat with the interior sloping upward. Each house contains approximately twenty-five square meters of floor space. Houses are constructed of wood with concrete floors with the exception of a few concrete block duplexes with concrete floors. Space for garden plots is provided at each house. Water and sanitary facilities are provided externally. As in HEA Project I pit latrines do not pose a serious health threat; water is supplied from an external source to each yard.

This project has approximately one in five female household heads and is the most Catholic (77.8%) of the projects. Three percent of the residents are employed in agriculture. Prior to moving here, residents were much better housed than the majority of other project residents. Approximately eighty-five percent came from houses of block or wood and three-fourths had hard floors. Large numbers also had water, electricity, and baths. Compared to the HEA Projects these residents lived in very good houses before the hurricane, but have received rather poor housing in a well located site.

Comparison Project II. This project is located south of Choloma on the primary highway giving it access to the same public transportation services available to the residents of HEA Project I and Comparison Project I. In addition it has local bus service generated by its size. The site is relatively flat and contains approximately six hundred houses. The houses are constructed of concrete block and are built as "doubles." Water and electricity are provided for each unit, but pit latrines provide the only sanitation system. Compared to the HEA Projects the space between houses and available for gardens is quite limited.

The majority of the residents formerly lived in houses constructed of cement block or wood with hard floors. They lived primarily in "modern" houses containing electricity, water and bathing facilities. Clearly the residents of this project were more advantaged in their prior living arrangements than HEA residents with the exception of those living in HEA Project III. Those moving here, however, moved in response to different social forces.

This project was constructed approximately three years before Hurricane Fifi and was generally unaffected by it. Even though there were very few housing projects from which to choose for comparative purposes, this project approximates the HEA Projects in important ways. It was very similar in terms of location, source of funding (external), house materials and facilities. Demographically, the residents were similar to those in HEA Project III. The amount of space available in and out of the house, however, was more limited than that of the HEA Projects.

THE ORGANIZATION OF RECONSTRUCTION

HEA Projects I, II, and IV were initiated by a United States Ecumenical Association (USEA) through their Honduran counterpart (HEA). The projects were funded through the USEA and other U.S. relief agencies. The person directing the projects was a North American and funded by the USEA. HEA Project III was initiated by a single Protestant denomination in the U.S. and became the responsibility of the HEA during the final stages of construction. It was realized at this late stage that the initiating denomination had failed to obtain clear title to the land upon which the houses were built. This difficulty has apparently been resolved, but it has created potential financial problems for the residents and sponsoring organization.

The HEA had existed prior to Hurricane Fifi, but was loosely organized and inactive. It had actually come into existence in 1969 to serve those affected by the so-called "Football War" between Honduras and El Salvador. With the advent of Hurricane Fifi and the influx of funds, volunteers, and a coordinator from the United States, HEA turned its emphasis to post-disaster reconstruction and development. With varying degrees of success a coordinating and support organization emerged to undertake the vaguely defined, but determined, efforts of reconstruction and development. With the exception of the one U.S. coordinator all paid employees in the expanding HEA were Honduran nationals. In June of 1976 there were fifty-one full time employees at offices in three cities. (Anonymous, HEA Annual Report, 1976, p. 1) Thus, a form of organizational innovation took place due to environmental changes. (Ross, 1976, p. 1–2)

Housing and food distribution were the first of a series of projects undertaken by the HEA following Fifi. Later came agricultural, medical, nutritional and educational programs. The four housing projects studied herein represent virtually all of the houses that came under HEA's direction and influence in Honduras. Very little planning preceded the arrival of the U.S. coordinator who came primarily to initiate and organize the housing programs. The coordinator was an ex-Peace Corps volunteer who had previous experience with development projects elsewhere in Latin America.

Very general and vague goals for the housing were apparently determined prior to the coordinator's arrival in Honduras. These were partially the result of similar housing projects that had been constructed after natural disasters in Peru and Nicaragua by the same U.S. organization funding the HEA Projects. Specific objectives for the housing, however, had not been developed. What the new coordinator found in Honduras was a skeletal organization that provided contacts and the possibility of expansion. What he brought with him were organizational and technical skills, organizational support, substantial funding capabilities, and the idea of constructing housing for hurricane victims.

Objectives for the housing projects were apparently never formalized in the usual organizational manner. Initially, organization was very loose and decisions were pragmatic. Thus, the situation did not make possible the error that Kates alludes to: "A basic error of the professional community is to assume that formal studies, plans, and designs are requirements for reconstruction." (Kates, 1975, p. 8) General objectives emerged as the coordinator and the HEA staff identified victim groups to be assisted and as they confronted the possibilities of reconstruction. (There was no intention to assist only those who were HEA affiliate members and it later became clear that non-members were the largest victim groups assisted.)

Although objectives were not formalized, they were operationally formulated. In discussions with the coordinator the authors of this paper identified five measurable objectives. The objectives, some assumed and some emergent, were: (1) recipients would be victims of Hurricane Fifi, (2) recipients would become owners and ownership would continue over time rather than selling, renting to another party, or abandonment, (3) housing would be built in the vicinity of the residents' former housing in order to minimize social disruption, (4) recipients would be better housed than they were prior to the hurricane, and (5) spatial characteristics would be consistent with their previous living experience.

These five objectives are assessed in this paper on the basis of interviews conducted with the housing recipients. Interviews were conducted with all but a few of the recipients in the summer of 1976 in order to gather basic social and demographic data. Samples were then interviewed in the summer of 1977 in order to determine residents' satisfaction with the houses and projects. (The projects were completed and occupied during the summer of 1975.)

With few exceptions the five objectives are assessed on the basis of information collected in the 1977 survey. Thus, objectives are being evaluated two years after the houses were occupied, giving the recipients sufficient opportunity to alter their living arrangements. Interviews with residents of the Comparison Projects are used when appropriate to place the HEA Project responses in proper perspective.

Objective number one states that housing recipients will be victims of Hurricane Fifi. Table I presents three measures of victimization and the most significant measure, that of housing destruction, indicates that with the exception of one, HEA Project IV (73%), more than 85% of the residents had their pre-disaster home destroyed by the hurricane. Only in Comparison Project I were there large numbers of family members killed and injured.

Objective number two states that recipients would be owners and that ownership would

TABLE I

Effects of Hurricane Fifi on Project Residents

	Housing destroyed		Family members killed		Family members injured	
	N	%	N	%	N	%
HEA Project I	49	87.8	50	16.0	50	6.0
HEA Project II	42	85.7	42	None	42	2.4
HEA Project III	26	88.8	26	None	26	None
HEA Project IV	37	73.0	36	2.2	36	2.8
Comp. Proj. I	27	88.9	27	33.3	27	29.6

TABLE II

Percentage of Owners and Non-Owners

	N	Owners (%)	Non-Owners (%)
HEA Project I	50	94.0	6.0
HEA Project II	42	95.2	4.8
HEA Project III	26	84.6	15.4
HEA Project IV	36	77.8	22.2
Comp. Proj. I	27	92.6	7.4

continue over time rather than selling, renting to another party, or abandonment. Table II presents the percentage of owner/residents and non-owner/residents and it is clear that a large majority are owner/residents. Non-owners were primarily renters, but some were simply relatives and friends who were caring for the houses during the owners' absences. The small percentage of persons seeking another house to live in (5.8%) were persons who anticipated the owners' return. Only in two projects are more than ten percent of the residents non-owners.

A high percentage of ownership, however, does not mean that present owners were the original owners. In order to determine the rate of changing occupancy we asked residents when they moved to the respective projects. Table III presents these findings by the years and it is assumed that those occupying in 1975 are the original residents. As is indicated residency is very stable. Only in two projects are fewer than 80% of the residents 1975 occupants. In these two projects the availability of water became particularly problematic during 1977.

TABLE III

When Residents Moved to the Projects

	N	1975 (%)	1976 (%)	1977 (%)
HEA Project I	50	82.0	10.0	8.0
HEA Project II	42	76.2	9.5	14.3
HEA Project III	23	91.3	4.4	4.4
HEA Project IV	37	73.0	5.4	21.6
Comp. Proj. I	27	88.9	7.4	3.7

This high percentage of victimization and continued ownership/occupancy are not simply accidental matters. They are undoubtedly related to the victim's involvement in the construction of the house and participation in the program "Food for Work." The victim/recipients were encouraged from the beginning to be involved in the construction and in turn, receive food for this participation. In the 1976 survey respondents indicated that 87% had participated in the construction of the HEA projects and 84.7% had received food for this activity.

Objective number three states that housing would be built in the vicinity of the residents' former housing in order to minimize social disruption. In doing this it was hoped that cases such as the following could be avoided. "My wife doesn't know people here in this barrio, and she seldom leaves the house except to make the little purchases of things she needs for cooking that day" (Trainer, Bolin and Ramos, 1977, p. 154). This quote was from a "composite story" concerning families whose homes had been destroyed in the Managua earthquake of 1973. Not only are individuals isolated, but whole projects are often isolated in that they are not sited on the existing communication/transportation network. Due to their small size they often fail to generate necessary linkages with existing transportation nets. For instance, "Although the project is really only a half mile from the edge of town and a mile from its center, Loma Jardin residents feel isolated. Few have automobiles and the local bus service, though frequent, is very irregular" (Burns, 1970, p. 28). This problem of available land is nearly ubiquitous since land values tend to skyrocket after such disasters.

The amount of social disruption was measured on the basis of answers to three issues: (1) distance from previous domicile, (2) percentage of residents traveling farther to work as com-

TABLE IV

Distance from Previous Domicile

	N	0–4 km (%)	5–19 km (%)	20 or more km (%)
HEA Project I	46	87.0	10.9	2.2
HEA Project II	40	82.5	12.5	5.0
HEA Project III	23	78.3	21.7	None
HEA Project IV	35	60.0	22.9	17.4
Comp. Proj. I	27	88.9	3.7	7.4
Comp. Proj. II	45	15.6	60.0	24.5

pared to pre-disaster times, and (3) proximity to friends and relatives. Table IV contains the distance residents presently live from their pre-disaster domicile. Clearly, a large majority of the residents live near their previous location. Only in HEA Project IV do fewer than 78% of the residents live more than four kilometers away. This is in stark contrast to Comparison Project II where only 15.6% live that close.

The distance to work question was asked within a comparative framework. In only two projects (Comparison Project I and HEA IV) do more than fifty percent travel farther to work than before the hurricane (Table V). We cannot assume, however, that all are working at the same jobs.

Two approaches were used concerning the question of proximity to friends and relatives. Respondents were first asked if there were "pre-disaster" friends and relatives living in their projects, and were then asked if they were currently living sufficiently near to friends and relatives. Table VI contains the responses to these questions for friends. Only in HEA Project II and Comparison Project I did more than fifty percent of the residents have friends from their pre-disaster residence living in their project. Although this might be perceived as less than desirable, when one looks at the percentage of residents having friends sufficiently near their present residence one finds high satisfaction. This may mean that there are previous friends outside of the project that are sufficiently near or that the residents have developed friendships within the projects. We have not determined which of these assumptions is correct, but it is clear that the isolation felt by the Managuan victims is not wide-spread in these projects built for victims of Hurricane Fifi.

The percentage of residents having relatives

TABLE V

Percentage of Residents Traveling Greater Distance to Work as Compared to Previous Residence

	N	%
HEA Project I	49	20.4
HEA Project II	41	34.2
HEA Project III	24	33.3
HEA Project IV	35	51.4
Comp. Proj. I	25	52.0

TABLE VI

Proximity to Friends

	Those having friends from previous residence living here		Those currently living sufficiently near to friends	
	N	%	N	%
HEA Project I	50	30.0	50	98.0
HEA Project II	40	52.5	42	92.9
HEA Project III	26	30.8	26	100.0
HEA Project IV	36	38.9	37	97.3
Comp. Proj. I	26	61.5	27	92.6

TABLE VII

Proximity to Relatives

	Those having relatives in this project		Those currently living sufficiently near to relatives	
	N	%	N	%
HEA Project I	50	52.0	50	80.0
HEA Project II	40	47.5	42	69.1
HEA Project III	26	26.9	26	69.2
HEA Project IV	36	33.3	37	62.2
Comp. Proj. I	25	44.0	27	55.6
Comp. Proj. II	54	37.0	55	56.4

in their project and having relatives sufficiently near their present home is presented in Table VII. Those having relatives in their project range from 26.9% to 52%, including Comparison Project II. Responses to the question of proximity to relatives increase the range from 55.6% to 80% including Comparison Project II. Thus, respondents were not as satisfied with their proximity to relatives as they were to friends. This condition, however, exists for residents of Comparison Project II and we cannot subsequently account for this on the basis of the victims' project locations. It is theoretically possible that respondents would have answered similarly at their pre-disaster location.

Objective number four states that recipients would have better living conditions than they had prior to the hurricane. This is assessed on the basis of three questions that compare the house, location, and neighborhood before and after Hurricane Fifi. The results of these questions are presented in Tables VIII through X. With reference to housing, only in Comparison Project I do fewer than ninety percent of the recipients agree that their present house is equal or better than before the hurricane. This is consistent with our previous observation that many of these residents came from pre-disaster houses that were constructed of more durable materials and more "modern" facilities.

TABLE VIII

Is this House Better than the One in which you Previously Lived?

	N	Better (%)	Equal (%)	Worse (%)
HEA Project I	50	98.0	2.0	None
HEA Project II	42	85.7	4.8	9.5
HEA Project III	26	88.5	7.7	3.9
HEA Project IV	36	91.7	5.6	2.8
Comp. Proj. I	27	55.6	7.4	37.0
Comp. Proj. II	55	92.7	5.5	1.8

TABLE IX

Is this Location Better than Where You Previously Lived?

	N	Better (%)	Equal (%)	Worse (%)
HEA Project I	50	98.0	2.0	None
HEA Project II	42	88.1	4.8	7.1
HEA Project III	26	88.5	7.7	3.9
HEA Project IV	37	91.9	5.4	2.7
Comp. Proj. I	27	85.2	None	14.8
Comp. Proj. II	55	94.6	3.6	1.8

TABLE X

Is this Neighborhood Better than Where You Previously Lived?

	N	Better (%)	Equal (%)	Worse (%)
HEA Project I	50	98.0	2.0	None
HEA Project II	42	83.3	11.9	4.8
HEA Project III	26	84.6	11.5	3.9
HEA Project IV	37	86.5	13.5	None
Comp. Proj. I	26	92.3	3.9	3.9
Comp. Proj. II	55	89.1	9.1	1.8

The locations of the projects were better or equal for more than ninety-two percent of the residents in all but Comparison Project I. The dissatisfaction of these residents, however, was much less than that which they expressed toward the houses. The project's neighborhood was considered worse by less than five percent of the residents in any of the projects. Thus, with the partial exception of Comparison Project I, the new housing represented an improvement in living conditions as measured by these three variables.

The final objective states that the houses and projects would contain spatial characteristics consistent with the recipients' experience. In order to measure this we asked recipients if the space for gardens, between houses, within the houses and the space available for cooking was satisfactory. In each case the space provided for victim projects was larger than that provided for Comparison Project II and we can subsequently gain some insight into the relative importance of space. Table XI contains the number and percentage of

TABLE XI

Spatial Characteristics

	Garden space		Between houses		Interior space		Cooking space	
	N	%	N	%	N	%	N	%
HEA Project I	26	96.2	26	96.2	26	100.0	26	96.2
HEA Project II	27	88.9	27	85.2	27	100.0	27	88.9
HEA Project III	50	92.0	49	95.9	50	96.0	49	86.0
HEA Project IV	37	94.6	37	100.0	37	100.0	36	61.1
Comp. Proj. I	42	85.7	42	92.9	42	95.2	42	71.4
Comp. Proj. II	54	66.7	55	58.2	55	69.1	55	60.0

respondents indicating that these four spatial factors are "Excellent" or "Adequate." These two responses are combined since there were so few "Adequate" responses. Exclusive of Comparison Project II, satisfaction is above 85% on all responses except cooking space for two other projects. Comparison Project II, in contrast, ranges from 58.2% to 69.1%, expressing less satisfaction with the spatial characteristics. Although we cannot identify the exact point at which spatial factors are perceived as satisfactory or unsatisfactory it is evident that the space provided in Comparison Project II is approaching the unsatisfactory level. It may be, on the other hand, that the victim projects could have satisfied their recipients with less space.

CONCLUSION

In summary, it appears that two years after the completion of housing for hurricane victims in Honduras the afore mentioned objectives have been satisfactorily achieved in the HEA Projects. HEA Project IV did lag behind the other projects at many points, but still met the objectives with a large majority of the residents. With the exception of house quality and facilities Comparison Project I, built for hurricane victims by an agency of the Honduran government, generally met the five objectives. Residents of Comparison Project II, a pre-disaster project built by the Honduran government, had moved greater distances from their previous homes and expressed greater dissatisfaction with the spatial characteristics of their project.

With reference to the five victim projects more than eighty-five percent of the residents in each project previously lived in homes destroyed by Fifi with the exception of HEA Project IV. Except for HEA Projects II and IV (76.2% and 73%) more than eighty percent of the residents moved into the projects during the first few months of their existence. With the exception of Project IV (77.8%) more than eighty-five percent of the residents live in owner-occupied houses.

Social disruption due to the location of the projects appears to be minimal. Again, with the exception of HEA Project IV, seventy-eight percent or more of the residents live within four kilometers of their previous residence and in only two cases (Comparison Project I, 52%, and HEA Project IV, 51.4%) do more than half of the household heads currently travel farther to work. Friendship and proximity to relatives also appear to have been relatively unaffected by the move.

With the exception of Comparison Project I, ninety percent or more of the housing recipients found their house, location, and neighborhood equal or better than their pre-disaster situation. In Comparison Project I, the exception, fifteen percent felt the location was less satisfactory and thirty-seven percent felt the house was less satisfactory.

Spatial characteristics for the victim residents, with two exceptions, were perceived as good (exceeding 85%). Only in Comparison Project I (71.4%) and HEA Project IV (61.1%) with reference to cooking space, were there fewer than eighty-five percent expressing satisfaction. Comparison Project II registered many complaints related to the spatial features of their project.

One issue not addressed by this research is the question of national housing needs and housing built for disaster victims. Is the housing built during the replacement reconstruction period consistent or inconsistent with national housing needs? In the case of Honduras the housing needs are critical, "... a five-year plan called for 9,500 houses to be built in the public sector between 1965 and 1969, although population increase alone required 64,000 new houses in this period, and the housing deficit of 1965 was estimated at 263,000" (Medina-Spyropoulos, 1975, p. 34). To this can be added an estimated 100,000 persons rendered homeless by Hurricane Fifi.

Undoubtedly, an objective cost analysis of the projects described herein would result in the conclusion that these units were too extravagent and costly. Rather than building a limited number of finished, relatively high quality houses on large lots it would have been more reasonable to build modest and partially complete houses on smaller lots and in larger numbers. Using such an approach it might have been possible to build two, three or four times as many houses for a similar cost. Thus, we would contend, a more realistic model is needed for organizations constructing housing during the replacement reconstruction period in third world nations. This model should consider the national housing needs as well as the needs generated by the disaster. Such a model would result in less capital outlay per unit and would place greater responsibility for completion of the unit with the recipient. Such an approach would not, however, meet with the degree of satisfaction we have found among these recipients.

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Mass Emergencies 3 (1978) 251–265
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HURRICANE RESPONSE AND HURRICANE PERCEPTION IN THE COMMONWEALTH OF THE BAHAMAS [1]

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INTRODUCTION

The Commonwealth of the Bahamas, though distinctly influenced culturally and economically by proximity to the United States, cannot divorce itself from its Caribbean neighbours. Historically, of course, there are similarities between the Bahamas archipelago and the more literal Caribbean islands – British colonization, the transference of English parliamentary institutions, slavery and emancipation, and post-emancipation economic decline – and yet equally significant differences such as the evolution, in the Bahamas, of a predominantly maritime economy and the benefits accruing from a strategic position vis-à-vis the United States (Lewis, G.K., 1969). The Bahamas, thus, displays a hybrid quality revealed in economic and cultural paradoxes. Nevertheless, factors exist, as in any conveniently defined "region", which transcend politico-historic influences and differences within the Caribbean and its fringes. Among these factors, natural phenomena figure prominently and of these, none is so violent in expression as the hurricane. Hurricanes affect most of the Caribbean islands together with its Atlantic perimeter – the Bahamas and Bermuda – and the southern coastline of the United States and Central America.

The ferocity of the Caribbean hurricane is well known and well documented:

> "A tropical Caribbean hurricane can destroy a whole city, like Belize in 1931, in a matter of a few hours; or shatter an island economy, like the pulverization of the Puerto Rican highland coffee industry in 1899 or of the Grenada nutmeg industry in 1955; or level every building, private or public, if the victims be, like Anguilla or Anageda, small, flat islets utterly defenceless against its onslaught" (Lewis, G.K., 1969).

But just as the Bahamas itself is situated, in a cultural-economic sense, on the periphery of the Caribbean region, so its vulnerability to hurricane strikes is somewhat peripheral. This is not to say that the hurricane threat is unimportant. A significant observable feature of hurricanes in the Caribbean is their unpredictability. Hurricane tracks can be generalized from available data but the idiosyncracies of individual storms make the threat omnipresent.

The Commonwealth of the Bahamas, however, consisting as it does of some thirty inhabited islands and myriads of small cays spread over five hundred miles of the Atlantic Ocean to the south-east of Florida, has never suffered the devastation of a Belize or a Puerto Rico. Few lives have been lost and damage has been slight by comparison. Of the forty-one

hurricanes recorded between 1878 and 1971 that have passed over or adjacent to the Bahamas, few have actually caused significant damage (Lewis, J., 1975). Only a small number of hurricanes at the peak of their ferocity have passed directly over the Bahamas and damage from individual storms has been reserved for one or two principal islands rather than for the archipelago as a whole.

It is against this background that social response and perception of the hurricane threat in the Bahamas can be observed. Such response and perception is obviously governed by the frequency of occurrence and the degree of personal experience. With this frequency and experience spasmodic, awareness of the threat and the ability to counter the threat are more likely to be coloured by legend, hearsay and public information. Despite the infrequency of actual hurricanes, defined more closely as tropical storms with wind speeds of greater than sixty-three knots, storms of lesser intensity are also of great importance to the awareness of the Bahamian people. Topographically, the Bahama islands are extremely flat; nowhere does the land surface rise above 206 feet. Many settlements are, consequently, barely above sea level and, with a general lack of substantial vegetation cover, are exposed to low-intensity climatic vagaries. The assumption is that in many cases hurricanes imply storms of lower intensity if the response is based upon personal recall; the hurricane experience of many Bahamians is limited to legends from older members of family and kin groups. In any discussion of the perception of the hurricane threat in the Bahamas this lack of accurate or unambiguous information must be deemed a vital factor. This factor of itself, in individual terms, may not be a significant problem. However, in terms of public education and community hurricane preparedness, correct information becomes an important issue. Any attempt to assess the degree of perception of the hurricane threat in the Bahamas must realise that much of what appears to be experience-derived information is, in fact, legend-derived or derived from experiences with storms of lower intensity than officially-defined hurricanes. Nevertheless, the implication by association is that storms of lower intensity contain somewhat similar properties to hurricanes and may effect damage related to that described in hurricane legends, although on a smaller scale. This would be expected to hold some truth on the local level given the topographic qualities of much of the Bahamas archipelago.

The Bahamians, thus, assess the hurricane threat in terms of environment, experience and folklore. Theirs, like that of all societies, is a unique response differing, as in many other ways, from a truly Caribbean assessment where experience and frequency of hurricane occurrence would appear to play a larger role and where the natural environment contains considerably greater variation (Lewis, G.K., 1969).

AIMS AND METHODS OF ANALYSIS

Originally the aim of an analysis of individual hurricane perception and awareness in the Bahamas was to test responses to potential hurricane watch/warnings, hurricane strikes and accompanying injury and damage, by testing previous experience, if any, together with any personal projections of attitudes to future events. It was hoped, also, to test the efficiency of current public information services and the suitability of this information for each personal situation.

A questionnaire was devised with a firm but flexible structure to allow the maximum amount of desired information to be elicited comfortably. The questionnaire was divided into four principle sections concerning basic socioeconomic data, previous hurricane exper-

ience, potential future response to a hurricane strike, and perception of the hurricane phenomenon and the damage it may cause [2]. The analysis was based on a random point sample of 0.01 percent of the population of the Commonwealth of the Bahamas current at the 1970 census (168,000). Careful division of survey application between various islands in the archipelago was necessitated by, for example, the presence of New Providence Island containing the capital Nassau, towards which the majority of the population was weighted. Approximately sixty percent of the Commonwealth's population resided on New Providence and consequently sixty percent of the survey was undertaken in Nassau and its immediate hinterland. Of the remainder, it was felt imperative to reflect the differing economic and environmental dimensions of the remaining inhabited islands. Seven islands were, therefore, selected as being representative of the socio-economic conditions not reflected by New Providence. The seven "Family Islands" selected were Abaco, Andros, Eleuthera, Exuma, Inagua and San Salvador.

The original aims of the questionnaire were, to a great extent, satisfied; awareness of existing warning facilities was adequately tested together with individual response to an experienced hurricane strike. A detailed impression of the perceptual depth and capabilities of individuals with no experience of hurricane activity was gained from the survey results. However, it was found difficult to establish the degree of folk-myth present in the response of individuals with no previous hurricane experience. Likewise, an inevitable inability to determine the degree of community environment influence upon individual responses emerged. These difficulties were due, in significant part, to the structure of the questionnaire which made no attempt to make a detailed examination of community response. Nevertheless, the questionnaire did make a useful contribution to an understanding of individual response to the hurricane threat in the Bahamas from which a degree of community response can be pieced together.

THE HURRICANE EXPERIENCE

Two-thirds of all respondents claimed to have experienced a hurricane in their present locality. This figure, in the light of the above discussion, is almost certainly an over-exaggeration. Within the present century only one major hurricane affected a substantial part of the archipelago and that occurred in 1929. Other hurricanes have passed close to the Bahamas and some have certainly passed peripherally over part of the Commonwealth. Yet, other than in 1929, the full force of a hurricane has never been experienced in the Bahamas apart from occasional experiences by individual islands such as Abaco Island's brush with hurricane "Betsy" in 1965. The claimed hurricane experience, therefore, does not necessarily emanate from full-force hurricanes but from other strong, damage-causing storms, from superficial interaction with hurricane perimeters, or from a mixture of these factors spiced with legends probably associated with the 1929 hurricane. Nevertheless, and especially among younger respondents, superficial interaction with passing hurricanes implies, to all intents and purposes, actual hurricane experience because of the amount of warning and other information available via the media for interpretation during the threat phase. Certainly a potential hurricane strike in the Bahamas is often the cause of great excitement because of its comparative rarity. Relatively unique events of this kind, even if the hurricane passes, result in vivid and often embellished mental retention. The fact that individuals merely take part in a watch-and-warning situation and associated preparation activities may be enough to mentally translate the response into actual hurricane experience.

Specification of the actual number of hur-

ricanes experienced produced responses alluding to one experience (hurricane "Betsy" in 1965 or the 1929 hurricane among older respondents) or two experiences, the latter referring most frequently to combinations of "Betsy" and hurricane "Donna" – which passed over the Bahamas in 1960 – or "Betsy" and the 1929 hurricane among older respondents. Non-commital responses, principally the response "many" delivered by one-fifth of all respondents, indicated an inability to distinguish between actual hurricane experience and experience with other storm activity.

Similarly, delimitation of the year in which the last hurricane occurred produced varied responses over and above the expected fifty percent of respondents who gave 1965, the year of hurricane "Betsy", the last major hurricane the affect the Bahamas. Some also offered 1960, the year of "Donna", while older respondents retained vivid memories of 1929. The fact that older respondents offered 1929 rather than 1965 gives some indication of the ferocity of the 1929 hurricane compared with "Betsy". Other submitted dates, principally the years 1969 through 1974, contained no reported hurricane activity. Many of these responses came from inhabitants of the Family Islands like Andros with its exposed, low-lying coastal settlements. Andros residents reported that flooding was frequently a problem, a fact not necessarily requiring hurricane-force storm activity.

Damage

Reported damage in a respondent's locality during the last experienced hurricane varied predictably between New Providence and the Family Islands. The significant difference in the amount of tree damage reflected areal extent and different uses of vegetation. Nearly three-quarters of all respondents from New Providence expressed tree damage as the principal damage type. This does not refer to the proliferate coconut palm which can withstand the strongest of storms. It refers, in the main, to the fact that many avenues and thoroughfares in Nassau are tree-lined, the use of the casaurina for decorative purposes being indicative of Nassau's desire to be attractive to tourists and potential residents. Media reports of past hurricanes affecting Nassau indicate frequent blockage of roads by trees.

In the Family Islands trees as decorative floiage play a less important role and in many cases natural vegetation cover is sparse. Thus Family Island damage response placed less emphasis on fallen trees and road blockage than Nassau respondents. As may be expected, crop damage was of greater significance in the Family Islands than in more urban New Providence. Flooding was also a major damage type reported from both New Providence and the Family Islands.

The surprising factor in damage response was the lack of emphasis placed on damage to dwellings throughout the archipelago. Specifically, it emerged that few dwellings suffered from damage and dwellings in the Family Islands did not suffer greater damage than dwellings in Nassau which contained a higher proportion of buildings of concrete or other more durable material. The reasons for the lack of dwelling damage may be twofold – first, the strength of the storms expressed as experienced hurricanes may not have been of sufficient magnitude to cause substantial structural damage; and second, materials used in house-building and the ratio of wood to stone or concrete is *fairly* uniform throughout the Commonwealth although in the Family Islands dwellings lack the decorative ostentation observed in Nassau and remain simply functional.

Damage to personal dwellings during the last-experienced hurricane was non-existent for sixty-five percent of all respondents, a figure which again challenges the ferocity and

intensity of experienced hurricanes in the Bahamas particularly as the negative responses included both wood and stone or concrete dwellings. Respondents whose dwellings did suffer damage expressed indirect causes rather than causes due to structure, this being particularly true of Nassau. Here tree damage figured prominently as did water penetration; In the Family Islands tree damage was absent but a sizeable minority of respondents reported direct damage. This group was the only expressed indication of the possible greater structural vulnerability of Family Island dwellings to hurricane damage. However, no firm conclusions can be drawn from the data.

Activities

Disseminated warning information before and during the threat phase before a potential hurricane strike stresses the need to remain inside the dwelling during the storm. The majority of respondents reporting hurricane experience took heed of this information seemingly as a matter of course. Conditioned attitudes and responses of this kind are prevalent in the Bahamas, indicating the importance not only of official and institutionalised information dissemination, but also of non-institutionalised family or kin based information sources where the experience of the 1929 hurricane by older family members plays a large part.

Nevertheless, despite this apparently conditioned element in response, many Family Island inhabitants reported that they sought shelter rather than remain in their own dwellings. Yet even this may be a conditioned response based upon legend and circumstantially derived information on the suitability of personal dwellings to withstand hurricanes. Certainly the apparent lack of confidence in personal dwellings casts doubt upon their perceived structural suitability. Moreover, though no respondent reported seeking shelter in Nassau, a small number did remain in a designated place of collective safety such as a school or a church. No Family Island respondent reported staying in a designated place of collective safety implying either a lack of suitable buildings or a lack of information on the part of respondents.

Activities immediately after the departure of the hurricane were related either to repairs and the returning to normality or to activities primarily enacted to ease stiff and tired limbs gained through long periods spent inside the dwelling, or to satisfy curiosity. Chief among these activities was the surveying of damage to the immediate locality, a probable response to the claustrophobic hours spent in a batterned and shuttered dwelling. For the children, post-hurricane activity is directed towards the gathering of fallen fruit.

Activities directed at a return to normality consisted primarily of sweeping up, repairing dwellings or opening them up, with sweeping up of particular importance and probably occurring simultaneously with a survey of damage. Those respondents in designated places of collective safety returned home while others checked the safety of friends and relatives, buried their dead (a rarity in the Bahamas because few lives have been lost in hurricanes especially during recent years), or simply thanked God.

There is no doubt that the occurrence of a hurricane is, for many Bahamians, a time of high excitement tinged with awe and foreboding. Moreover, it is a time of social cohesion. The following is a childhood recollection of the 1929 hurricane as it affected the island of Andros.

> "...most families resorted to an old habit: they deserted their houses if they feared they might fall....and piled into the homes that appeared to be most stable....
> ....The common-sense policy of women....who believed in buying their needs and keeping a little for emergencies, was the working force in these situations. Coal and wood, flour and sugar, cocoa and milk, stored for the next week's

> subsistence were cheerfully hauled out of their storage tins and put at the disposal of all....
> ....We sang and prayed and tumbled from side to side as the house rocked on its shaky wooden groundings....if one went to sleep he missed the old stories that were going the rounds among the adults. A terrifying but happy experience. When the hurricane abated the adults gave loud praise to God, the children rushed to the outside to gather and plunder....In our childish simplicity, we actually looked forward to the next hurricane when the batterning and hammering could be heard for miles around, and excitement mounted at an equal rate to the wind's increase" (Ford, 1971).

Hurricane Recurrence

The sparse and spasmodic hurricane history of the Bahamas influenced respondents concerning the recurrence of hurricanes similar to those experienced. While few negative responses were given, positive responses were overshadowed by the non-commital category. More surprising, on islands with some hurricane history, this response type nevertheless expresses the nature of hurricane occurrence in the Bahamas.

PERCEPTION OF A FUTURE HURRICANE THREAT

Experienced hurricanes, to a great extent, were expressed in terms of implied variations in magnitude. Assessment of responses from respondents stating hurricane experience indicates a strong degree of uncertainty. Several factors emerge which are relevant to a discussion of the perception of future risk.

First, the factual hurricane history of the Bahamas reveals little activity of a magnitude severe enough to cause substantial damage.

Second, awareness of the hurricane threat among the majority of the population appeared as a mixture of legend from older family and kin and personal experience of *all* strong storm activity. The result produced a certain amount of confusion.

Third, given the sparse hurricane history of the Bahamas and the concommitant relative uniqueness of each full hurricane strike to individuals, it is surprising that of those stating previous hurricane experience, the majority could not recall the vivid detail that might be expected from participation in a relatively unique event. The exception to this was the clarity of recollections from older inhabitants who had experienced the 1929 hurricane. Of these inhabitants, almost all recalled the 1929 hurricane in considerable detail but made little or no reference to more recent storm activity. Younger inhabitants, conversely, expressed recent storm activity as hurricane activity whether or not this was factually substantiated. Often descriptions of experienced hurricane damage and activity were coloured by information culled from other events of lesser significance or were legend-derived, principally, it is suggested, from the 1929 hurricane. Older inhabitants pointed out that it was to be hoped that a hurricane similar in magnitude to that of 1929 would not occur again. They were anxious to curb the wishes of younger family members to experience a full hurricane.

These factors considerably influenced respondents' perceptions of the hurricane risk *whether they expressed previous hurricane experience or not*. It is clear that most younger respondents believed that whatever experience they considered themselves to have undergone, they had yet to experience hurricane activity of great magnitude.

Asked to assess the likely degree of damage to their personal dwelling during a future hurricane, nearly half of the respondents from New Providence considered that damage would be substantial. A great number of these respondents had professed previous hurricane experience and had stated that, according to this experience, damage to personal dwellings was slight or non-existent. Awareness, thus, was adjusted when respondents were asked to assess *potential* risk. All risks were perceived as hurricane risks but hurricanes as a perceived

concept included a greater range of magnitudes and frequencies than hurricanes as officially defined. The significance of this is discussed elsewhere; often official hazard definitions do not coincide with community or individual hazard definitions leading, thus, to a dichotomy between action taken and action demanded [3].

Almost one-third of respondents from Nassau and New Providence also offered responses in the "unknown" category. Many could not perceive likely damage to their dwelling, a legitimate and comprehendable response among those with no previous hurricane experience but an unlikely one among those with stated experience. This again reflects the syndrome so typical of the Bahamas experience: full-force hurricanes are infrequent but publicly warned against, individuals are asked to prepare for a possible strike which does not occur – only the peripheral effects are felt. Therefore, hurricanes *occur* in that awareness upholds their proximity with a prompt from the media and family legend, but hurricanes *do not occur* in that perception of the effects of a full-force hurricane is keen. Responses from Nassau indicate a lack of consensus concerning potential damage to a personal dwelling. The hurricane is to be feared as an unknown quantity. Such a consensus was found to be further lacking in the Family Islands. The most sensible and carefully judged responses perceived potential hurricane damage as a function of the intensity of the storm. The majority of respondents, however, could make little detailed assessment of likely damage.

Post-Damage Activities and Aid

Further responses concerning where respondents would go if personal dwellings were badly damaged in a hurricane indicated a similar but not unexpected lack of consensus. Difficulties in the assessment of hurricane magnitude plus difficulties in the assessment of potential damage led to a lack of perception of action likely to be taken in the event of substantial damage to personal dwellings. Responses tended to reflect the different normality emphases of individuals – financial loss, safe home environment, desire for government involvement, etc. Government facilities, the homes of relatives or friends, insurance companies, banks, and the Red Cross are given as places of possible refuge (if not physically then financially in the case of banks and insurance companies). A significant feature of these responses was the different emphasis placed on the value of government facilities or potential help in the Family Islands when compared with Nassau. Under twenty percent of respondents in the Nassau group indicated that they would attempt to locate a government designated safe place whereas nearly forty percent of Family Island respondents would rely on government sources of protection by removing themselves to a designated safe place, by seeking out their Representative or a government member, or by reporting to the local government Commissioner for their island. This may seem paradoxical because of the obvious proximity of Nassau respondents to government and the concommitant remoteness of Family Island inhabitants. Yet urban environments, by their very nature, lead to a remoteness and suspicion of the activities of the national executive and physical proximity to government also implies proximity to the machinery of bureaucracy which is frequently defined, at grass root level, as cumbersome. In the Family Islands, alternatively, Commissioners are appointed by the government to run the affairs of the islands on a local basis. Each Commissioner deals with a comparatively small population and a society devoid of the tensions of urban life. Consequently, the Commissioner is an integral part of a relatively stable social environment and tangible proof

that the government cares; so remoteness is, in most cases, not felt by Family Island inhabitants. Family Islanders, thus, have no hesitation in placing their trust and confidence in government sources for assistance.

The factor of government and the dichotomy between Nassau and the Family Islands is reinforced by perceptions of potential aid following a hurricane. Respondents from Nassau gave the cynical majority verdict of no expected aid at all from any source, a response indicative of apathy and a lack of faith in the people in control or in a position to offer aid. In the Family Islands the single biggest response pointed to government sources of aid and yet the majority of these responses indicated remoter political figures, such as a member of the executive, rather than the Commissioner who is accessible. It can be assumed that the Islanders, in close contact with their Commissioners on a day-to-day basis, would know of his limitations in situations of community stress demanding corporate action.

Over fifty percent of all respondents, however, had no knowledge of anyone who had received help after a hurricane, this despite the large majority claiming previous hurricane experience. Yet implied attitudes differed between Nassau and the Family Islands. In the latter, for example, responses expressed a contented reliance on the fact that aid, particularly from government sources, would be forthcoming if the situation arose whereas impressions gained from Nassau were of a cynical fatalism.

Damage Reduction

A majority of respondents throughout the archipelago had knowledge of some methods of damage reduction. A substantial minority did not know how to reduce damage even on a simple level but this cannot necessarily be attributed to ignorance but rather to a lack of interest in the question. Positive damage reduction types can be summarised as follows for New Providence.

1. General activities associated with batterning up. Batterning up is the most consistently undertaken of all protective acts being positively associated with the physical protection of the home. Most homes in the Bahamas carry shutters for covering windows and batterning up activities (which include any action promoting the physical security of the dwelling) are subconsciously and regimentally carried out in response to hurricane threat situations as prompted by environment or media derived warnings.

2. Cutting down trees was an activity relevant to Nassau in particular in the light of earlier discussions concerning witnessed hurricane damage. Many Nassau residents considered tree damage, either from actual experience or from media-derived information, as the single most probable cause of damage from an indirect source.

3. Securing or neutralising other factors likely to cause damage indirectly such as television aerials, loose objects around the house – for example, oil drums or trash cans – and the shutting down of electric power.

In the Family Islands responses concentrated almost solely on batterning up activities with smaller supplementary and elaborative items showing a similarity with responses from Nassau – the cutting down of trees, the removal or securing of dangerous objects, and the cutting off of electricity. Other supplementary responses were legend-derived – for example, keeping the part of the house directly facing the hurricane empty or leaving one door open while the storm is in progress. These responses indicate the educational role of past hazard perception as expressed through family and kin information sources. Further responses looked to the long-term – the reduction of damage by building in stone, building on higher land or constructing shelters.

Warning Sources and Information

The Commonwealth of the Bahamas is well served by media through which hurricane warning information can be disseminated. Radio Bahamas, providing an inter-island community service operating from Nassau, was established in 1936 principally to disseminate hurricane warning information. This may have been in direct response to significant hurricane or near-hurricane activity during the years from 1926 through 1929 (Lewis, J., 1975). The reliance of the Bahamas' population on information via the radio is heavy, ninety-five percent of all families in the archipelago owning a radio with many owning two or more. Television is unimportant outside of Nassau and, therefore, of little use as a medium for hurricane warnings. Radio reinforcement from mainland radio stations in Florida is profuse, these stations being easily obtainable on radios throughout the Bahamas. The situation of the Commonwealth adjacent to the Miami National Hurricane Center aids the speedy diffusion of up-to-date information and plotting. Given these facts, perceptions of the principal sources for hurricane warnings were predictable and as follows:

1. Great emphasis was placed upon the reception of hurricane warnings from radio sources in both New Providence and the Family Islands.

2. Televisions were only given as sources of warning information in Nassau, this reflecting the lack of television sets in the Family Islands.

3. Among minor responses, some took warning information back to its original source stating that hurricane warnings are available from the United States or the meteorological office.

4. Other minor responses from the Family Islands referred to the Commissioner or the local hurricane committee as sources of warning information. These were obviously insignificant compared with radio warnings and had little relevance to overall warning psychology. The hurricane committees do produce and display warning information but it must be remembered that committee members would obtain their information from the same radio source as the rest of the community.

Respondents expressed the kind of information they would like to receive during a hurricane watch-and-warning in terms of their own practical experience of previous warning situations. The information respondents wished to receive was also expressed, in many cases, as information *actually* received in the past. Two categories emerged – warning information including specific instructions concerning personal and community precautions and preparedness, and information concerning the physical properties, magnitude, intensity and locational status of the actual storm.

By far the greatest number of respondents required to know when to take precautions, either expressed in direct terms or through statements indicating imminent and genuine danger.

Descriptive information concerning the actual storm was demanded by one-quarter of all respondents although the detail of the information required depended upon individual priorities and circumstances. Thus, a range of responses emerged as follows:

a. The direction in which the hurricane is travelling.
b. The location of the hurricane vis-à-vis a respondent's personal location.
c. The wind velocity of the hurricane.
d. The distance of the hurricane from a respondent's location and its estimated time of arrival at that location.
e. The strength of the hurricane – that is, the likely destructive capacity.
f. The likely size of the waves accompanying the hurricane.

It can be assumed that the optimum degree of warning information for inhabitants of the Bahamas should contain mention of both

storm status and necessary precautions and preparedness. Most respondents do not require to know what specific precautionary action to take but rather *when* to take precautions or the degree of likely danger. Most respondents appeared to be satisfied that if they were told to take precautions, they could undertake the necessary action without further prompting.

This is reinforced by the number of respondents who considered themselves to be reasonably well prepared for the next hurricane. Questions concerning the perception by an individual of his state of preparedness asked respondents to place their perceived state into one of five categories – very well prepared, well prepared, adequately prepared, poorly prepared and very poorly prepared. A large majority of all respondents gave one of the middle three categories, although the biggest single response in Nassau expressed 'poor' compared with 'adequate' in the Family Islands. Thus, most respondents did not overstate their preparedness preferring, as with the perception of future hurricane activity, to remain cautious and guarded.

Folk-Based Perception of Hurricane Properties and Signs

Individual assessment of the hurricane hazard in the Commonwealth of the Bahamas is derived from legend and media information reinforced by actual experience of a wide range of storm activity. Legend-derived information comprises compacted and embellished factual material from past hurricane activity directed through family and kin education functions plus traditional folk-myth themes concerning hurricane properties and warning signs. These folk-myth elements constitute more primitive but astute attempts to comprehend and measure the hurricane hazard outside of official and formal institutionalised information sources.

The first category of folk-myth responses concerned the methods utilised by respondents in the recognition of the approach of an imminent hurricane other than by formal warnings via the media. A wide range of responses was collected, often lengthy and colourful in character and based upon personal perceptions of the natural environment. In summary, the majority of responses from New Providence expressed the approach of a hurricane in terms of perceived weather changes in general or specific weather changes such as changes in the wind. One-quarter of respondents from New Providence expressed no way of recognising the approach of a hurricane other than via official warning media. Two reasons were primarily responsible for the existence of this response category:

1. A lack of personal hurricane information either legend-derived or experience-derived. Many older inhabitants would not have experienced the 1929 hurricane (because it did not affect all locations) while younger inhabitants may have avoided recent hurricane or near-hurricane activity. The combination of these factors, especially among respondents born after 1925 (that is, too young to have vivid personal memories of the 1929 hurricane, if experienced), produced limited perceptual capabilities and a strong reliance on official information.

2. The prominence of attitudes reflecting the relative velocity of hurricanes, a velocity perceived by some respondents as great and, in the absence of official warnings, too great to judge or estimate the storm's arrival in time to prepare for a strike. Such responses were fatalistic in tone and revealed a respondent's preference for official warning information – some respondents did not care to trust their own perceptual capabilities.

Smaller response categories expressed the behaviour of domestic animals and birds as a method of assessing the imminent approach of a hurricane, neighbours telling each other (although it is not clear how the information

would begin to circulate), the stillness of the trees, by telephoning the meteorological office (although the time to do this was not stated), and the build-up of the sea.

The following are examples of actual responses given in Nassau and New Providence:

"The wind blowing from the north-east to the north-west is a sure warning."
"You pick it up from the uneasiness in the air."
"A yellow sky."
"Watch the animals – the birds come on land."
"Listen to the wind."
"Look at the skies – look for the cloud build-up."
"Only by telephoning the meteorological office."
"Clouds flying along the sky."

The situation in the Family Islands was similar to Nassau in summary – the major response categories referred to weather changes while changes in the wind were again specifically mentioned. A greater number of respondents expressed no way of recognising the approach of a hurricane other than through official warning media, a slightly surprising figure (almost forty percent) given the relative lack of proximity in the Family Islands to more sophisticated technological and other information stimuli compared with Nassau residents. However, the explanation may be sought in the comfort felt by many Family Island residents in the participatory relationship many of them have acquired with local Commissioners and government representatives. Mention of the sea and its alteration prior to a hurricane strike constitutes a larger response category in the Family Islands as might be expected with so many low-lying, coastal settlements, some with fishing as the predominant economic activity. Other responses referred to the use of "The Almanack", an old book which lists past storms and their locations. This response was given principally by older residents who considered that referral to the "Almanack" would aid in predicting whether an imminent hurricane would strike their community or not. Religious fatalism was also expressed – "It depends on the Lord" – while use of the barometer was surprisingly mentioned in the Family Islands while being absent from Nassau responses.

The following actual responses from the Family Islands are indicative of significant folk-myth elements in hurricane perception:

"Watch the clouds and the design of the sky, changes in the sky. There's a red glow in the sky if a hurricane is coming."
"You look for a branch in the east and a branch in the west with a rainbow in between to the north of the sun and that's a hurricane travelling."
"No, if you don't get a warning, you don't know."
"The whole place goes dry and then the sea comes back."
"The hurricane birds come before it."
"The barometer is dropping and you get the feel in the air."
"There's no wind and it's very hot."

Hurricane formation and its processes and locations are complex climatological issues. Not unexpectedly, the majority of respondents understood little of these processes. Nevertheless, any assessment of responses to questions concerning where hurricanes come from must be viewed in the light of information available to individuals in the form of hurricane tracking maps issued by the printed media, by commercial companies and by local hurricane committees. Such tracking maps, allowing people to follow the progress of imminent hurricanes, might contain information about hurricane formation similar to the following:

> "A West Indian hurricane is by definition an intense tropical storm with roaring winds rotating around its center, or 'eye', at 74 miles per hour or stronger.... At birth it begins to form when moist air, heated by the sun, rises from the surface of a warm tropical sea. It

> funnels up in a natural updraft much as hot air in a house is drawn up a fireplace flue. The moist air rises, cools and condenses into rain. In this condensation process, huge amounts of heat are fed back into the air to add to the force of the storm's updraft and thus provide a main source of the hurricane's power. As the air goes spiralling upward, more hot, moist air rushes inward from all sides to replace it and keep the updraft moving. The motion of the earth's rotation eastward deflects these inpouring currents to one side and, north of the equator, starts a counterclockwise movement. Then the winds whirl faster until they reach 74 miles per hour when the storm officially becomes a hurricane" (Esso Standard Oil S.A. Ltd., 1964).

Such descriptions of hurricane formation, though considerably simplified, still require a knowledge of climatological processes and concepts such as condensation or the Coriolis Force for adequate comprehension. This detailed knowledge is likely to be absent in most people and the Bahamians are no exception. Thus, from an analysis of responses as to where hurricanes come from, the following points emerge:

1. Responses were expressed in terms of the location of the primary area of hurricane-generation serving the Bahamas, or in terms of an estimation of the processes involved in hurricane formation.

2. The range of response categories indicate no real knowledge of hurricane formation among respondents. Responses tended to be vague and contained limited knowledge.

In Nassau many responses included elements of hurricane formation even though actual processes were not understood. Thus, expressions such as 'air pressure' or 'hot air' were frequently given while others associated hurricanes with depressions, the sea (and more specifically, the bottom of the sea), or hot and cold air. All these responses contained an element of truth in that they referred to parts or elements connected with hurricane formation as given in the simplified example above. Other 'process' responses, however,contained myth-derived concepts and notions – for example, the association of hurricanes with mountains (an allusion to the proximity of the Bahamas to mountainous Eastern Cuba across which hurricanes are known to have travelled on their journey northward), and the more extreme 'earth eruptions'.

Locational responses referred to hurricanes emanating from 'the south' in general terms, or 'the Gulf' or the Caribbean in more specific terms. Other responses dismissed the question with a flippant 'they just build up'. Examples of actual responses from Nassau and New Providence reveal the infiltration of folk-legend and religious factors:

"From the bottom of the sea or behind mountains – heat trying to get out."
"Only God can answer that."
"Hot and cold air fusing together."
"From heat, but wind develops with squalls, etc."
"The sea has something to do with it."
"Earth eruption."
"They form in the Gulf but the Lord knows where it comes from. A hurricane is just like the devil."

In the Family Islands the sea again played a major role in response patterns. The largest single response category referred to the manifestation of hurricanes from the sea or the bottom of the sea. Further responses referring to processes of hurricane formation expressed air pressures, hot air, depressions or hot and cold air as primary forces along with vaguer expressions alluding to changes in the weather or atmospheric disturbances. Other 'process' responses retained folk-myth qualities and included mountains, tornadoes (an astute analogy to the circular wind pattern associated with hurricanes), combustion, and a 'hot planet' (although the actual planet was not specified). Locational responses included 'the Gulf' or the Caribbean and 'the east and west'.

Specific responses from the Family Islands reveal further reliance on folk-myth or religious themes in the assessment of hurricane processes and locations, to a greater degree

than responses from Nassau:

"From the bottom of the sea and it whirls round like a whirlwind."
"Tornado developing and growing into hurricanes."
"Sometimes from the east, sometimes the west."
"Basically from Miami depressions."
"Combustion, some kind of churning up, a certain gas."
"From the valley of a mountainous place, from heat."
"I'm sure it ain't God's work."
"Flat area between mountainous land."
"The ocean, but God stirs it."
"By pressures of wind, low and high, cold and hot meeting and this causes a circular movement and motion."
"From the Bible. Made by God to destroy wicked men in wicked cities – the disobedience of man."

In the Caribbean there exists a folk rhyme which succinctly summarises the official hurricane season. It is sometimes quoted in the Bahamas and runs as follows:

> "June too soon
> July stand by
> August it must
> September remember
> October all over." (Edwards, 1961)

Thus, the official hurricane season, publicised by government and the media, occurs between the months of June and October – it is the period of most intense hurricane activity. Of course, hurricanes do not always conveniently occur between these months – rogue hurricanes have been known to occur in the Bahamas well outside the official season but these are a rarity.

Nevertheless, and even allowing for certain fluctuations from the officially designated season, inhabitants of the Bahamas are not clear when to expect hurricanes. Twenty-five permutations were given, some including the months of the official season but many including only part of the season. Some, indeed, fell right outside the official season. For example, of the response categories from Nassau and New Providence, only four included the months from June to October while ten included part of this period. In the Family Islands only three responses included all the months from June to October while twelve categories included part of this period. Four categories from the Family Islands fell right outside the officially designated season.

The reason for this extraordinary range of responses is unclear but certainly it can be assumed that responses are based on legend and personal experience rather than official information sources. An earlier discussion has revealed the large part played by storms of below hurricane strength in the personal assessment of hurricane experience and with many of these storms occurring outside of the official hurricane season it is clear that this kind of personal experience may have influenced the stated period for hurricane occurrence.

SUMMARY AND CONCLUSIONS

Hurricane occurrence in the Commonwealth of the Bahamas is infrequent and spasmodic. The archipelago, historically, has only been visited by full-force hurricanes on a few occasions. Hurricanes frequently pass adjacent to the Bahamas so that only peripheral effects are felt. However, numerous tropical storms of below hurricane strength do occur and these play a considerable part in *hurricane* response and perception by inhabitants of the Bahamas because of the proliferation of low-lying coastal settlements lacking shelter from substantial vegetation cover which are vulnerable to damage from low-intensity climatic events. The high-intensity hurricane of 1929 affected substantial numbers of the population of the archipelago and was vividly recalled by many older respondents. Post-1929 hurricane

activity has been documented, including hurricane "Donna" in 1960 and hurricane "Betsy" in 1965, but although these caused considerable damage to some islands, the magnitude of the storms appears to be somewhat lower than that of 1929 and to have affected a smaller population. Attitudes to past hurricane activity are, therefore, attitudes to perceived damage-causing storms of varying intensities coloured with legend-derived information from predominantly family and kin sources, generated particularly from the experiences of older residents who recalled the 1929 hurricane. Perception of future hurricane activity is a function of past experience and legend-derived information adjusted, in most cases, to take account of the fact that most residents believed future hurricane activity *might* be substantially more severe than that already experienced.

Respondents who professed experience of previous hurricane occurrence placed greater emphasis on damage done to the area within which their home was located than on damage done to their personal dwelling. Two conclusions can be drawn from this: first, that dwellings, generally, were adequately constructed; and second, that the particular hurricane experience alluded to was not of sufficient intensity to effect much damage upon dwellings.

The majority of respondents reported remaining inside their dwelling during the last experienced hurricane which they are advised to do by hurricane safety information disseminated before and during the warning and threat phases prior to a strike. Those respondents in the Family Islands who did not trust the safety of their own dwellings often stated that they were uncertain where to seek shelter. In Nassau, respondents leaving their homes sought shelter in government designated places of collective safety such as schools or churches. Family Island residents did not appear to have the same information concerning safe places as Nassau residents.

The majority of respondents considered the possibility of another hurricane, similar to that experienced in the past, to be likely. However, there was no consensus on the question of where people should go if their house was substantially damaged in a hurricane. This again suggests a lack of adequate information on the provision of safe places.

Indeed, one significant feature of future hurricane perception was the dichotomy between respondents from Nassau and those from the Family Islands on the matter of reliance on government sources of aid after a hurricane. While considerable aversion to reliance on government sources of aid following a hurricane was expressed in Nassau, in the Family Islands this reliance was an important factor, expressing the close relationship between Family Island residents and government-appointed local Commissioners. After a severe hurricane in Nassau the government would undoubtedly be required to provide aid and, in order to instigate a change in attitude on the part of Nassau residents, it would need to be *seen* to provide aid.

Generally, respondents were satisfied that the currently operating warning service, particularly via the radio, worked satisfactorily. Respondents required warning information first, on when to take precautions, and second, on the imminent hurricane's physical properties and progress. This reflects individual and community priorities.

Respondents considered themselves to be adequately well or adequately poorly prepared for the next hurricane. In general there existed a lack of specific concern which reflected a feeling among inhabitants of the Bahamas that they could cope with most hurricane situations adequately. This may be considered a false complacency if judgement was based on previous experience with storms of below hurricane intensity.

Folk-myth methods of observing the approach of an impending hurricane (other than via the

official warning system) were varied and colourful and provided reinforcement to warnings from official channels. Similarly, while little knowledge of hurricane formation and the location of the areas of hurricane-generation was expressed, many respondents utilised folk-myth or religious interpretations of these climatic processes which, in many cases, partly coincided with climatic fact. It would not be necessary for residents to know in detail the facts concerning hurricane-generation as this would do little to aid an individual's perception of hurricane occurrence nor his interpretation of warning signs. However, interpretation of the hurricane season produced a wide range of responses, many falling outside of the officially-defined season of June through October when the most intense hurricane activity can be expected. Obviously, and with the considerable lack of actual previous hurricane experience evident among inhabitants of the Bahamas, official stressing of the months of greatest vulnerability (with adequate warning of the *possibility* of hurricanes occurring outside of the stated period) would aid overall preparedness.

NOTES

1 This paper describes the results of a questionnaire survey which attempted to suggest the extent of attitudes to and perception of the hurricane threat in residents of the Commonwealth of the Bahamas, as part of a mission to review and make recommendations on the state of predisaster planning in that country, undertaken, during November 1974, by the Disaster Research Unit, University of Bradford, England, on behalf of the League of Red Cross Societies. The author wishes to extend his thanks to the League of Red Cross Societies for their kind permission to reproduce this material.

2 The full questionnaire survey form utilised during the survey is reproduced in Lewis, J. (1975), Appendix 8, pp. 71–72.

3 Differences in hazard perception between resource users and planners are explained in Burton and Kates (1964).

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