

INTRODUCTION

It is important initially to provide a context for the discussion of mitigation that follows. For many terms, there is a lack of standardization of meaning. For example, the term of "hazard" reduction is used primarily by those with specific interest in hazards per se. Also, the term "risk" reduction is often used as an equivalent term. The preference here is to use the term "mitigation." Mitigation itself has become somewhat standardized as one of the four phases of disasters, including, besides mitigation, preparedness, response and recovery. These phases are best seen as circular, rather than linear. As some studies have suggested, the recovery period may be an appropriate time to initiate mitigation strategies. The "circular" pattern of phases is a useful "metaphor," even if the delineation of the phases is sometimes difficult. For example, preparedness activities can be considered as one element of "mitigation." Some of the studies mentioned later do discuss various preparedness measures, either at the personal or community level.

The concept of mitigation includes "policies and actions taken before an event which are intended to minimize the effects of damage and injury when an event does occur." (Drabek, Mushkatel and Kilijanek, 1983, p. 12) Within that definition, I will include not only activities which attempt to reduce vulnerability, such as land use planning, zoning and building codes, but also efforts to spread costs, which is at the base of efforts to develop hazard insurance. I have also included studies of how people perceive risk since such perceptions are important in the adoption of mitigation efforts.

The discussion of mitigation here will be on seismic risks. This introduces some artificiality, since the trends in most social science research is to see mitigation in generic, rather than in specific agent, terms. That is, the trend is to consider mitigation as a social process which cuts across specific agents. This generic view is difficult to maintain since most researchers in the geophysical/atmospheric sciences are concerned only with a specific hazard--such as earthquakes, floods, wind, etc. Also, most government agencies which operate programs to fund research or to implement mitigation activities focus on a specific hazard. So the emphasis on a single hazard is reinforced by both scientific and bureaucratic considerations. While the discussion here will be delineated to seismic hazard mitigation, not all of the research mentioned had that simple focus.

University of Delaware
Disaster Research Center

PRELIMINARY PAPER
#163

SOCIAL SCIENCE RESEARCH ON EARTHQUAKE
HAZARD MITIGATION:
RELEVANCE FOR POLICY AND PRACTICE

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1991

Prepared for International Symposium on Building Technology and
Earthquake Hazard Mitigation, March 25-29, 1991, Kunming, Yunnan,
People's Republic of China.

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SOCIAL SCIENCE CONCERNS WITH EARTHQUAKE HAZARD MITIGATION

The research on which this discussion is based comes from several different streams. There has developed, in the last several decades, a considerable volume of social science research on "disaster," much of it in the United States. (For an excellent summary, see Drabek, 1986.) Only a small part of the research tradition, however, has focused on mitigation, per se, let alone earthquake mitigation. Certainly, none of the major research traditions have had mitigation as a central concern. One stream of work, primarily identified with the Disaster Research Center, has been conducted by sociologists and has focused on organizational and community response during the emergency period. That is, this research effort focused on the response phase and, to a certain extent, on the preparedness phase, rather than on mitigation and recovery. A second stream of work, often identified with the work of Gilbert White and other geographers, examined the effects of human intervention on the natural environment. While much of the work on mitigation evolved from this orientation, the initial effort and much of the subsequent work has centered on floods, rather than earthquakes. Floods were "closer" to the intellectual interests of such geographers. A third, more recent development has been work centering on risk as a concept itself. This has attracted a more eclectic group of scholars and was prompted more directly by the emergence of new "non-natural" risks, especially those found in the technologies in the industrial and industrializing societies. None of these three major areas of research have given central attention to mitigation or to seismic risk.

On the other hand, one could argue that the social sciences, in more general theoretical terms, have contributed in many ways to the understanding of mitigation. In the first instance, the social sciences have always studied the relationship between social life and its environment, including hazards. In the broadest sense, the "adaptations" which various societies have made to hazards over the centuries constitute an important basis of understanding, especially in light of the fact that no society has ever failed because of its inability to deal with seismic risk. This constitutes one rather understudied aspect of mitigation. A second aspect of mitigation is understanding activities which are planned to reduce seismic risk. Mitigation, thus, is part of a larger understanding of "planned change." Many current mitigation efforts seek ways to get individuals or various social groups, including communities, to engage in behavior which would reduce their vulnerability to certain risks or to accept forms of protection, such as insurance. In these ways, understanding past adaptations or implementing planned change, mitigation can be viewed as a traditional concern of the social sciences.

Tierney (1989), in her extensive treatment of mitigation as a social science concern, has argued that past research has been atheoretical and primarily guided by pragmatic policy concerns. She also suggests that researchers have considered mitigation to be the most political and value-laden among the four disaster phases. Consequently, mitigation research has also attracted the attention of policy and public administration researchers. While this is an accurate description, within the sociological tradition, it would be accurate to suggest that such research has been rooted in attempting to understand planned change. In that sense, it has a number of similarities to research on programs intended to improve and enhance public health and safety.

EXISTING RESEARCH RELEVANT TO MITIGATION POLICY

Perhaps the most useful way to summarize existing research is to identify certain common assumptions which are made about the implementation of mitigation efforts. A series of casual steps are posited here which can be stated in the following terms--IF SCIENTISTS INFORM THE PUBLIC THROUGH THE MEDIA ABOUT SEISMIC RISKS, THE PUBLIC WILL GIVE THEM HIGH PRIORITY AND TAKE APPROPRIATE PERSONAL ACTION. THEY WILL ALSO ENCOURAGE POLITICAL LEADERS TO GIVE HIGH PRIORITY TO MITIGATION ACTIVITIES. Looking at that formulation in various parts provides one way to summarize research

IF SCIENTISTS INFORM THE PUBLIC THROUGH THE MEDIA...

While "scientists" have a considerable amount of credibility among the American public, so do other ways of gaining knowledge. For example, Turner, Nigg and Paz (1986, Chapter 10), in their study in California, showed that there was extraordinary faith (84%) in the ability of scientists to predict earthquakes, either now or in the future. The respondents were also overwhelmingly favorable toward science. On the other hand, 31 percent of the sample were also convinced that others besides scientists, could predict earthquakes. Psychics and mystics were mentioned most frequently. In addition, the sample indicated that reports of unusual animal behavior should be given the same seriousness as a prediction from a well-known scientist. The study was able to divide their sample into several categories, separating those who only believed in scientific predictions and those who also believed in other non-scientific possibilities of prediction, which they labeled "believers." Believers constituted 55.7 percent of the sample while those who "believed" only in scientific predictions were 28 percent. Furthermore, the "believers" had taken more personal preparedness actions than those who were strictly "scientific" in their beliefs.

The study also indicated that the "public" used a number of different media sources, especially television, but they sought to

clarify and evaluate the information from the media through discussion with family members, friends and neighbors. In fact, those who supplemented the media information by interpersonal discussion made them more aware of an earthquake threat than those who depended on the media alone. In addition, those persons were more likely to have taken steps to prepare for an earthquake. In effect, this study indicates that neither sole dependence on scientific knowledge nor sole dependence on media presentation is sufficient to prompt behavior to mitigate seismic risk.

...ABOUT SEISMIC RISKS...

There has been a considerable amount of research on how people perceive risk. The perception of risk is generally seen as being more important for understanding mitigation actions than are the risks which are stated in probabilistic terms. In a recent study of persons in four California counties, Palm (1990) found no consistent relationship between objective measures of seismic risk and the risks which were perceived. She commented, "Despite the efforts of state and federal agencies to produce and disseminate information about earthquake risk and microzonation, no statistical correlation was found between perceived and actual geophysical risk. This finding suggests a major failing in the translation of scientific information into public understanding....Clearly agencies charged with improving public information must reexamine their strategies and come up with new ways of communicating scientific findings to the general public." (Ibid, Pp.122-123)

...THE PUBLIC WILL GIVE THEM HIGH PRIORITY...

It is clear that the priority that the public gives to seismic risk depends on how they are asked about it, the context in which the question is asked, the comparisons which the person is asked to make, and the location of those responding. In addition, the "public" is a very heterogeneous category and, within that, there may be subgroups that respond quite differently. There is much evidence on this complexity. Turner, Nigg and Paz (1986), in interviewing 1450 persons in southern California, started their interview by asking for the three most important problems facing the residents of that area. In that context, with three choices, only 35 people, or 2.4 percent, mentioned earthquakes. They next asked, "if a friend was moving to southern California in the near future, is there any particular problem you might warn them about...?" About 64 percent said "yes" and these 904 respondents were then asked to identify that "problem." Only 26 people responded "earthquakes." Obviously, questions asked in this way reflect the low salience of seismic risk, even in a geographic area where a number of earthquake precursors, including the Palmdale Bulge, has been given considerable media attention. The publicity

previously given to those events did not produce high salience for seismic risk in that sample.

In addition, further along in the same interview, respondents were asked to make judgements about how they would like to see additional governmental funds used for different types of projects. Funding for earthquake preparedness is favored in comparison to funding for parks and recreation and slightly favored over flood control. (See Figure 1.) But earthquake preparedness is ranked far below expenditures for improving police protection and hospital services and especially below expenditures for better public education.

...AND TAKE APPROPRIATE PERSONAL ACTION....

In addition to the relatively low salience and priority which was given to seismic risks, the sample was asked what type of personal earthquake preparations they had taken. Even counting steps which usually are done as a consequence of owning a home, such as having a flashlight or owning a battery-operated radio, the study concluded that over 25 percent of the respondents would be without emergency light and 45 percent could not follow emergency broadcasts. While, in general, the earthquake preparation overall was very low, households containing children and owner-occupied households showed more seriousness in adopting a greater range of preparedness activities. (Ibid, Chapter 7) In general, studies suggest that individuals may not take significant action to personally prepare because they see mitigation as primarily a governmental responsibility. Consequently, understanding the perceptions of local political elites may be an important clue to understanding how mitigation programs are implemented.

....THEY WILL ALSO ENCOURAGE POLITICAL LEADERS TO GIVE HIGH PRIORITY TO MITIGATION ACTIVITIES....

Rossi, Wright and Weber-Burdin (1982), in a sample of 20 states and 100 local communities, surveyed more than 2000 political elites picked from sectors of the state and local power structure related to the management of environmental risk. The states and local communities "represented" perhaps three quarters of the U.S. population in 1977 living at risk from floods, tornadoes, hurricanes and earthquakes. This study produced a number of "findings"; only a few will be highlighted here. For example, each respondent was asked to rate the seriousness of 19 potential state and local problems, including five environmental hazard problems. In all states the most serious problems were inflation, welfare, unemployment and crime and the least serious were floods, hurricanes, tornadoes and earthquakes. In the aggregate, pornography was seen as a more serious problem than any natural hazard problem. In general, the best predictor of the seriousness

attributed to hazards was prior experience with disaster. While disaster experience raises the salience of hazards management issues, it did not result in any clear consensus as to what policy should be undertaken. There was general agreement that something should be done but no agreement on what. One other interesting finding was that state elites considered hazard problems more serious than did local elites. This also leads to the possibility that different governmental levels will have differing views as to the importance of mitigation problems. Part of this difference may come from the fact that at the state level there exists a coalition with a greater "occupational" interest in hazards. Such a coalition, however, does not exist at the local level. the more overwhelming finding of this study is that natural hazards are not seen as especially serious by politically influential people in most states and local communities.

While the study design included 20 states and 100 local communities, it also included a special study on nine communities in California where, in addition to the elite sample, there was a block quota sample of residents. In the California context, like their political elites, residents rank natural hazards low on their agenda of political concern. In 1977, earthquakes, fires and floods were all seen to be less serious problems than pornography and much less serious than matters such as inflation or crime. (See Table 1) There was substantial agreement on the rating on these issues between the general population and the elites of California. Concern for natural hazard problems in California are highest among younger and less affluent respondents and among relative newcomers to the state. (This leads to the suggestion that the longer one resides in California, the more jaded one becomes.) While residents do not see natural hazards as serious, they do exhibit concern about what would happen to themselves and their families. The authors suggest that Californians see natural hazard problems as private troubles rather than political issues. This suggests that they may be more willing to support mitigation efforts which are directed toward individual action, such as purchasing earthquake insurance, than mitigation activities which would change the character of the community, such as zoning or the adoption and enforcement of building codes.

While the Rossi, Wright, Weber-Burdin study indicates the low salience of hazard issues in general among political influentials, Mittler (1989), in a re-analysis of that data, suggests that the adoption of non-structural mitigation measures may not depend on extensive local support to insure legislative activity. Mittler implies that when mitigation programs exist, they carry with them their own force which may prompt other legislation. This would suggest that, in the U.S., Federal legislation may prompt local communities to adopt mitigation programs even if there is little local political support. If that causal sequence is valid, that also means that an increase in local mitigation efforts in the near future in the United States would be unlikely since recent Federal

administrations have taken the position to minimize the role of the Federal government and to seek initiatives from state and local governments. Given the low salience of mitigation at the local level, this political position is not likely to prompt future innovations and adoptions of mitigation measures.

TENTATIVE CONCLUSIONS

The research previously cited suggests that community mitigation programs are difficult to implement in American communities. Such programs are dependent in part on the public perception of the risks of earthquakes. The perceptions are socially constructed and have little or not relationship to actual geophysical risks or to accurate scientific information. So improvements in the accuracy of earthquake predictions nor the wider availability of information by prominent scientists will have little direct effect in radically modifying those perceptions.

Earthquake hazards are only one of many concerns people have, and, even in high hazard areas, earthquake hazards are given low priority by individuals as a reason to make efforts to reduce the consequences of such hazards. In addition, insuring against housing damage attracts minimal interest. The same low level of priority is also evidenced by local political leaders. Thus, in a society such as the United States, hazard mitigation programs initiated at the "grass roots" level are likely to be uncommon. Such programs are seen as the responsibility of higher levels of government. In the current political atmosphere, higher levels of government define such programs as local responsibilities. Those contradictory political assumptions are not likely to produce effective programs.

RESEARCH ON OTHER ISSUES

The research reported previously has generally focused on individual risk perceptions and its implications for mitigation, but there are several other areas of research which deserve mention. Five areas will be mentioned: 1) Adoption of Mitigation Programs; 2) Implementation of Mitigation Programs; 3) Purchasing of Hazard Insurance; 4) Unanticipated Consequences of Mitigation Programs; 5) Communicating Risk Information to the Public; and 6) Special Populations.

1. Adoption

One research approach has been to examine communities that have successfully implemented earthquake mitigation programs. This direction was followed by Alesch and Petak (1986) in studying three California communities, Long Beach, Los Angeles and Santa Ana, in developing and implementing policies related to strengthening unreinforced concrete building. From their analysis they developed

a number of suggestive propositions about the conditions which lead to adoption of mitigation programs within these communities:

--There has to be recognition by a reasonably large proportion of the policy community that there is a problem--that the hazard exists, that the probabilities of loss are more than trivial, and that something can be done about it that will be politically acceptable.

--In order for hazard mitigation policy to be enacted there must be an available policy option that includes a technical solution viewed as practical and efficacious by non-technical policy makers.

--The probability that hazard mitigation will be enacted is in direct proportion to the extent that there are inside policy advocates who are persistent and tenacious in their pursuit of the policy, who have access to and credibility among policy makers.

--Windows of opportunity are essential for hazard mitigation policy to be enacted. Windows can be pried open with enormous, continuing effort, but they automatically open in the event of a low probability/high consequence event that demands community attention because of geographic proximity or other reasons.

--Most hazard mitigation policies are enacted in the period immediately following a low probability/high consequence event.

--Hazard mitigation is not a technical exercise; it is inherently and often intensely political because mitigation usually involves placing cost burdens on some stakeholders and may involve a redistribution of resources. Hazard mitigators must, therefore, develop political as well as technical solutions.

--Because values and perceptions are different among stakeholders, it is difficult, if not impossible, to reach consensus about appropriate mitigation policy interventions.

--Hazard mitigators are frequently willing to require other people to spend more of their money on hazard mitigation than they want to or may be able to afford, given other priorities...

--Professional associations are a primary means of communicating innovations in hazard mitigation among jurisdictions...

--The probability that mitigation policies will be enacted is directly proportional to: 1) the extent to which mitigation technology is known and tested, 2) the ability of its advocates to describe the consequences of implementation, including the level of costs, who will bear the costs, and the level of hazard reduction being purchased by the mitigation, 3) the number of other jurisdictions that have enacted similar hazard mitigations, and 4) the perceived imminence of the hazard.

2. Implementation

The fact that community-wide programs and adopted does not mean that they will be effectively implemented. Risa Palm (1981) studied the effects of California legislation which mandated that property owners or their agents were required to inform prospective purchasers that the property was located in potentially or recently active fault zones. That legislation was seen as a form of consumer protection to warn prospective home-buyers of potential risk. Palm examined how real estate agents handled the "disclosures" process and found that the disclosure was not likely to take place when it might jeopardize the sale. Instead of making the disclosure when the house was being shown, it was introduced later at the purchase contract time. In addition, the "disclosure" was often stated in terms that the property was in a "special studies" zone and words such as "seismic," "earthquake" and "fault" were not used. She concluded that not only was disclosure occurring at the least sensitive time in the sales transaction, but methods were used to convey the least amount of information possible.

In addition to the behavior of real estate agents, the study pointed out that for those purchasing homes earthquake mitigation had low priority, although knowing about the hazard increased their propensity to seek insurance. Palm concluded that while the law may have effected the behavior of the developers of large-scale new housing projects, its effect on individual homeowners was almost nonexistent.

3. Insurance

Another area which has been the subject of investigation has been insurance, including earthquake insurance. Kunreuther, et al (1978) examined why home owners in hazard-prone areas (to both floods and earthquakes) had not even considered how they would recover should they suffer damage. They treated such events as being sufficiently infrequent to permit them to ignore the consequences. This finding runs counter to certain theories that predict that, in the events which have low probability but high consequences (such as floods and earthquakes), losses are more likely to be insured than those which have high probability and low loss. Palm, et al (1990), in a recent study of persons who owned and occupied their homes in four California counties, suggests that insurance purchase had increased from about five percent in 1973 to

20 to 40 percent in 1989. (This also means from 60 to 90 percent did not have such coverage.) This study also tried to assess factors which were involved in insurance purchase. It found that there was no relationship between geophysical risks and risk perception. Risk perception, especially the individual's evaluation of potential destruction of the home by an earthquake, was the factor most closely correlated with insurance purchase. The authors comment that a large number of elderly households, low income households and households with most of their wealth tied up in home equity remain susceptible to major losses. From that study the authors make a number of suggestions for increasing the number of persons buying insurance, including increasing the availability of earthquake insurance, providing additional information about personal risk to specific homeowners and reducing the rates.

4. Unanticipated Consequences

Some studies which focus on implementation and why certain mitigation schemes are adopted or rejected also look at the unanticipated consequences of those innovations. There have been a number of studies of floodplain land-use management policy in the United States. Mitigation efforts on floodplains have had a somewhat longer history and are more geographically disbursed in the U.S. than are earthquake mitigation attempts. Burby, et al (1988), among others, have studied both the intended and unintended consequences of the effects of land-use management programs. They determined, in a ten-city study that the programs did discourage the purchase of vacant floodplain property for residential use and for speculation. On the other hand, land management policies did not consistently decrease the attractiveness of the floodplain for builders and developers or for consumers. The study indicated when developable land outside the floodplain is scarce and, when population growth and the demand for building sites is high,, the added costs incurred in building in the floodplain area will be considered worthwhile. In addition, the interest and activities involved in implementing floodplain management measures often prompted investors to buy land in the floodplain for speculative purposes. Thus, a good idea may also have many negative consequences.

Implementation studies of earthquake hazards have only focused on the factors involved in adopting a particular program. One study which does suggest certain unanticipated consequences is Mary Comerio's analysis (1990) of the possible consequences of the adoption of an ordinance in San Francisco requiring unreinforced masonry buildings to be retrofitted to a higher standard of seismic safety. Most of the unreinforced concrete buildings are located in Chinatown, the Tenderloin area and South of Market. The units are generally occupied by people who are poor, elderly, ethnic minorities, people who pat a high proportion of their income to rent and people who are attracted to these areas because they provide poor quality but affordable housing. The costs involved in retrofitting and the difficulty of the owners of these building to

obtain loans make retrofitting uneconomical. For example, in Chinatown, banks have traditionally required higher owner equity when buildings are sold, and in many of the buildings there is commercial property on the first floor which pays higher rent and thus subsidizes the long-term renters on the floors above. Comerio suggests that one consequence of the ordinance to insure seismic strengthening would be to cause such buildings to be abandoned and/or replaced. This would mean that the stock of affordable housing would be reduced in the city and, in addition, the character of these communities would be transformed. She concludes "We cannot afford the risk of destroying our communities in our effort to save them."

Comerio's conclusion may be too pessimistic. Tyler and Gregory (1990) did a study of the consequences of an ordinance in the City of Los Angeles, passed in 1981, to strengthen 8,000 unreinforced masonry (URM) buildings. It would have been possible for the owners of those buildings to sell, demolish or strengthen them. The owners decided to strengthen after coming to the conclusion that tearing down and rebuilding would cost more. This decision was made in the context of optimism about the economic future of the area. In fact, demolitions of URM's were lower than anticipated and occurred in areas where demolition of non-URM's were occurring, that is, where changes in land use were occurring anyway. The report suggested that seismic strengthening should be coordinated with redevelopment and that process might best be accomplished by focusing on small areas. Many of the programs establish priorities on the basis of structural and/or occupancy characteristics, but these criteria might be supplemented by neighborhood or even block, characteristics. The study also pointed out that the provision of alternative housing for displaced low income tenants was one of the most serious problems for the strengthening program. The suggestion was made that if thought was given to how such persons would be rehoused after an earthquake, that process might lead to ideas about how to rehouse the "victims" before such an event.

5. Communicating Earthquake Risk Information to the Public

Dennis Mileti and his colleagues (1990) have developed a theoretical statement on public risk communication which covers both hazards education and risk communication, or what is more commonly designated as "warning." The theoretical model is based on the notion that the perception of risk is a social process which includes factors such as the understanding or meaning that people impute to heard risk communication, their belief in what was communicated and whether or not the communicated risk is personalized versus seen as someone else's problem. The perception emerges from interacting with risk information from multiple sources. Too, people seek out additional sources and try to verify what they have heard from other sources and persons. This new information acts as confirmation.

Mileti was able to test the theory in communities near the Parkfield Earthquake Prediction location studying public knowledge and response to that prediction. On the basis of that research and the theoretical understanding of the process, he was able to derive a number of implications for communicating risk information to the public. He suggested the more effective techniques were to:

- use written materials explaining what the risk is, where it is going to happen, when it is going to happen, what the effects will be, what people should do and where to get information about it. The information should be as clear and certain as possible.

- supplement such information with that message from many different sources and many different channels.

- use multiple information sources to reinforce the risk information in the materials. Reinforcement also comes from other people. Visible demonstration projects help.

- give people time to feel that taking some action is their idea. People will not necessarily take action as a result of the materials. They will discuss the risk with local organizations and with friends to gather information as to what they should do about it and make decisions based on that information. Action is a result of this process, rather than a simple response to information.

Thus, it is essential that other sources of information are available for this "milling" process. Mileti uses the idea that people need to come to "own" information before they take action. This underscores the point that mitigation actions are inherently social, not simply informational or technical.

6. Special Populations

In the United States there has been recent attention to understanding the unique problems of special populations in relationship to particular hazards. Such research was initiated by studies of the warning process and how that process might be different for particular subpopulations, primarily Afro-Americans and Hispanics. The basic idea was that such groups might use different channels of communication and have different modes of informal communication which could be utilized in making the warning process more effective. Some of that Research has underscored the value of attempt to provide hazard information in different languages. For example, disaster assistance materials after the Whittier earthquake was issued in eight different languages.

A more recent attempt to look at a special population, the disabled, has concentrated on earthquake hazards and their implication for both mitigation and preparedness. Tierney, Petak

and Hahn (1988) have pointed out that in the Los Angeles area disabled persons are concentrated disproportionately in the sections of the city and the kinds of multifamily structures that are likely to sustain heavy damage in the event of an earthquake. They point out that one of the major problems to be faced is the failure to provide multiple building access and egress routes, thus limiting the options which disabled occupants have. They also conclude that efforts to improve mitigation and preparedness for the disabled will be affected by the similar pattern of interest and disinterest which affect efforts to promote the same goals within the larger community.

SOME CONCLUDING COMMENTS

There are certain conclusions that can be made concerning social science research on earthquake mitigation.

1. Any suggested mitigation program is an instance of planned social change and is thus within the traditional concerns of the social sciences.

2. Improvements in the accuracy of identification of both the probability and location of seismic risk will have limited consequences for the adoption of earthquake mitigation programs.

3. The perception of risk is a social product which is neither static nor unidimensional. The importance people give to seismic risk is conditioned by many different social factors, including, of course, scientific and technical information. (Perhaps the most certain generalization is that people who attend earthquake conferences give seismic risks a higher salience than those who attend flood conferences.) It is quite possible that the perception of risks is most closely associated with basic world views centering on life, death and existence. Seismic risks, or any other risks, are conditioned by those views, but risks have little independent effect on those world views.

4. It also seems clear that, in the United States, people who live in areas with identifiable geophysical risks are not overly concerned about those risks--they do not prompt personal behavior to reduce those risks. They are likely to see mitigation and particularly preparedness activity as important for someone else, e.g. the local government, to consider. Most of the time even that activity is given rather low priority. Priorities may be increased immediately after an actual event. To describe that period as a "window of opportunity" overestimates both the size of the window and the opening.

5. The research done in the United States, while impressive, has very limited applicability in other socio-cultural systems. The focus of that research has concentrated on information-

gathering by individuals assumed to lead to voluntary decisions to reduce their personal risks. These people studied live, primarily in California, in owner-occupied single family dwellings in communities that practice grassroots politics where they encourage politicians to reallocate community resources to reduce risks. I do not imply that such a view is necessarily one which the researchers would assume to be accurate, but it seems to be a view which many American policy makers have made normative. However, the notion that people will take voluntary action often leads to the conclusion that if people "volunteer" to live in areas of high seismic risk, they should not ask others to share in the economic burden of supporting localized mitigation efforts. This suggests that mitigation programs based on risk information and individual voluntary actions are likely to have very limited success in the future.

6. It may be that the best direction for future research will be how mitigation programs can be developed by "central" governments, how can they be implemented by these governments and what measures can be taken to insure acceptance and compliance by citizens. Central governments are more collectively conscious of the various risks. For example, Rossi, et al, says "The power to affect the fate of non-structural hazard mitigation legislation is even more firmly in the hands of elected officials on the state level, as compared to local communities." (Ibid, p.272) Borrowing from lessons from other areas, certain programs will not be very effective unless they become mandatory. For example, fire insurance on housing is required when purchases are financed by mortgages and automobile insurance is required when registration and licensing is obtained. In addition to mandated mitigation efforts, it is clear that not enough experimentation has been done with incentives to adopt mitigation efforts. It is obvious that scientific information to encourage private mitigation efforts is not a particularly useful incentive. And information which dramatizes risk is likely to "turn off" prospective mitigations because persons will perceive that individual efforts will not be sufficient.

7. By suggesting the limited success of individual voluntary mitigation efforts and the possibility of greater collective mandatory mitigation effort is not, personally, a very comforting conclusion. One knows that, throughout history, governments have subjected certain groups to high risks and have protected other groups. This continues to be true and I would not see any dramatic change in such allocations toward a goal of risk equity in the future. Perhaps the best that we can hope to accomplish is selective mitigation programs which argue that certain population categories, such as children, deserve special attention or that certain public structures, such as schools, need seismic strengthening, or that certain types of quasi-public structures, such as theaters and hotels, deserve special attention. Describing the potential consequences of earthquakes is likely to result in

the conclusion that not much can be done about such a future event. An actual earthquake can illustrate not only mitigation lessons but also can be interpreted as having fulfilled the statistical probabilities for such events in the lifetime of community residents. For centuries, people have died from earthquakes, but they also have lived with earthquakes. Certainly, modest improvements have been made in mitigating some of the consequences and probably modest improvements will continue to be made in the future.

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Table I

Mean Seriousness Ratings of Selected Local Problems by California Residents and Elites, 1977

Problem Area	<u>Residents</u>			<u>Local Elites</u>		
	Average Rating ^A	Rank	N	Average Rating ^A	Rank	N
Inflation	7.59	1	(891)	7.14	2	(183)
Drought	7.39	2	(894)	-- ^B	--	--
Crime	7.01	3	(887)	6.07	3	(181)
Unemployment	6.83	4	(875)	7.47	1	(183)
Pornography	4.49	5	(863)	3.89	4	(180)
Fires	4.48	6	(889)	3.89	5	(181)
Earthquakes	2.28	7	(892)	2.21	7	(184)
Floods	2.15	8	(886)	2.90	6	(184)

^A1=no problem at all, 10 = most serious problem: Hence high ratings mean high seriousness.

^BThe drought question was not included in the elite survey.

Source: Table 5:1, Peter H. Rossi, James D. Wright and Eleanor Weber-Burdin, Natural Hazards and Public Choice, New York: Academic Press, 1982, p.109.

Earthquake-hazard reduction	22.8	77.2	Improve public education
Earthquake-hazard reduction	28.1	71.9	Improve police protection
Earthquake-hazard reduction	28.6	71.4	Improve public hospitals and health care
Earthquake-hazard reduction	52.8	47.2	Improve flood control
Earthquake-hazard reduction	66.4	33.6	Improve parks and recreational facilities

Figure 1. Priorities for Spending Government Surplus, Adult Sample, N/1450, Los Angeles County

Source: Figure 37. Ralph Turner, Joanne M. Nigg and Denise Heller Paz, *Waiting for Disaster; Earthquake Watch in California*, Berkeley, University of California Press, 1986