COMMUNITY RESPONSE TO EARTHQUAKE THREAT IN SOUTHERN CALIFORNIA

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PART NINE
CHANGE AND STABILITY IN THE PUBLIC RESPONSE

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This volume is part of a study investigating individual and community response to earthquake threat in southern California. The overall objective is to provide a basis for understanding community response to earthquake predictions released to the public. Time dimensions were considered crucial in evaluating public response. These were based on "lead time"--the period between a prediction and event; the "time window"--the period within which the predicted event is expected to occur; and the "southern California Uplift announcement"--an open-ended "time window." After an initial survey, interviews were conducted throughout these time periods and provided a means for assessing responses to events as they developed. Patterns of change and stability were analyzed, based on a panel study. Assessments of changes in communication and in attitude toward the southern California Uplift are reported. Another area examined was the false alarm effect of near predictions. In general, stability was found to be more characteristic of response than change.

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PART NINE

CHANGE AND STABILITY IN THE PUBLIC RESPONSE

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THE REPORT

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Part Nine was written primarily by Ralph Turner. Gerald Goetsch was the chief statistical collaborator in the analysis and prepared drafts for some methodological portions of the manuscript.

PART NINE

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CHAPTER ONE

WAITING FOR DISASTER

The Time Dimension in Warnings

The problem of response to warnings of future disaster takes very different shapes when the temporal dimension is introduced. At least three time dimensions are crucial. First is the lead time, the period of time between the issuance of prediction, near prediction, or warning and the expected occurrence of the event. An imminent warning calls for prompt and decisive action and creates the occasion for setting aside normal routines until the anticipated disaster is over. Anxieties and fears can be converted immediately into action. A longer-term warning provides the opportunities for more carefully considered action and fuller preparation, but introduces the problems of waiting. People often say that waiting for misfortune to strike is worse than the misfortune itself. Waiting also invites postponement of action, so the many things that could have been done are not done. And normal life must go on during the waiting period. Somehow time for attention to the forthcoming event must be snatched from the continuing attention to normal needs and routines.

A second crucial time dimension is the time window. This term is used to refer to the period of time within which the predicted event is expected to occur. The narrowest time window specifies the exact time at which the disaster will strike. When a dam bursts it is often possible to calculate a precise time that the wall of water will strike a downstream community on the basis of distance and speed of the moving water. When the time window is narrow, it is easy to set aside normal routines and take emergency protective actions for the indicated period. A narrow time window may be combined with a long lead time. For example, ocean front flooding may be predicted months ahead for the precise hour when a peak high tide is due. But a longer time window means that

the exact time of the disastrous event cannot be specified, but only an extended period. The threatened population are at risk every minute of a long and drawn-out period, during which they ought to be extra vigilant but must sustain most normal life routines. The effect of an extended time window can be quite different from the effect of a long lead time. During the long lead time the affected population are at least assured that for the time being they are safe. They have been granted a moratorium, as it were. But there is no moratorium during the extended time window. The disaster could strike at any moment.

As we look at the most significant earthquake forecasts and near predictions of 1976, they fall into two principal patterns. Henry Minturn's forecast involved a moderately short lead time of just under a month and a brief time window of from 24 to 48 hours. Some of the forecasts by seers also had this character, specifying the precise day or week when the quake would strike, but often providing a longer period of warning. The Whitcomb announcement, on the other hand, involved zero lead time and a one-year time window. The quake could conceivably have occurred while Whitcomb was issuing his announcement, or it could have been delayed for as much as a full year. In practice we have observed that many people transform a warning message of this kind by translating the time window into lead time and reducing the time window to a very brief period. Thus many people understood Whitcomb to have said there would be an earthquake in April, one year from the time of the announcement. The announcement of the Uplift, insofar as it was treated as a near prediction, had this same characteristic of zero lead time and an extended time window. People were being told in effect that they were in danger at the moment of the announcement and would continue in that state until the quake occurred.

The Uplift introduces a third time dimension. Unlike the Whitcomb

announcement, the Uplift announcement leaves the time window open-ended. The closed- or open-endedness of the warning makes a great difference in planning. A flood warning is often closed-ended. The crest of the river is known to be approaching, and it can be confidently predicted that if the crest passes without flooding, the danger will be past. In the case of closed-ended earthquake predictions the closing date is not the date by which the danger will have passed, but the date by which the accumulating tension must have reached the breaking point. But an open-ended warning provides no time toward which people can look forward when the disaster will either have occurred or have been averted.

Insofar as the Uplift is the dominating and persisting focus of the earthquake threat in southern California, it conveys a warning with zero lead time and an open-ended time window. By the time we gathered our first survey data that time window had already lasted for a full year. By the time we completed our fourth wave of follow-up interviews the elapsed time window was approaching three years, and the warning remained no less open-ended than before.

The prevailing warning situation is more confused than this account indicates, since interpretations of the Uplift have generally been made against the background of a more general near prediction based on seismic gap theory. Conceivably the threat based on the Uplift could become closed-ended if the Uplift subsided or even became stable for a sufficiently long period. The alternate interpretation that the Uplift was part of a recurrent and benign mountain-building process that had originally produced the magnificent San Gorgonio mountain configuration might then be generally accepted. Reports that the Uplift was sinking or migrating southward were susceptible to this kind of interpretation. Just as the crest of the flood had passed without inundation, so the peak of the uplifting had passed without an attendant earthquake, and we could begin to relax once again in relative security.

But the more commonly heard view from the seismological community has been that the Uplift is a matter of concern just because southern California is due or overdue for a great earthquake. During the course of our investigation the seismic gap was often cited, and it became a topic of particular interest with reports of a local investigation that lead to more precise dating of past earthquakes than had heretofore been available. The new evidence actually seemed to extend the time window, allowing for as much as 160 years between great quakes. With the last great quake having been the Fort Tejon disaster of 1857, the next could come as late as the second decade of the twenty first century, or forty years hence. And according to the principle mentioned in connection with the Whitcomb announcement, it was easy to transform this extended time window into an extended lead time and heave a welcome sigh of relief.

Hence while the enduring threat situation in southern California involved zero lead time and an open-ended time window, lasting nearly three years by the time our investigation was completed, the situation involved these additional elements. First, people might look for subsidence of the Uplift as a sign that the time window was being closed, except that a longer time window was already in effect on the basis of the seismic gap. But the longer time-window might be taken less seriously for at least two important reasons. First, living at risk of a destructive earthquake was a part of life in California, and the vague exhortions based on the seismic gap may not have been perceptibly different from the general awareness of living in earthquake country. And second, the new evidence setting a more definite but extended duration for the time window may have been translated into lead time and a sense of lessened imminence. Yet it was not at all clear that subsidence of portions of the original Uplift lessened the danger specifically associated with the Uplift. It might merely be a sign of continuing stress and activity along the major fault zone,

keeping the threat alive. Perhaps it was because of this uncertainty that the report of a swarm of micro-tremors in the fault zone attracted more attention than other reports during this time, as we shall see in Chapter Two.

Grounds for Changing Responses

The survey data that we have gathered over a twenty-one month period provides us with an opportunity to examine the relative change and stability of attitudes and actions within a population subjected to a threat characterized by an open-ended time window of nearly three years duration. We look for changes in attitude and action having two different bases. We look first for the natural evolution of human response as people live out the experience of an open-ended and long-lived time window. When nothing changes objectively for an extended period of time, the situation necessarily changes subjectively for the participants. And we look second for changes that are responses to specific events during the course of our investigation. New and revised announcements came out, a damaging earthquake struck a nearby community, and earthquake safety became a pawn in political controversies having their roots in very different concerns.

Various and contradictory effects might plausibly be anticipated from simply living through an open-ended disaster forecast time window. The most commonly discussed potential effects are generally viewed as being negative for the individual and the community. We shall briefly discuss these possible effects under four headings.

The first hypothetical effect of lengthening experience in an open-ended time window is a declining sense of urgency and correspondingly reduced vigilance and preparedness. The underlying assumption is that in case of a warning message without any lead time the sense of urgency and resultant preparatory action are likely to be greatest at two moments in time. The first

moment of urgency and potential action is the moment of the warning and immediately thereafter as the message undergoes both formal and informal verification and reinforcement. If disaster could strike at any time, now is the time to act. The second moment of urgency and action potential comes when the end of the time window is imminent. We have mentioned already the tendency for some people to translate time window into lead time so that the event is not expected until the end of the time window. But even for those who make no such translation, the period during which disaster can strike is progressively narrowed so that concern is focused on an ever shortening moment of time as the close of the time window approaches.

Between these two moments, there should be a more or less extended period of lessened urgency. The sense of imminent danger cannot remain at a high pitch for an extended period of time. As days go by and then months and years without the anticipated disaster, the future time span is extended. We might say that when confronted with a long or open-ended time window, people create their own subjective time window that is initially much shorter than the announced period. Our discovery that more than two fifths of our respondents expected a damaging quake within a year when we first interviewed them illustrates this foreshortened subjective time window, since there was no justification for a one-year time window in scientific discussion of the Uplift. As time passes, the hypothesis is that the subjective time window is extended into the future so that people begin by expecting a quake in a matter of weeks and gradually shift to expecting it in a period of years.

In case of the Uplift there is no second moment of urgency unless people interpreted announcements of changes in the Uplift or the 1978 Soviet forecast as signs of a closing time window. Hence we should expect the sense of urgency to decline according to either a linear or exponential curve. If the greatest

loss of urgency comes early, followed by a gradual levelling off as people come closer to fully appreciating the open-endedness of the forecast, we should expect declining urgency to follow the exponential curve. This is the more theoretically justifiable assumption.

Action accompanying such a pattern should exhibit an initial spurt of preparedness, followed by growing inattention. Thus people might store water and food, then gradually let the stocks deteriorate or borrow from them without replacement. Or they might put fresh batteries in their emergency radio and not replace them as they wear out.

If people have perceived the time window as extended but closed-ended, or if they interpreted new announcements as signalling the approaching end of the time window, we should expect a reawakening of urgency as the subjective moment of climax approaches. If this pattern prevails, within the span of our surveillance, we should find that a concave parabollic curve best describes the trend. The concave parabola is a U-shaped curve, with high points at the beginning and the end.

The second hypothesized effect of lengthening experience in an open-ended time window carries the declining sense of urgency a step further into active disillusionment and disbelief. This hypothesis might be called the false-alarm effect or the cry-wolf effect. In the first hypothesis we envision no loss of conviction that disaster will strike eventually. Consequently the loss of urgency would not necessarily weaken the disposition to respond to a new and more urgent short-term warning. But under the second hypothesis people conclude that the entire alarm was unjustified in the first place, and that the scientists or other forecasters really don't know what they are doing. People who expected a damaging quake within the year should experience the passing of the year without a quake as disconfirmation, inclining them to skepticism about

any future forecasts, predictions, or warnings. Periodic reminders of the earthquake threat should constitute a "deconditioning" experience, since each new declaration is an unreinforced stimulus. The response to an imminent warning, if scientists were to announce that a crescendo of evidence shows that the long awaited quake is about to strike, would be something like "We've heard that one before!" The dissillusionment should, at the very least, be expressed through reduced confidence in scientific earthquake prediction capability. It would probably be expressed through increasing fatalism about earthquakes and their consequences for human beings. In extreme instances it might produce a disbelief in earthquake danger, though it is difficult to see how the earthquake history of California could be totally ignored.

The third hypothesized effect is accumulating anxiety and fear with their many attendant effects. If people feel they are living beneath a Damoclean sword, the passage of time will perpetuate and compound anxiety rather than dispelling it. If people wake up each morning wondering whether today will be the disastrous day, the effects should be manifested in many ways. People should be preoccupied with the earthquake threat, so that it is the topic that comes to mind in suggestive situations. We already know that preoccupation or salience was surprisingly low, but we might expect increasing salience as the unrelieved strain begins to "get to" more and more people. Modest anxiety should be expressed through a desire for information relevant to the anxiety-provoking topic. But as anxiety climbs toward pathological levels, people should begin to resist and resent new information. We should observe a declining receptivity to news and other information on the topics of earthquake prediction and earthquake safety and preparedness. Compounded anxiety also leads to defensive denials of danger. People should increasingly deny the probability of earthquake danger.

Such defensive denial is likely to be distinguishable from simple declining belief or a waning sense of urgency by the presence of contradictory responses. Thus if earthquake salience increases while the expectation of an earthquake declines, or if expressed fear of earthquakes increases while expectation declines, we could plausibly interpret these trends as signs of anxiety-produced denial.

Compounding anxiety would be quite counterproductive in any real emergency. Both apathetic disregard for emergency instructions and panicky response would result.

The fourth hypothesized effect is akin to the third, but translates accumulating personal tension into a more active and aggressive response. Living through a lengthening time window of earthquake threat could lead to anger, resentment, and scapegoating. Scientists and public officials would be actively blamed for disturbing the peace of the community by issuing or permitting unsettling public pronouncements. Scientists should be viewed with increasing suspicion. Public officials would be subjected to more and more severe condemnation. Appeals for preparedness would be met, not with apathetic disregard, but with active and hostile refusal to comply.

While these four possible negative effects of living through a lengthening time window have been widely advertized, a plausible case can also be made for some effects of a more positive kind. We shall describe two of these.

It is common knowledge that men and women in the modern world are bombarded with more information and more reminders of their precarious existence than they can assimilate in meaningful ways. Modern people have a wide range of superficial awareness, without any sense of personal relevance. The earthquake threat, the meaning of earthquake prediction, the distinction between safe and unsafe situations in an earthquake, and the need and possibility for earthquake preparedness are all matters of which most Californians are superficially aware, as they are of the dangers of freeway driving. Personal

experience is generally recognized as the most effective agent for translating superficial awareness into meaningful awareness. People who have automobile accidents commonly experience a qualitative change in their awareness of driving safety and may abruptly become compulsive about wearing seat belts and taking other precautions. Less effective than personal experience but nevertheless important as sensitizing agents are vicarious experience and involvement in active discussion of the danger in primary groups. Even without discussion, sheer exposure to repeated warnings may have effects in some situations, though this possibility is more uncertain.

If the continuing time window of threat creates repeated occasions for discussion among family members, friends, and coworkers, the effect may be to make the earthquake prospect increasingly real and vital for many people. There may be an increasing sensitization, so that discussions of the Uplift and of earthquake safety that were initially meaningless to many who heard them increasingly evoke responses of recognition and appreciation. An idea like earthquake prediction that was so new that many people were initially unable to grasp it becomes familiar and its implications begin to be appreciated.

The assumption underlying this hypothesis is that the context of threat in which discussions take place is essential to produce the sensitizing effect. In this context the discussion of each new announcement or reminder leads people increasingly to ask questions and experience insights concerning the relevance of events for themselves. People who have lived through an extended time window are more likely to hear and grasp the significance of a new and more urgent warning than those who have not been through such an experience.

The second positive hypothesized effect simply carries the first one further. Responses evoked by early and repeated warning announcements become rehearsals and drills in preparation for the eventual emergency. A rehearsal

familiarizes and habituates people to the responses they will make in a true emergency and enables them to discard inappropriate responses and replace them with more effective responses through trial and error. In some instances the rehearsal is active. For example, having once stored food and water, people know better what to do next time even if they have allowed their stocks to deteriorate after the initial effort. In other instances the rehearsal takes place in thought and imagination, shared through discussion. In either instance the effect is to increase readiness to respond.

The six possible effects of living through a lengthening time window of disaster warning are not mutually exclusive. The predominant response in the community may be some combination. In addition, it is likely that different population segments will respond in different ways. It will be our aim in the chapters that follow to try to identify the dominant response patterns and, when possible, to relate less frequent patterns to appropriate population segments.

But before we can analyze the evolution of responses to the objectively unchanging threat situation, we must take note of significant events that occur during the period monitored. It should certainly make a difference whether there is a steady stream of news about new developments in the earthquake threat situation or whether there is only the initial report that is repeated from time to time. It will be important to note whether new reports tend to intensify or undermine the original concept of threat, and whether the earthquake threat becomes linked to other live concerns such as ongoing controversies.

Accordingly, we shall devote Chapter Two to exploring public awareness of some of the events and objective changes that might reinforce or modify the naturally evolving response to the lengthening time window. The events have already been reviewed in detail in Part Two. But the question for Chapter Two is how much these events have penetrated public awareness. In Chapter Three we will then examine the trends of responses for which we have repeated

measurements with a view of discovering whether any of our hypothesized six effects might be applicable.

The Panel Study

The general plan for this phase of the investigation was to conduct four waves of follow-up interviews at five to six month intervals after the basic field survey was completed. The interview schedules provided for repeated administration of a set of crucial items that could be used in identifying trends, and for inclusion of new items that measured response to current developments and new items that might help to clarify ambiguous responses in the basic field survey. Because the cost of repeated field surveys is prohibitive, we conducted all the follow-up interviews by telephone. The interviews were also briefer, though seldom less than one half hour. The sample sizes were also smaller, though in all cases they remained substantial.

In designing a panel study investigators are confronted with choices between reinterviewing the same respondents and interviewing fresh samples of respondents. From the start it seemed wisest to work with a combination of new and reinterviewed respondents. A number of considerations were weighed explicitly in choosing the final pattern of new and reinterviewed samples.

Reinterviewing respondents from the basic field survey was important for two principal reasons. First, we would have considerably more information about people included in this longer field survey than we could get from people in the briefer telephone interviews. Relatively stable items of information from the basic survey could be correlated with new items in later interview waves. Second, by reinterviewing we could relate changing or stable responses to personal characteristics. While repeated interviewing shows the general pattern of stability and change in the community, reinterviewing specific individuals allows us to distinguish between the kinds of people who changed and the kinds who did not. Only by reinterviewing

individuals, for example, could we tell whether a high fear of earthquakes predisposed people to volatile judgments concerning the likelihood of an earthquake in the near future.

At the same time there are serious drawbacks to reinterviewing a panel of respondents as compared with interviewing a new sample each time. First, allowance must be made for sample attrition, since many respondents will not be reachable for a second or third interview. The attrition is also likely to be selective, introducing progressive bias into the sample. Second, there are likely to be reinterview effects on answers to some of the questions. For example, it would be surprising if awareness of the Uplift did not increase on reinterview. Some of the respondents may only have heard of the Uplift for the first time from our interviewers, and may not have forgotten between interviews. The interview process may sensitize respondents to issues under investigation so that they are stimulated to think and talk about earthquake matters between interviews. The interviews may even stimulate action, such as fixing cupboard latches for earthquake safety. Third, repeated questioning regarding attitudes and beliefs and once-for-all actions may produce diminishing returns because of the sense of having been asked before, and may in some instances be actively resented.

We took note of two basic panel designs, as described by Kish (1965, pp. 469-474). The first is known as the complete follow-up design. If we designate each sample by a letter of the alphabet, the design for succeeding interview waves would be as follows: a,b; a,c; a,d; a,e,; a,f. The basic field survey would be divided by a random process into two samples designated "a" and "b." Sample "a" would then be reinterviewed repeatedly. But each interview wave would also include a fresh sample. The size of samples "a" and "b" might be equal or unequal.

This design permits maximum follow-up of individuals, and would permit maximum use of the fuller information secured in the basic field survey. Because of severe attrition, it would be necessary to start with a large sample "a" in order to have an adequate sample at the end of the period of study. The great disadvantage of this design lies in maximal reinterview effects. The use of a fresh group each time, drawn according to the same sampling procedure (b, c, d, e, and f), compensates for the sensitizing and action-precipitating effects of reinterview, but diminishing returns from repeated questioning might render sample "a" of dubious merit in the last waves. In addition, it is doubtful that we could make constructive use of the reinterview data for so many waves.

The simple overlap design provides that the new sample in each wave will be reinterviewed just once, in the next wave. This design can be described as follows: a,b; b,c; c,d; d,e; e,f. This design minimizes sample attrition problems and minimizes all types of reinterview effects. The two principal disadvantages are the lack of opportunity to follow individuals over longer periods of time and the loss of fuller information secured in the basic field survey after the first reinterview wave.

The most comprehensive design, combining the benefits of the two preceding designs, can be called the comprehensive design. It is better suited than either of the first designs for the application of sophisticated statistical procedures for separating trend, event, and reinterview effects. The design is as follows: a; a,b; a,b,c; a,b,c,d; a,b,c,d,e. The drawbacks for our purposes are as follows. Reinterview effects are multiplied to an unmanageable extent. The sample attrition and bias effect is serious. And the escalating total numbers to be interviewed in later waves made the cost prohibitive.

In an effort to compromise the merits and demerits of these three designs in serving our purposes we have adopted a hybrid design. This design can be described as follows: a,b,c, (basic field survey); c,d; b,d,e,; f; b,g. The design is presented more graphically, with the actual numbers in each of the samples, in Table 1. In each reinterviewed sample the loss by attrition was larger than we had anticipated. We had estimated originally that setting the size for sample "b" at 600 would provide us with 500 responses eleven months later and 400 responses 21 months later, rather than the 462 and 348 we actually secured. Nevertheless, the minimal differences between new and reinterview samples on most variables lead us to believe that the design served its purpose. This design has the following features: it (1) "saves back" a substantial unit from the field survey for use in establishing longer-term trends, preserving the information included in the field survey but not the shorter telephone interview, without excessive reinterview effects (sample b); (2) It provides two opportunities to compare individuals at five-to-six-month intervals, one comparing telephone reinterview with the original field survey and the other comparing first and second telephone interviews. The two comparisons are needed because of sampling and response differences between field and telephone interviewing: (3) It provides a fresh sample free from reinterview effects for each wave; (4) It assumes that there will be little to gain by comparing individuals at two periods after the first two comparisons described under (2).

Contingency Plans and the New Years Day Earthquake

An essential feature of our research plan was to be prepared to take advantage of certain events that might have a substantial effect on public response if they should occur during the course of our study period. The five contingencies were as follows: The occurrence of a damaging earthquake in Los

TABLE 1

HYBRID PANEL DESIGN AND ACTUAL SAMPLE SIZES

Sample designation	Field survey	Wave one	Wave two	Wave three	Wave four
a	350				
b	600		462		348
c	500	426			
d		551	390		
e			516		
f				536	
g					550
Total	1450	977	1368	536	898

Angeles County; the occurrence of a moderate but nondestructive earthquake, felt throughout the County and of sufficient magnitude to cause public discussion; the issuance of a significant new prediction or a substantial upgrading of the urgency of an existing earthquake notice; the cancellation or substantial downgrading of an earthquake prediction or near prediction; the disconfirmation of a widely noticed prediction by passage of the predicted time without a quake. Five sets of interview schedules were developed, printed, and pretested, and key interviewers were briefed on their use. The plan was to be ready to interview within a few days of any of these events. Plans were made for readjusting the regular follow-up interview time schedule to accommodate the contingency interviews. Since none of the events occurred before our final follow-up interview wave had been conducted, no readjustments were necessary.

Just one of the contingencies occurred. This was the magnitude 4.6 earthquake on New Year's Day, 1979. Although this event came one day after the planned termination of all new data gathering, we launched the interview wave a few days later and completed interviewing before the end of the month. A fuller account of this phase of the study appears in a later chapter, where we give serious attention to the apparant effects of a small earthquake coming after nearly three years of waiting for "the big one," and soon after a mildly destructive quake in nearby Santa Barbara.

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CHAPTER TWO

THE RESPONSE TO DEVELOPING EVENTS

The succeeding waves of interviews provided us with a means for assessing responses to events as they developed after the initial survey. In this chapter we shall report the findings from questions dealing with developing events that were included in the four follow-up interview waves. In addition, some items were included in the final wave calling for the respondents' own assessments of changes in communication and in attitude toward the Uplift. We begin with the reports that the confirmation of the Uplift was changing.

The Changing Uplift

As early as May 28, 1976, Los Angeles area newspapers reported that the Uplift was higher and wider than previously thought, with the inference that the Uplift was still rising. Little more was said about changes in the Uplift during the rest of 1976, until December. In December newspapers again featured the report of a rising and expanding Uplift, but added a new kind of change. In the San Gabriel foothills north of Pasadena, within the circumference of the uplifted region, a subsidence of as much as six inches had occurred. In February, 1977, came reports of tilting and of subsidence over a much wider area of the southern California Uplift. Subsidence to the north, including the vicinity of Palmdale, and uplifting farther south led to a suggestion that the Uplift might be migrating southward. In March there was an isolated report that the Uplift extended much farther east than formerly supposed.

After an extended period of relative quiet concerning the Uplift, September brought reports of a swarm of very small tremors on the San Andreas Fault near Palmdale. We shall deal with these reports in the next section.

But the swarm was blamed for slight shifts in the aqueduct bringing water to Los Angeles. The shifting occurred near the point where the aqueduct crosses the San Andreas Fault, within the circumference of the original uplifted region. In October and November, television specials on earthquake hazard featured histories of the Uplift, including the changes subsequent to discovery. As December came around again, so did reports on papers presented at the annual meeting of the American Geophysical Union, some of which dealt with the Uplift. These were followed later in the same month with reports of a projected resurvey of the Uplift by the U.S. Geological Survey. Among the papers summarized was the Geological Survey's historical review of the Uplift, reminding readers of its steady rise and expansion for several years and its more recent subsidence, especially around Palmdale.

After December, media attention to the changing character of the Uplift faded. For about a year and a half there had been occasional media accounts of changes in the Uplift, beginning with an emphasis on the continuing rise and expansion of the Uplift, and ending with reports of subsidence, especially in the northern portions.

In January, 1978, we included a series of questions in the telephone interview to assess awareness and interpretation of reports concerning changes in the Uplift. All respondents who mentioned the Uplift spontaneously in reply to the general question about predictions, forecasts, and other announcements, and all respondents who answered affirmatively when asked if they remembered "hearing about a bulge in the earth near Palmdale in the Mojave Desert" and who acknowledged that scientists were saying that it might signify a coming earthquake were asked the series of questions about changes.

Respondents were first asked, "Have you recently heard of any changes in the bulge?" If they answered "Yes," they were asked, "What were these changes?" Answers to the follow-up question were recorded verbatim and subsequently

coded for analysis. Regardless of whether respondents answered "yes" or "no" to the opening question, they were then asked specifically about the report that parts of the bulge were sinking. We shall report the exact wording of this item and the follow-up items after examining responses to the more general question.

The January, 1978, wave of interviews consisted of three samples, one of which was new and two of which were being reinterviewed. When responses from the three samples were compared, they did not differ significantly, so they have been combined and reported as a single sample of 1366 persons. As reported in Table 1, 177 respondents, or 12.9 percent of the entire sample remembered hearing recently of changes in the Uplift. These 177 respondents constituted 19.0 percent of the 934 respondents who remembered hearing of the Uplift and understood its possible connection with an earthquake. Whichever percentage we prefer to emphasize, awareness of the developing character of the Uplift phenomenon is quite limited in the general population.

Among those who remember hearing of changes in the Uplift, there is little consensus about the nature of the changes. Respondents divide about equally among those who say the Uplift is rising and those who say it is sinking. A very few people who said it was both rising and sinking are included in the "other" category, along with people who gave varied answers. Earlier reports had referred to a rise in the Uplift, but recent reports had emphasized that the Uplift was sinking, especially in the vicinity of Palmdale. Earlier reports may have made a deeper impression than later reports on the fifty percent who thought the Uplift was rising. Alternatively there may be a disposition to perceive and remember reports in such a way as to confirm people's expectations. The expectation of a destructive earthquake within a very few years seems to have been firmly implanted in the thinking of most people in Los Angeles County.

TABLE 1

AWARENESS OF CHANGES IN THE UPLIFT, JANUARY AND JUNE, 1978

Awareness	Number	Percent of Sample	Percent of Heard
January 1978			
Uplift is rising or higher	71	5.2	40.1
Uplift is falling or shrinking	60	4.4	33.9
Cracks in Los Angeles aqueduct	3	0.2	1.7
Other	9	0.7	5.1
Don't know	34	2.4	19.2
Total who heard of changes	177	12.9	100.0
Not heard of changes	757	55.5	
Total who remembered and understood Uplift*	934	68.4	
Do not remember or understand Uplift	432	31.6	
Total sample	1366	100.0	
June 1978			
Uplift is rising or higher	32	6.0	46.4
Uplift is falling or shrinking	15	2.8	21.7
Both rising and falling	13	2.4	18.8
Other	2	0.4	2.9
Don't know	7	1.3	10.2
Total who heard of changes	69	12.9	100.0
Not heard of changes	276	51.5	
Total who remembered and understood Uplift*	345	64.4	
Do not remember or understand Uplift	191	35.6	
Total sample	537	100.0	

*This total includes the few respondents who remembered the Uplift but didn't know whether or not scientists were saying it signified a possible future earthquake.

From the perspective of folk thinking, the imagery of a rising Uplift may support the expectation of disaster better than the imagery of an Uplift in process of returning to its customary level.

The same questions were repeated in the next wave of interviews in mid-1978. The proportion of respondents who remembered hearing of changes is just the same. But the interpretations people have heard have changed significantly (Chi-square = 13.505, 3df, $p < .01$). And the proportion who say the Uplift has been reported as rising remains about the same. There has been some shift from saying simply that the Uplift is sinking to reporting that it is both rising and sinking. Perhaps this shift represents a slight increase in awareness of the complexity of the physical phenomena at work in the fault system under southern California. And if we apportion respondents who say both rising and sinking between the two simple replies, there is a marked shift from mentioning sinking toward mentioning rising. With about two thirds of the people assuming that there probably or definitely will be a damaging earthquake within five years (see Chapter Three), and a hiatus in media coverage between December, 1977, and the time of these interviews in June and July, 1978, perhaps the aforementioned tendency for people to remember those accounts of events that justify their expectations has been at work between surveys.

The next series of questions began with the query:

> One recent report has been that parts of the bulge are sinking,
> Do you remember hearing anything about this?

This question was asked in January, 1978, but was not repeated in midyear. Fully 16 percent of the 1366 respondents remembered hearing something about the Uplift sinking (Table 2). This figure is higher than the 12.9 percent who remembered hearing about change and certainly higher than the 4.4 percent who referred to sinking as the kind of change that was occurring. Although 16.1 percent is still not a very substantial proportion of the population at

TABLE 2

AWARENESS OF REPORTS THAT PARTS OF UPLIFT

ARE SINKING

Awareness	Number	Percent of Sample	Percent of Sample
Heard Uplift is sinking	220	16.1	23.6
Not heard Uplift is sinking	714	52.3	76.4
Not heard or understood Uplift	432	31.6	
Total	1366	100.0	
Interpretations heard:			
Earthquake will happen soon	38	2.8	17.3
Earthquake less likely	45	3.3	20.4
Both	14	1.0	6.4
Neither	123	9.0	55.9
Total	220	16.1	100.0

large, the difference between that figure and 4.4 percent calls attention to the care with which all answers to questions must be interpreted. If concern about the Uplift is not particularly salient to an individual, the general question about changes in the Uplift may not trigger recall of reports about specific changes in the Uplift. Presumably the reservoir of awareness that could be tapped in case of a vitally experienced emergency is much larger than the memories we could elicit through our interview format.

The 220 respondents who had heard that parts of the Uplift were sinking were then asked about possible interpretations of this information. They were first asked,

> Have you heard anyone say that this sinking is a sign that an earthquake <u>will</u> happen soon?

After two follow-up questions that will be presented later, they were then asked,

> Have you heard anyone say that the bulge sinking means that we are <u>less</u> likely to have an earthquake soon?

The majority of the respondents who were asked these two questions answered "No" to both. The possible sinking of parts of the Uplift remained a curiosity, devoid of relevant meaning to 55.9 percent of those who remembered hearing. A very few people had heard both interpretations, and the remainder were fairly evenly divided between the two interpretations.

After each of the two questions concerning interpretation of the Uplift's sinking we asked a question on credibility:

> What do you think of this statement--that the bulge sinking is a sign an earthquake will happen soon? (--that the bulge sinking means we are <u>less</u> likely to have an earthquake soon?) Do you think: It is <u>definitely</u> true, It is <u>probably</u> true, It is <u>probably</u> false, or It is <u>definitely</u> false?

Because of the small numbers of respondents who remembered hearing each of the interpretations, we must be especially cautious not to inflate trivial differences by assigning them unwarranted importance. The frequencies are

reported in Table 3.

Even with the small number of cases, a few summary observations are warranted. First, there is very little disposition to go out on a limb by "definitely" endorsing or rejecting either interpretation. Responses are heavily clustered in "probably" categories. Second, the disposition to believe is stronger than the disposition to disbelieve. Whether people have heard that the sinking of the Uplift is a positive or a negative sign concerning the likelihood of an earthquake in the near future, they are more likely to believe than to disbelieve what they have heard. Among the fourteen people who heard both interpretations, only one is inclined to disbelieve both. Third, the sinking of the Uplift is more credible as a sign that an earthquake will happen soon than it is as a sign that we are less likely to have an earthquake soon. None of the people who heard both favors the view that an earthquake is less likely, while respondents who heard only one interpretation are more likely to believe what they heard if they heard that the sinking signifies the approach of an earthquake. Finally--and here we must be quite tentative because of the small number of cases--hearing contradictory interpretations does not foster disbelief, as is often feared. Of the fourteen people who heard both interpretations, five concluded that either might be true and another five favored the positive intepretation, while only one took the skeptical position and three said they didn't know about either interpretation.

The recognized impact of the reported sinking of parts of the Uplift on public estimation of the prospects of an earthquake occurring soon is not great. Only 7.1 percent of the total sample have heard about the sinking and heard one of the two interpretations. While a majority of these are inclined to believe one or both interpretations, they constitute only 4.2 percent of the entire sample.

For each of the interpretations we also asked the source:

TABLE 3

BELIEF IN INTERPRETATIONS OF REPORTS THAT

PARTS OF UPLIFT ARE SINKING

Extent of Belief	Number	Percent of Sample	Percent of Sample
Heard earthquake will happen soon:			
Definitely true	1	0.1	2.6
Probably true	24	1.7	63.2
Don't know	5	0.4	13.2
Probably false	8	0.6	21.0
Definitely false	0	0	0
Total	38	2.8	100.0
Heard earthquake is less likely:			
Definitely true	2	0.1	4.4
Probably true	22	1.6	48.9
Don't know	12	0.9	26.7
Probably false	9	0.7	20.0
Definitely false	0	0	0
Total	45	3.3	100.0
Heard both:*			
Both are true	5	0.3	35.7
Earthquake soon is true	5	0.4	35.7
Earthquake less likely is true	0	0	0
Neither is true	1	0.1	7.2
Don't know about either	3	0.2	21.4
Total	14	1.0	100.0

*Because of small numbers when both interpretations were heard, replies have been combined into positive and negative.

TABLE 4

ATTRIBUTED SOURCE FOR INTERPRETATIONS OF BULGE SINKING

Attributed source	Number		Percent	
	Quake soon	Quake less likely	Quake soon	Quake less likely
Scientist	13	13	50.0	56.5
Media	3	8	11.5	34.8
Person	8	2	30.8	8.7
Other	2	0	7.7	0
Total making attribution	26	23	100.0	100.0
Don't know	34	28		
Total who heard interpretation	60	51		

Do you remember any particular people who were saying this?

Since the majority of respondents do not remember who was saying whichever interpretation they heard, numbers of cases became quite small for analysis. Scientists are most often the identified source. Apparent differences between attributed sources for the two interpretations are not statistically significant. But we hesitate to ignore one apparent finding: that the interpretation that lends support to the popular expectation of a damaging earthquake soon is more often traced to conversations with other people while the less congruent interpretation is more often traced to the media. We shall look to see whether the finding is replicated with other items (Table 4).

The Micro-quake Swarm

The report that scientists at California Institute of Technology had been studying a swarm of several hundred very small quakes near Palmdale drew front-page attention in major newspapers and was announced on all major network television news programs on September 9, 1977. The implied portent was conveyed by the question included in every news item, whether the small earthquakes presaged a large one. As usual, answers were to cite examples in which quake flurries had preceded large earthquakes, but to indicate that there was not a certain connection. The quake swarm study was featured again in December in reports on the American Geophysical Union meeting in San Francisco. It is our impression from the nature of the news coverage and our experience in the community that word of the quake swarm was generally received as more meaningful than the reports of changes in the Uplift. The young woman scientist, Karen McNally, who was conducting the study, also seemed to capture public fancy, which may have contributed to interest in the reports.

Although the quake swarm occurred in the uplifted area, it seemed to have acquired the status of an independent phenomenon in media treatment. The fact that people did not think of the swarm when asked about recent

TABLE 5

AWARENESS OF THE EARTHQUAKE SWARM

Awareness	Number	Percent of Sample	Percent of Sample
Heard of earthquake swarm	529	38.7	
Not heard of earthquake swarm	837	61.3	
Total	1366	100.0	
Interpretations heard:			
Damaging earthquake is coming	142	10.4	26.8
Relieving pressure, no earthquake	117	8.6	22.1
Both	132	9.6	25.0
Neither	138	10.1	26.1
Total	529	38.7	100.0

reports of changes in the Uplift confirms the supposition that people viewed it separately. Consequently we asked everyone about the quake swarm, regardless of whether they remembered hearing about the Uplift or not. The pattern of questioning was similar to that followed in case of the sinking of parts of the Uplift. The actual questions follow:

> In October, a Caltech scientist announced that there had been hundreds of very small earthquakes within an eight-month period in the Palmdale bulge area. A. Do you remember hearing anything about this?
> (If "yes,")
> B. Have you heard anyone say that these small earthquakes are a sign that a damaging earthquake is coming?
> (If "yes,")
> a. Do you remember any particular people who were saying this?
>
> b. What do you think about this statement--that these small earthquakes are a sign a damaging earthquake is coming? Do you think: It is definitely true, It is probably true, it is probably false, or It is definitely false.
>
> c. Have you heard anyone say that these small quakes are relieving pressure so that a damaging earthquake will not occur?
> (If "yes,")
> a. Do you remember any particular people who were saying this?
>
> b. What do you think about this statement--that these small quakes are relieving pressure so that a damaging earthquake will not occur? Do you think: It is definitely true, etc.?

The earthquake swarm was more widely recognized than the sinking of parts of the Uplift (Table 5). More than three out of every eight people in our sample remembered hearing something about it. Not only do significantly ($p < .001$) more people remember hearing about the swarms; significantly ($p < .001$) more of the people who heard of the swarm have also heard one or both of the interpretations of the swarm. A total of 391 people, or 28.6 percent of the entire sample have heard of the swarm and of some interpretation relating it to the future earthquake prospect. The earthquake swarm is seen as less of a curiosity and more of a relevant sign for the future. In addition, people who have heard an interpretation are more likely to have heard both interpretations.

TABLE 6

BELIEF IN INTERPRETATIONS OF THE EARTHQUAKE SWARM

Extent of Belief	Number	Percent of Sample	Percent of Sample
Heard sign damaging earthquake coming:			
Definitely true	9	0.6	6.3
Probably true	99	7.3	69.7
Don't know	19	1.4	13.4
Probably false	14	1.0	9.9
Definitely false	1	0.1	0.7
Total	142	10.4	100.0
Heard relieving pressure, no earthquake:			
Definitely true	22	1.6	18.8
Probably true	80	5.9	68.4
Don't know	7	0.5	6.0
Probably false	8	0.6	6.8
Definitely false	0	0	0
Total	117	8.6	100.0
Heard both:*			
Both are true	47	3.4	35.6
Earthquake coming is true	39	2.9	29.5
Relieving pressure is true	32	2.3	24.2
Neither is true	1	0.1	0.8
Don't know about either	13	0.9	9.9
Total	132	9.6	100.0

*Because of small numbers when both interpretations were heard, replies have been combined into positive and negative.

Because the numbers of cases are much larger than for the Uplift sinking, we can report findings concerning the credibility of interpretations with greater confidence (Table 6). As before, people generally say "probably" rather than "definitely." The tendency to believe rather than disbelieve applies here also. Seventy six percent of those who heard that the small quakes are a sign that a large earthquake is coming believed it was probably or definitely true and 87.2 percent of those who heard the small quakes were relieving pressure believed that. And the evidence to support the finding that being exposed to contradictory explanations does not lead to rejection of both is clear. Only one of the 132 respondents who heard the two interpretations rejected them both, while over a third felt that either could be true.

Only the disposition to see events as harbingers of disaster is not confirmed for the quake swarms. Among respondents who have heard only one interpretation, the disposition to believe that the small earthquakes relieve pressure may be stronger than the disposition to believe that they are precursors ($p < .05$). But among those who have heard both, the apparent disposition is reversed. If we correct for the fact that the precursor interaction is relatively more prevalent in case of the quake swarm (difference is not statistically significant) by comparing the proportion who favor the precursor interpretation among all who favor just one or the other interpretation, the ratio is 53/47 for the precursor interpretation of the quake swarm and 57/43 for the precursor interpretation of the Uplift sinking, a difference which is trivial and nonsignificant statistically.

In summary, the swarm is more widely known and more generally understood as relevant to the prospect of a future earthquake than the report of sinking in parts of the Uplift. An even 24.0 percent of the entire sample accept the swarm as a credible sign concerning the likelihood of a future earthquake, compared to only 4.2 percent who accept the sinking of the Uplift as a credible sign.

TABLE 7

ATTRIBUTED SOURCE FOR INTERPRETATIONS OF QUAKE SWARM

Attributed source	Number		Percent	
	Quake soon	Quake less likely	Quake soon	Quake less likely
Scientist	50	30	53.8	40.3
Media	18	29	19.3	35.4
Person	24	19	25.8	23.1
Other	1	1	1.1	1.2
Total making attribution	93	82	100.0	100.0
Don't know	152	196		
Total who heard interpretation	245	278		

But four generalizations about the credibility of interpretations apply equally to both cases. People may be more evenly divided about whether the swarm is an earthquake precursor or a tension-releasing mechanism than they are about the Uplift sinking. But our analysis on the latter point is inconclusive because of the partially offsetting differences between awareness and acceptance of the opposing interpretations.

As with the Uplift sinking, interpretations are most commonly attributed to a scientist (Table 7). But in this instance there are differences of borderline significance ($p < .05$) in the attribution patterns for the two interpretations. As before, media are more often given as the source for the view that the immediate likelihood of a quake is lessened. But the offsetting difference is principally in a greater tendency to attribute the earthquake harbinger interpretation to scientists, rather than the previously suggested tendency to attribute it to friends, coworkers, and other people in face-to-face contact.

Proportionally more of the respondents who heard interpretations of the quake swarm than of the Uplift sinking are unable to remember who is responsible for the interpretations. This difference is clearest in case of the relief-of-pressure interpretations. Interpretations of the swarm are more generally "in the air," so more people know of them without remembering sources.

The Soviet Prediction

On April 22 and 23 of 1978 a few of the local newspapers and some television and radio news programs featured an unusual and sensational announcement. Andrei Nikonov, an earth scientist in the Soviet Union, issued a forecast for an earthquake of magnitude 7.5, to occur in the vicinity of the southern California Uplift before the end of the year. The Information Department of

the Soviet Embassy In Washington, D. C., distributed the announcement through a press release sent directly to the Los Angeles Times and other media. The prediction was criticized by leading California seismologists. The Los Angeles Times, the San Gabriel Valley Tribune, and the Antelope Valley Press featured the announcement prominently, each with a single story, after which the subject received no further significant media attention.

Although the forecast was not given sustained attention in the media, its foreign origin, the magnitude of the anticipated quake, and the definite time span of the forecast should have made it newsworthy. Accordingly, in our panel survey conducted in July, 1978, we sought to determine how generally the people were aware of the Soviet announcement and how seriously they took it. Interviews took place approximately three months after the announcement, but five months before it would be disconfirmed by the passage of time without a corresponding earthquake.

The Soviet prediction was handled in our survey in the same way as the Uplift was handled in this and other interview waves. First, respondents were asked the general question:

> In the past year or so, have you heard any predictions, statements, or warnings about earthquakes in the southern California area? That is, about specific locations, specific time, or from specific people?
>
> (If "Yes") I'd like you to tell me about the predictions, statements, or warnings. Any specific ones, anything at all that you remember.

Answers were recorded verbatim. After as many as three announcements had been recorded, the interviewer asked the standard set of detail questions about each of the announcements in turn. Subsequently the announcements were coded, and the Soviet prediction was added to the standard list for coding purposes. For those respondents who mentioned the Soviet prediction in response to the general question, we say that the Soviet prediction is salient.

After the standard questions had been asked about all announcements mentioned, respondents who had not referred to the Soviet prediction were asked:

Did you happen to hear about a Soviet scientist predicting an earthquake for southern California?

Respondents who answered "Yes" were then asked an abbreviated set of detail questions, covering anticipated date of the quake, intensity, how seriously the respondent takes the prediction, the chief source of information about the prediction, and anything else important about it.

As indicated in Table 8 , only 18 people, or 3.3 percent of the entire sample, mentioned the Soviet prediction. Considering the recency of the announcement and the fact that the period covered by the prediction (the time window) had not yet passed, this is a surprisingly low figure. Another 21.3 percent of the sample acknowledged having heard of the announcement when asked directly. When the two sets of respondents are combined, about one quarter of the entire sample were aware of the Soviet forecast.

The 18 respondents to whom the announcement was salient all correctly identified the source as a scientist. Since the remaining respondents were asked specifically about a prediction by a Soviet scientist, we cannot tell whether they would have made the correct identification if "scientist" had not been mentioned.

Because of the predicted magnitude of 7.5, and the proximity to the metropolitan area, the earthquake would have been quite destructive and produced many casualties. A little over half of the 132 respondents who had heard of the forecast correctly identified the anticipated intensity as "destroy <u>many</u> buildings and take <u>many</u> lives." Another 11.4 percent anticipated a more moderate intensity: "destroy <u>some</u> buildings and take a <u>few</u> lives." Nearly a third did not know the expected intensity or thought it had not been included in the announcement. Hardly anyone minimized the expected damage. These findings can be summarized by observing that a small majority of those who had heard of the Soviet announcement had a correct appreciation of the forecasted severity of the quake. Fully 45 percent

TABLE 8

AWARENESS OF SOVIET EARTHQUAKE FORECAST, JULY 1978

Type of awareness	Number	Percent of Sample	Percent of Sample
Awareness:			
Salient (mentioned without prompting)	18	3.3	13.6
Heard, not salient (after prompting)	114	21.3	86.4
Total who heard	132	24.6	100.0
Not heard	404	75.4	
Total	536	100.0	
Earthquake intensity:			
Many buildings and may lives	72	13.4	54.5
Some buildings and a few lives	15	2.8	11.4
Some damage, not widespread	3	0.6	2.3
Little or no damage	0	0.0	0.0
They didn't say	1	0.2	0.8
Don't know	41	7.6	31.0
Total	132	24.6	100.0
Time of occurrence:			
Before the end of 1978	2	0.4	1.5
Sooner than the end of 1978	4	0.7	3.0
Within a year	13	2.4	9.9
In a past period of time	2	0.4	1.5
In a future period of time	3	0.6	2.3
Total who said they remembered	24	4.5	18.2
None given in the announcement	14	2.6	10.6
Don't know	94	17.5	71.2
Total	132	24.6	100.0
How seriously forecast is taken:			
Quite seriously	12	2.2	9.1
Fairly seriously	23	4.3	17.4
Don't know	5	0.9	3.8
Not very seriously	54	10.1	40.9
Not seriously at all	38	7.1	28.8
Total	132	24.5	100.0
Chief source of information:			
Television	35	6.5	26.5
Radio	18	3.4	13.7
Newspaper	44	8.2	33.3
People (family, friends, coworkers, etc.)	5	0.9	3.8
Other	2	0.4	1.5
Don't know	28	5.2	21.2
Total	132	24.6	100.0

of those who had heard of the forecast did not fully appreciate the threat.

Respondents who remembered the Soviet forecast were also asked:

> Do you remember whether a date was given for this earthquake to occur? (If "yes") When?

Only 18 percent of the respondents who remembered hearing about the Soviet announcement thought they remembered when the quake was to occur. Only two persons correctly placed the time as before the year's end. The largest number, thirteen people, made the understandable mistake of placing the expected time as within a year, while four others placed it closer to the time of the announcement. Thus even approximately correct information concerning the projected time for the quake was rare among the respondents. If a sizable minority failed to recognize the predicted severity of the quake, the overwhelming majority failed to grasp the eight-month time window which was part of the forecast.

Respondents who remembered the Soviet forecast were asked the standard question: "How seriously do you take this prediction?" Just over a fourth answered "fairly seriously" or "quite seriously." More than two thirds answered "Not very seriously" or "Not seriously at all." These rates can be compared with the rates for the Uplift and for spontaneously mentioned announcements in the earlier basic field survey. The Uplift was taken fairly or quite seriously as a sign of a coming quake by 58.6 percent of the respondents who remembered hearing of the Uplift, or about twice as high a rate. For announcements volunteered in answer to the general question, by type of announcement, the corresponding rates were as follows: Scientific announcements, 57.2; general announcements, 29.2; pseudo-scientific announcements, 28.5; prophetic announcements, 21.2. Thus, among those who remember hearing the announcement, the Soviet forecast was taken seriously by about the same fraction of the population as general and pseudoscientific announcements.

We conclude that the Soviet scientist's forecast was assigned the credibility

of vague reminders of earthquake danger and pseudoscientific forecasts, rather than that of scientific announcements emanating from American sources. The chief difference between the Soviet announcement and the more important general admonitions and pseudoscientific forecasts was the smaller number of people who remembered it, which can probably be ascribed to the very limited media coverage it received. Six and one half percent of the entire sample remembered hearing the Soviet forecast and took it seriously. The acknowledged impact of the forecast was thus quite small.

It is reasonable to ask whether the low salience of the forecast, failure to grasp its full import, and a prevailing tendency not to take it very seriously were closely linked. Perhaps the forecast was salient for those respondents who remembered it without prompting because they grasped its full import and took it seriously. A reliable comparison between respondents who volunteered mention of the Soviet forecast and those who remembered only when asked directly is difficult because of the small number in the former group. However, it seems fairly clear that substantially more of the "salients" had some idea about the predicted time of occurrence (Chi-square = 22.6, 1 df, $p < .001$) More salients may have had some idea about the probable intensity of the quake (not significant, $p \leq .05$), and slightly more may have taken the announcement seriously (not significant), $p \leq .05$). Among respondents who thought they knew the intensity of the quake, salients and nonsalients gave similar estimates of intensity. Thus while we cannot speak confidently except concerning specification of a time for occurrence, it does appear that salience is associated with specific rather than vague information, and possibly with taking the notice more seriously.

A final question concerns chief sources of information. Newspapers are most commonly given as the chief source of information, in contrast to the early 1977 pattern in which television was cited more than four times as often as newspapers. Perhaps the fact that the report was aired principally in newspapers

and was not extensively featured in television and radio news helps to explain the low level of awareness. However, as we shall see in Chapter Three the importance of newspapers as compared with television increased steadily during 1977 and 1978 for all announcements, making this one less distinctive. The small number of respondents naming people as their chief source indicates that there was no surge of rumor to compensate for the limited media attention to the Soviet forecast.

As a concluding step in assessing the impact of the Soviet prediction we looked for spontaneous references in response to the next wave of interviews, conducted principally in November and December of 1978. The direct query about the Soviet acientist's announcement was not included in this interview. However, apparent references to the Soviet forecast were again coded separately among the answers to the standard question on predictions and other announcements the respondent had heard.

Unlike the July interview sample which consisted exclusively of newly interviewed respondents, the November-December sample consisted of 550 new respondents and 348 respondents who had been previously interviewed in January of 1978 and January-February of 1977. The orienting question was worded slightly differently for the reinterviewed sample, asking about announcements heard "since our last interview," rather than "in the past year or so." Since the Soviet announcement was aired in April, 1978, reference to it should have been elicited equally by both wordings of the question.

Out of the combined sample of 898 respondents, only eight, or 0.9 percent, made apparent reference to the Soviet forecast. Only three of these eight specifically mentioned a Soviet scientist. The others mentioned a quake of 7.5 magnitude or a quake due by year's end, which we interpreted as referring to the Soviet forecast. Thus before the predicted time window has passed, salience had already dropped to an inconsequential level.

Proposition Thirteen

In the statewide primary election on June 6 , 1978, the California Constitution was amended by an overwhelming popular vote. The specific aim of Proposition Thirteen was to reduce taxes on real property and limit their growth in the future. This was accomplished by using assessed values as they appeared on the record two years earlier as a baseline, setting an inflexible limit on the percent by which assessed valuation could be increased annually, and setting an inflexible limit on the tax rate. The effect of the proposition was to reduce property tax revenues to local governments and schools from residential and business property by half and sometimes more. Passage came after a campaign in which government waste was widely advertised and the affirmative vote was generally interpreted as a dramatic mandate for economy in government. Many economies was instituted immediately. The need for drastic economies without delay took on crisis proportions because Proposition 13 applied to the budget year beginning July 1, 1978.

So far as we know, there was no public discussion of earthquake mitigation programs as expendable or as having high priority. Police and fire services were often mentioned as activities to be maintained at full strength and recreational facilities, museums, and welfare were frequently mentioned as low priority enterprises. Nevertheless, it seemed highly probable that public arousal against prevailing levels of government expenditure would create an atmosphere that would dampen the enthusiasm for earthquake mitigation activities. It seemed unlikely that the high level of popular support for government expenditures to reduce hazards from earthquakes recorded in the February 1977, survey, would be impervious to this atmosphere of economy. Coincidentally, Howard Jarvis, who was coauthor and leading sponsor of Proposition Thirteen, had played a major role during 1977 in preventing passage of an ordinance by the Los Angeles City

Council to require posting and rehabilitation or abandonment of seismically unsafe structures in the City.

About six months after the election, we included in our survey of November and December, 1978, a series of questions to guage whether the economy fever had turned the public against expenditure for earthquake hazard mitigation. Before mentioning Proposition Thirteen, we asked:

> Do you think that the government <u>is</u> spending too much, too little, or just about the right amount of money on earthquake preparedness?

This question was followed by a pair of questions:

> Have Proposition 13 and the recent discussions about government spending changed <u>your</u> views on how much the government should spend to reduce earthquake hazards?
> (If "yes,")
> Do you now think that the government should spend more or less on earthquake hazard reduction programs?

On the initial question the new and reinterview samples answered significantly differently (Chi-square = 15.892, 2df, $p < .001$), so we have reported them separately. The samples were not significantly different on the other two questions, so they have been combined.

In both samples, more people said government was spending too little on earthquake preparedness than said too much or about right, combined (Table 9). Substantial numbers in both groups say they don't know. The difference between the two samples involves only "too little" and the "don't know" responses. Fewer of the reinterviewed respondents say they don't know, and more of them say government is spending too little. Leaving the difference between samples for discussion in a later chapter, we note the replies from both samples convey the same message, that several times more people feel that government underspends than feel it overspends for earthquake preparedness. There appears to be little disposition to nominate earthquake preparedness for inclusion in the "fat" that Proposition Thirteen was supposed to eliminate from government.

TABLE 9

GOVERNMENT SPENDING ON EARTHQUAKE PREPAREDNESS

AND PROPOSITION THIRTEEN

Attitude toward spending	Number	Percent
Amount government is spending on earthquake preparedness:		
(New sample)		
Too much	29	5.3
About right	115	20.9
Too little	188	34.2
Don't know	218	39.6
Total	550	100.0
(Reinterviewed sample)		
Too much	15	4.3
About right	73	21.0
Too little	162	46.5
Don't know	98	28.2
Total	348	100.0
Has Proposition 13 changed your views on how much government should spend on earthquake preparedness?		
Yes	109	12.1
No	675	75.2
Don't know	114	12.7
Total	898	100.0
Do you know think government should spend more or less on earthquake hazard reduction programs?		
More	81	74.3
Less	17	15.6
Don't know and other	11	10.1
Total	109	100.0

When asked directly, three quarters of the respondents denied that Proposition Thirteen had changed their views about how much government should spend to reduce earthquake hazards. The remainder were almost evenly divided between those who said their views had changed and those who didn't know whether their views had changed. When the 109 respondents who said their views had changed were asked how they had changed, the results are even more surprising. Only 15.6 percent said they now thought government should spend less. But nearly three out of four among people who claimed their views had been changed by "Proposition Thirteen and recent discussions of government spending" said they now thought government should spend more on earthquake hazard reduction programs!

It is difficult to find a convincing explanation for this claimed reverse effect of Proposition Thirteen. Perhaps the six months of public discussion of what to slash and what to preserve in local government led many citizens to make their own more careful distinctions between what government should and should not be doing. Or perhaps the view that there was actually a great deal of "fat" that could be cut from government while leaving enough for essential services, advanced in advocacy of Proposition Thirteen, led some citizens to believe that more could be spent on earthquake hazard reduction without cutting back other valued services.

These explanations are tenuous speculations. But the major conclusion, that we find no evidence to support the assumption that Proposition Thirteen "economy fever" has turned people against government spending for earthquake preparedness, stands firmly on the data. The conclusion is not merely that people will not admit that Proposition Thirteen induced a change of heart. The overwhelming rejection of the conclusion that government is spending too much on earthquake preparedness, registered before the topic of Proposition Thirteen was introduced to the respondents, is especially impressive.

TABLE 10

IMPORTANCE OF SPENDING FOR GOVERNMENT HAZARD REDUCTION,

FEBRUARY 1977 AND NOVEMBER 1978

Purpose and survey date	Very Important	Important	Somewhat Important	Don't know	Not very Important	Not at all Important	Total	Total Persons
Enforcement of building safety codes and building repairs:								
February, 1977	64.5	26.2	5.0	1.3	1.7	1.3	100.0	1450
November, 1978	64.0	23.6	6.7	1.8	2.4	1.5	100.0	550
Loans to rebuild or reinforce unsafe structures before earthquakes:								
February, 1977	48.4	32.4	8.7	2.3	3.9	4.3	100.0	1450
November, 1978	42.9	29.5	12.9	2.7	6.7	5.3	100.0	550
Establishing new systems for issuing scientific earthquake predictions:								
February, 1977	27.7	37.3	16.4	3.3	9.1	6.2	100.0	1450
November, 1978	27.8	35.3	18.2	3.8	9.6	5.3	100.0	550
Prediction studies:								
February, 1977	26.1	32.2	20.4	1.8	9.8	9.7	100.0	1450
November, 1978	25.6	23.3	28.7	1.3	13.1	8.0	100.0	550

Although we shall not take up questions that were asked repeatedly throughout the survey until the next chapter, one set of questions was asked only twice, in the Basic Field Survey in February, 1977, and again in the last regular wave, in November and December of 1978, at the same time as the Proposition Thirteen questions. These questions came immediately before the sequence we have just reviewed in the November-December wave. Respondents were asked about the importance of spending on four kinds of government activities. The leading question reads:

> Please tell me if it is very important, important, somewhat important, not very important, or not important at all to you for the government to reduce the possible hazards of earthquakes by investing large amounts of money into:

The four types of government programs are identified as they appeared in the interview schedule in Table 10. Only the replies from the new sample of respondents are reported in the table, to guard against any tendency for reinterviewed respondents to be more favorable toward government earthquake hazard reduction efforts.

The similarity of responses over the twenty-one-month interval, in spite of the campaign and passage of Proposition Thirteen, is striking. The main conclusion, that Proposition Thirteen did not affect popular support for government expenditure in the interests of earthquake hazard reduction, is further confirmed by interviews with comparable samples of naive subjects before and after the campaign for Proposition Thirteen.

The Santa Barbara Earthquake

The only damaging earthquake in southern California during our study period occurred in nearby Santa Barbara, ninety-five automobile miles from Los Angeles. Although the magnitude registered only 5.1 and no deaths were reported, there were injuries and considerable damage to property, and the quake was felt over a wide

area including parts of Los Angeles County. Tha main quake came at 3:45 PM on August 13, and was followed by the usual spate of aftershocks. Damage and injury and disruption of normal automobile, rail, and air traffic were sufficient to create the impression of a much greater earthquake. The Governor of California officially declared a state of emergency and the State Seismic Safety Commission scheduled a fact finding hearing to look into ways of stabilizing buildings such as mobile homes, many of which were shaken off of their foundations in the quake. The earthquake was the occasion for discussions of earthquake prediction and earthquake preparedness in Los Angeles County newspapers and on television and radio. The quake had not been predicted, and was not on the San Andreas Fault or in the uplifted zone.

A battery of questions was included in the November-December interviews covering awareness of the Santa Barbara quake, interpretation of its significance for future quakes in Los Angeles, and preparedness measures that might have been stimulated by reports of a damaging quake nearby. The opening question was as follows:

> In August, an earthquake measuring 5.1 on the Richter scale hit Santa Barbara and caused widespread damage. Do you remember hearing about this quake?

A total of 747 out of the 898 respondents, or 83.2 percent, had heard of the Santa Barbara earthquake. New and reinterviewed samples did not differ significantly, so they have been combined. It is still surprising that more than one in every six Los Angeles County residents did not even remember that there had been a damaging earthquake centered less than one hundred miles from Los Angeles. This observation underlines the existence of a hard core of uninformed residents who seem to be insulated against awareness of significant current happenings.

Questions were asked about interpretations of the Santa Barbara quake, similar to those asked in earlier surveys about the sinking of parts of the Uplift and the earthquake swarm.

> Have you heard anyone say that the Santa Barbara earthquake is a sign that a damaging earthquake will occur in the Los Angeles area in the future? (If "yes,")
> What do you think about this statement--that the Santa Barbara quake means a damaging quake will strike Los Angeles? Do you think it is: Definitely true, Probably true, Probably false, or Definitely false?
>
> Have you heard anyone say that the Santa Barbara quake relieved pressure along the fault and that a damaging earthquake will not strike Los Angeles in the near future? (If "yes,")
> What do you think about this statement--that the Santa Barbara quake has reduced the possibility of an earthquake striking the Los Angeles area? Do you think it is: (etc.)

Unlike the interpretations of the earthquake swarm and the changed configuration of the Uplift, these interpretations of the Santa Barbara quake would probably find no support among earth scientists. The epicenter of the earthquake was sufficiently removed from the San Andreas Fault and the uplifted area that any connection between the buildup or release of strain in that earthquake and the probability of an earthquake in Los Angeles would be quite tenuous. Hence acceptance of either of these interpretations probably signifies a disposition to find omens of future events in similar events elsewhere, as in Lucien Levy-Bruhl's principle of participation, rather than attention to scientific interpretations. Nevertheless, 28.1 percent had heard the view that the tremor in Santa Barbara signalled an earthquake coming for Los Angeles, and 15.8 percent had heard that it relieved pressure and reduced the possibility of an earthquake striking Los Angeles. Both interpretations had been heard by 6.4 percent of the respondents (Table 11).

Just as we found in case of the earthquake swarm in the Palmdale region, more people have heard that the quake in Santa Barbara signifies a large quake coming for Los Angeles than have heard that the observed quake defused the future quake. However these interpretations did not circulate so widely as those concerning the quake swarm closer by. The tendency to avoid taking "definite" stands that we observed in both previous instances continues to be manifest. There is little disposition to assign greater credibility to either interpretation, and the

TABLE 11

BELIEF IN INTERPRETATIONS OF SANTA BARBARA EARTHQUAKE

Extent of Belief	Number	Percent of Sample	Percent of Heard
Heard sign damaging earthquake coming:			
Definitely true	10	1.1	6.2
Probably true	88	9.8	54.3
Don't know	19	2.1	11.7
Probably false	33	3.7	20.4
Definitely false	12	1.3	7.4
Total	162	18.0	100.0
Heard relieved pressure, earthquake less likely:			
Definitely true	4	0.5	5.7
Probably true	37	4.1	52.8
Don't know	10	1.1	14.3
Probably false	16	1.8	22.9
Definitely false	3	0.3	4.3
Total	70	7.8	100.0
Heard both:*			
Both are true	16	1.8	33.3
Earthquake coming is true	8	0.9	16.7
Relieving pressure is true	13	1.4	27.1
Neither is true	11	1.2	22.9
Total	48	5.3	100.0

*Because of small numbers when both interpretations were heard, replies have been combined into positive and negative.

previously observed tendency to believe that whichever interpretation one has heard is probably true applies to this instance also. Most people who have heard the contradictory interpretations believe at least one of them, and fully a third believe that both are probably true. Among respondents who heard both interpretations, the proportion who reject both is larger in this instance than in the two previous instances, though it is still less than a quarter. Because of the lesser plausibility of these interpretations of the Santa Barbara earthquake as compared with interpretations of sinking and quake swarms in the southern California Uplift, it is surprising that more people have not heard and rejected one or both.

Whether people took the Santa Barbara earthquake as a sign for their own futures or not, they might have been reminded by the disaster nearby to prepare for an earthquake in Los Angeles. Respondents were asked about six kinds of response that could have been stimulated by hearing and seeing the Santa Barbara quake. The stem question read:

Since hearing about the Santa Barbara earthquake have you . . ?

The specific responses are given in Table 12.

The responses have been listed in descending order of endorsement for ease of comprehension. This was not the order in which they were presented in the interview.

The endorsement rates for all items are low. Even with the relatively passive items we suggested, including thinking, watching, and worrying, no item was endorsed by as many as one quarter of the respondents. And seven percent responded in three or more of the ways suggested. On the other hand, it should not be overlooked that more than one third of our subjects responded in some way that related the Santa Barbara earthquake to their own situation.

Some generalizations are justified from the data. First, the items that involve action are at the bottom of the list while thinking, watching, and worrying are at the top. Second, the commonest response is to think about official preparation rather than about one's own preparation or safety at work. This finding is consistent

TABLE 12

RESPONSE TO THE SANTA BARBARA EARTHQUAKE

Response to Santa Barbara Quake	Number	Percent
Thought about how public officials in Los Angeles have been dealing with earthquake preparedness problems	182	24.4
Watched more carefully for signs that an earthquake might be coming soon	133	17.8
Worried more about the safety of your own home and work place than before	112	15.0
Less confidence now in the ability of scientists to predict earthquakes than you had before	78	10.4
Taken any new earthquake preparations or rechecked measures you had taken earlier	59	7.9
Contacted any agency or group for information about earthquake preparedness	15	2.0
Number of responses to quake:		
None	568	63.2
One	181	20.2
Two	86	9.6
Three	34	3.8
Four	21	2.3
Five	8	0.9
Six	0	0
Total	898	100.0

with other observations from our investigation that people look to government officials to prepare the community for an earthquake. Third, the second-ranked position of watching for signs of a coming earthquake underlines the preeminent desire for a predictable future, which seems to be more important than preparing concretely for an unpredictable future. This finding is consistent with Slovic, Kunreuther, and White's (1974) model of decision-making, in which serious attention is not paid to the probable consequences of a future natural disaster until the individual is convinced that the probability of the event's occurrence is very high.

The fact that only 10.4 percent say they have less confidence in earthquake prediction is important in questioning the common assumption that faith in scientific prediction cannot withstand the occurrence of unpredicted quakes and false alarms. There may be sufficient popular understanding of the limits of current earthquake prediction capability to nullify any such effects.

Point Conception Liquid Natural Gas Terminal

On April 29, 1978, the first reports of a potentially active earthquake fault at the proposed site of a Liquid Natural Gas Terminal at Point Conception, California, appeared in the press. Uneasiness had been expressed earlier about the safety of such terminals, where natural gas that was shipped in liquid form would be unloaded and reconverted to a gaseous state for distribution by pipeline. Local Indian groups opposed use of the site as profaning their traditional sacred burial grounds. Beginning in April, the possibility of earthquake damage to the facility became an added dimension in the existing controversy. For the rest of the year a steady flow of news items reported occupation of the site by Indians, recommendations of the Coastal Commission concerning placement of the LNG Terminal, and the views of the several parties to the conflict over the location.

TABLE 13

LIQUID NATURAL GAS TERMINAL AND EARTHQUAKE RISK

Recommended course of action	Number	Percent
LNG terminal should definitely not be built	486	54.1
Build and use until damaging earthquake is predicted	140	15.6
Take our chances with earthquake and build LNG terminal now	231	25.7
Don't know and Other	41	4.6
Total	898	100.0

Reference to the earthquake fault and debate over the likelihood of a damaging earthquake at the Point Conception site became standard elements in these reports. Some concentrated press attention was given to the issue in November, while our final panel survey was underway.

In the November-December survey we asked a single question concerning liquid natural gas terminals. The question was phrased as follows:

> Recently there has been some debate over whether to locate a liquid natural gas (or LNG) terminal at Point Conception, about 40 miles south of Santa Barbara. That site may be dangerous because of active earthquake faults nearby. Yet at the same time, California needs a continuing supply of natural gas. As I read the following statements, tell me which you most agree with:
> A liquid natural gas terminal should definitely not be built where the possibility of a damaging earthquake exists;
> A liquid natural gas terminal could be built near small faults and used until a damaging earthquake is predicted; or
> We should take our chances with an earthquake and use the Point Conception site for gas storage now.

This question was not designed like some of the others reviewed in this chapter, to ascertain whether people were aware of the controversy or not. It was designed instead to pose squarely the choice between safety and the need for natural gas. To the extent to which people had already taken sides in the controversy on other grounds such as the fear of explosion during the unloading or gassification process or respect for the sacred grounds of the Indians, answers would not depend exclusively on their concern for earthquake safety.

In spite of the effort to pose the issue as a dilemma, relatively few people were unwilling to register an opinion on the subject or to accept one of the three proposed answers (Table 13). This observation suggests that respondents either are familiar with the issue in question or are sufficiently accustomed to choices involving earthquake safety that they can form opinions on specific questions quickly. The majority oppose building a terminal where the possibility of a damaging earthquake exists. But fully one quarter of the respondents are willing to accept the risk of an earthquake. And more than one in every seven respondents is willing to fall back on the unjustified faith in the present state of earthquake prediction to avoid a clear cut choice.

While the majority votes for the more cautious course of action, the LNG terminal issue is more like the dam safety issue than like the issue of old buildings. While the issue of old buildings evokes near consensus, publics are more divided over the dam safety and LNG terminal issues. The percent of respondents who favor taking a chance on earthquakes is quite similar for the two issues (27.7%, LNG: 23,5%, dams).

The liquid natural gas terminal issue is discussed more fully in relation to other earthquake safety issues in Part Five of the report.

Changing Communication Level

In the final interview wave in November and December, 1978, we included two questions to assess public perception of changes in the amount of communication taking place about earthquakes. We have an objective record of changing newspaper attention to earthquake topics that was reviewed in Part Two of the Report. But the subjective sense that people have concerning change or stability of communication levels is equally important.

Respondents were asked the following question:

> Now, a question about television, radio, and newspaper coverage. Compared to a year or two age, do you think there has been more, less, or about the same amount of coverage on the possibility of a damaging earthquake striking southern California?

The largest group of respondents report the media coverage has been about the same (Table 14). And five percent say they don't know. But nearly twice as many say that there is less coverage than say there is more coverage. Changes have not been so dramatic or attention to media coverage of earthquake topics so intense as to produce consensus regarding change. But there is a substantial perception that media coverage has declined.

A similar question was asked about informal communication to see whether people perceived a change in the amount of public interest in earthquake danger

TABLE 14

EARTHQUAKE COMMUNICATION COMPARED TO A YEAR OR TWO AGO

Comparison	Number	Percent
Media coverage on the possibility of a damaging earthquake striking southern California:		
More	150	16.7
About the same	420	46.8
Less	283	31.5
Don't know	45	5.0
Total	898	100.0
Informal discussion concerning the possibility of a damaging earthquake striking southern California:		
More	89	9.9
About the same	475	52.9
Less	316	35.2
Don't know	18	2.0
Total	898	100.0

as a topic of conversation at home, in the neighborhood, and in the workplace.

> Now, let me ask you a question about topics of conversation among you, your family, friends, or coworkers. Compared to a year or two age, has there been more, less, or about the same amount of discussion (among you, your family, friends, or coworkers) concerning the possibility of a damaging earthquake striking southern California?

A slight majority report that discussion levels are about the same. But the balance in direction of change shifts even more strongly toward perceiving decreased discussion, as compared with the change in media coverage. More than three times as many people feel that discussion of earthquake danger in their circles has declined as feel it has increased.

The prevailing impression of declining attention to the earthquake threat is similar for the media and for interpersonal discussion, though the impression of decline is stronger for discussion. The impression concerning the media is justified by the evidence of declining newspaper coverage from Part Two. The unanswered question is whether the parallel decline in discussion took place as a consequence of reduced media coverage or whether the reduced media coverage was a response to declining interest as measured by declining discussion. On the one hand the potential interest may have remained constant, but there may have been less to discuss because of reduced media attention to earthquake topics. On the other hand the decline in discussion may have been an accurate indicator of declining public interest and the media may have perceived and responded to declining interest by reducing their coverage appropriately.

In Chapter Eleven of Part Four we reported findings from the January, 1978, survey indicating that the vast majority of our respondents wanted to hear more rather than less about most earthquake topics. Unfortunately this same battery of questions was not asked during the first year. But it was repeated in both mid and late 1978 so it is possible to look for trends over a ten-month period culminating with the same survey in which people recorded their sense that media coverage and discussion had declined. Citing television, radio, and newspaper coverage, the question asked:

> . . . Would you say there has been too little coverage, just about the right amount of coverage, or too much coverage for each of the following:

The wording of the five topics and the comparative frequencies from the three survey waves are given in Table 15. Since replies by new and reinterviewed samples did not differ significantly, they have been consolidated into a single sample for each survey wave.

The table shows remarkably little change. The overwhelming assessment throughout 1978 was that media coverage was insufficient. In no case did fewer respondents in November and December than in January state that coverage was too little. With this evidence before us it is difficult to defend the position that media coverage declined in response to declining public interest. The data contribute instead to the plausibility of concluding that public discussion declined in spite of a stable rate of potential public interest simply because the media provided people with less to discuss.

This conclusion should not be misinterpreted. The reduced level of media coverage may have been a direct reflection of a declining number of newsworthy events, or it could have been a consequence of editorial misperception of public interest. But whatever the explanation for the reduced media coverage, discussion levels appear to have followed media levels rather then leading them.

One peculiarity of the data in Table 15 deserves special notice. In the case of "earthquake predictions by people who are not scientists," the judgment of too little coverage increased quite significantly during the year. In Part Four we reported the widespread credibility given to nonscientific as well as scientific prediction sources and the widespread attention attracted by amateur scientist Henry Minturn's earthquake forecast. While the judgment of insufficient attention to nonscientific forecasts is only half as prevalent as the sense of insufficient attention to scientific prediction at the close of our study period, the increase shows that the demand for such information is a continuing

TABLE 15

ADEQUACY OF MEDIA COVERAGE OF EARTHQUAKE TOPICS:

JANUARY TO DECEMBER, 1978

Topic of coverage and adequacy of coverage	January 1978	June 1978	Nov./Dec. 1978
What government officials are doing to prepare for an earthquake:			
Too little	78.9	78.3	78.8
About right and Don't know	19.2	19.8	19.5
Too much	1.9	1.9	1.7
Total	100.0	100.0	100.0
How to prepare for an earthquake:			
Too little	77.8	75.7	79.0
About right and Don't know	20.9	23.0	20.5
Too much	1.3	1.3	0.5
Total	100.0	100.0	100.0
What to do when an earthquake strikes:			
Too little	72.1	71.3	73.8
About right and Don't know	25.7	27.2	24.6
Too much	2.2	1.5	1.6
Total	100.0	100.0	100.0
The Palmdale Bulge and scientific earthquake predictions:			
Too little	60.5	61.9	60.6
About right and Don't know	36.0	34.7	35.8
Too much	3.5	3.4	3.6
Total	100.0	100.0	100.0
Earthquake predictions by people who are not scientists:*			
Too little	20.9	27.8	30.6
About right and Don't know	33.7	28.5	33.5
Too much	45.4	43.7	35.9
Total	100.0	100.0	100.0
Total number	1367	536	898

*Difference among three time periods is statistically significant: Chi-square = 40.953, 4 d.f., $p < .001$.

force to be reckoned with.

Questions asked in the February, 1977, basic field survey and again in the waves for June, 1978, and November-December, 1978, provide further evidence on media trends. The identical question was asked on the three occasions, although it was extended to cover sources other than the mass media in the last two surveys.

> We'd now like to ask you some questions regarding where you have heard about earthquakes. During the past year have you heard about earthquakes or earthquake predictions or earthquake preparedness from any of the following sources?

The sources, as listed in Table 16, were read to the respondent one by one, and the respondent was to answer "yes" or "no" to each. We have listed the media sources that appeared in all three schedules first, in the approximate rank order of their use by respondents. The nonmedia sources added in the later surveys are also listed in approximate rank order of their use.

For all the nine media sources, fewer people in late 1978 than in early 1977 said they heard about earthquakes. The drop is especially strong for radio and movies, the latter undoubtedly reflecting the fact that the motion picture "Earthquake" was no longer being shown. For six of the seven most used media sources June, 1978, is the low point, and the last months of 1978 reflect a resurgence of media use. Tha pattern of a severe drop to June, 1978, and a substantial recovery by November-December is unmistakeable for television news, newspapers, and radio. Very likely the Santa Barbara earthquake was principally responsible for the recovery. It is surprising in light of the short-term rediscovery of the media that nearly a third of our respondents still recognized a decline over the longer term. But the overall trend shown in Table 16 supports public perception of a longer term decline in media attention to earthquake topics.

The rank order of media sources did not change much while the level of media use was dropping and partially recovering. Television specials dropped less than other sources in June, 1978, so they move up in relative importance. As the

TABLE 16

SOURCES OF INFORMATION ABOUT EARTHQUAKES AT THREE PERIODS OF TIME

Sources of information	February 1977	June 1978	Nov./Dec. 1978
Media sources			
T.V. news programs	88.5	57.1	76.7
Newspapers	76.7	39.9	66.8
Radio	73.0	25.0	49.0
T.V. Specials	50.6	39.9	38.1
Movies--fictional or documentary	48.8	21.5	30.0
Magazines	42.1	20.7	32.5
Books	18.2	7.6	14.1
T.V. commercials	16.3	12.1	11.7
Pamphlets in the mail	11.6	10.3	9.8
Other sources			
From friends or neighbors		22.0	37.5
From co-workers		16.4	29.3
From adults in your household		16.4	23.7
From other relatives		19.2	26.7
From children in hour household		14.4	12.7
At work organization or other group meetings		7.8	15.4
(Total number)	(1450)	(536)	(898)

other media recover in late 1978, television specials fall back to their original position.

Between June and the year's end in 1978, informal discussion as a source of information picks up in five out of six kinds of relationship to parallel the increased use of the media. The one exception is with children in the household. As we have observed elsewhere, children play a surprisingly minor role in the communication process concerning the earthquake threat in Los Angeles County. Insofar as people relay information from media sources to their associates and relatives and sift and evaluate what they hear through informal discussion, increased attention to media information propels increased interpersonal discussion. By the fact that children are the sole category of discussion partner that does not respond to the media upsurge, the widespread exclusion of children from this precess is further documented.

Another but less precise comparison among the same three surveys can be made of earthquake topics discussed. In the February, 1977, basic field survey we asked people about informal discussion of seven earthquake topics, but we arrived at the end result by a round about procedure. We asked first if people had discussed the possibility of an earthquake happening in southern California, then asked with whom they had discussed the possibility, and then, for each type of partner indicated, we asked which of the seven topics they had discussed. In our two final waves we did not ask either the initial sorting question or the question about partners. But we did ask directly:

> During the last year or so, earthquake topics have received quite a bit if attention in southern California. As I read the following, please tell me whether <u>you</u> have talked about any of these topics with people you know.

The same seven topics were presented to respondents as before. Because of the intervening steps in the initial interview, we cannot be sure that results are entirely comparable. But with this caveat, we report them in Table 17.

TABLE 17

EARTHQUAKE DISCUSSION TOPICS AT THREE PERIODS OF TIME

Discussion topic	February 1977	June 1978	Nov./Dec. 1978
Predictions**	83.0	42.7	48.6
Family preparedness*	48.7	42.7	41.9
Why earthquakes occur**	50.3	36.4	44.0
Quakes around the world	65.4	61.0	67.7
Old, unsafe or pre-1933 buildings	43.0	47.8	48.3
Dams/flooding*	32.7	54.9	52.6
Moving out*	28.3	16.2	19.8
(Total number)	(1450)	(536)	(898)

There are significant reductions in discussion of four topics and a significant increase in one. There is a very substantial reduction in the proportion of respondents who report having discussed predictions. A smaller but still highly significant drop ($p < .001$) in discussion of "why earthquakes occur" reflects related subject matter. The drop in discussion of predictions moves the stable topic of "earthquakes around the world" into first place. "Moving out" is consistently the least frequently discussed topic, but the drop is highly significant ($p < .001$). A smaller but still significant ($p < .01$) drop occurred in discussion of family preparedness. Changes in discussion of these four topics document a general decrease in attention to the prospect of a future earthquake and personal preparedness, though discussion of earthquakes around the world and the problem of old unsafe buildings remains steady.

The only highly significant ($p < .001$) increase is in the topic of dams and flooding. The rise from 33 to 53 percent is substantial, and rates in the two final surveys are very similar. The topic shifts from sixth rank in February, 1977, to second rank in the two concluding surveys. Unfortunately we did not include questions in either of the final surveys concerning awareness of the Auburn Dam controversy in northern California, since this appears to have been the only special treatment of the danger of dams collapsing during an earthquake in the local media. It is not our impression, however, that this controversy attracted widespread attention in southern California except among members of environmentalist groups. The collapse of the earth-filled Toccoa Falls Dam in Georgia on November 6, 1977, with the loss of thirty nine lives stimulated some nationwide attention to the hazard of collapsing dams, and may have increased local awareness of the seismic threat to dams. But again we have no direct information concerning our respondents' awareness and concern over this incident.

Perhaps the most obvious explanation for increased discussion of dams and flooding may be the weather patterns at the time. The basic field survey was administered during a long period of drought in California, with associated mandatory and voluntary restrictions in water consumption. But during the following winter and before our two final surveys came one of the heaviest rainy seasons on record locally, with accompanying flooding. While issues of dam safety were not brought to the fore, flooding replaced drought as a problem. Respondents may have been responding more to "flooding" than to "dam" in answering the question, and some may even have partially forgotten that the governing topic was earthquakes.

Continuing Significance of Critical Events

In this chapter we have dealt largely with the awareness and interpretation of events that might have changed the public view of the earthquake threat. The events we have examined took place after our first survey. But there are at least three critical events in relation to the earthquake threat that happened before the first survey whose recognition or evaluation may have changed. These events are the issuance and subsequent withdrawal of Dr. James Whitcomb's "hypothesis test," the issuance and disconfirmation of Henry Minturn's forecast, and the announcement of the Uplift. We shall consider the first two together.

A major concern of scientists and officials who deal with earthquake prediction and warning is the risk of issuing a false alarm. While the probable consequences of a false alarm are not known, there is a general conviction that they would be quite disruptive and would undermine confidence in future predictions and warnings. Both Whitcomb's and Minturn's announcements qualify as false alarms. James Whitcomb issued his forecast for a moderate earthquake in the Los Angeles area, to occur anytime within a year of the date of issuance in April, 1976. Although he carefully qualified his forecast by calling it an "hypothesis test," and explained that it

was based on a theory concerning which the evidence was contradictory, it was generally interpreted as a prediction and reviewed by the California Earthquake Prediction Evaluation Council as if it had been a prediction. Then in December, before the one-year time window had passed, he announced that data secured in subsequent monitoring of the same area no longer supported the forecast, and that he was withdrawing the forecast.

The important long-term question is whether the issuance of such a forecast by a reputable scientist and its subsequent withdrawal would disillusion people about future scientific predictions and warnings. For the present we shall ask merely how many people remembered, about two years later, that a scientist had issued a fairly widely publicized prediction and subsequently withdrawn it. Demonstrating that people remember the sequence will not demonstrate that the assumed effects of a false alarm have occurred. But ascertaining whether people remember the issuance and withdrawal is an essential first step in searching for a false alarm effect.

Similarly, in November, 1976, Henry Minturn issued his forecast for an earthquake in the Los Angeles region to occur on December 20 of that year. The short lead time was a period of widespread concern and attention to the Minturn forecast. This event was the most frequently mentioned one when asked in our basic field survey what predictions and other announcements people remembered hearing. December 20 came and went without an earthquake. Indeed it was not until New Year's Day, 1979, that an earthquake strong enough to be felt throughout Los Angeles County occurred. The Minturn forecast fits the classic conception of a false alarm. While Minturn was not a credentialled scientist, he represented himself as one and was widely misperceived as a scientist. Again, learning whether people remember the Minturn forecast and its disconfirmation is the essential first step to uncovering a false-alarm effect.

TABLE 18

MEMORY OF PREDICTION WITHDRAWN OR DISCONFIRMED

Information remembered	Prediction later withdrawn	Prediction that didn't happen
Remember hearding about?		
Yes	27.3	43.0
No	72.7	57.0
Total	100.0	100.0
Total number	898	898
What do you remember about prediction or who made it?		
Uplift	1.6	3.1
Whitcomb or Cal Tech	3.3	2.1
General scientific	7.3	6.0
Minturn	3.3	5.2
Psychic	8.6	12.4
Religious	1.2	2.9
California breakoff	4.1	5.4
Soviet scientist	.4	.5
General statement	10.6	7.5
Unclassifiable details	33.1	37.3
Don't know	26.5	17.6
Total	100.0	100.0
Total number	245	386

We assumed that if a false alarm is to affect the credibility of other announcements, the false alarm event should be salient and not merely subject to recall. Hence we did not ask about either Whitcomb or Minturn by name or by recounting the specific details of the two events. Instead we asked generally about a prediction that was later withdrawn and a prediction that didn't happen. The two questions were worded as follows:

> During the past year or two, do you happen to remember hearing about an earthquake prediction for the Los Angeles area which was later withdrawn?
>
> A. What do you remember about that prediction or who made it?
>
> During the past year or two, do you happen to remember hearing about an earthquake prediction in the Los Angeles area that didn't happen?
>
> A. What do you remember about that prediction or about who made it?

The results are summarized in Table 18.

Neither "prediction" is remembered by the majority of the respondents. Considerably more people remember an earthquake prediction that didn't happen than remember one that was withdrawn. The 43 percent who remember the disconfirmed prediction could have a far reaching effect on public attitudes toward earthquake prediction. The 27 percent who remember a withdrawn prediction could also have a substantial impact through informal discussion networks.

But we cannot take for granted that respondents had in mind the Whitcomb and Minturn forecasts. We have attempted to code information given in response to the followup questions in the same way that we coded statements about predictions and other announcements people remembered in each of the five survey waves. We do not expect lay people to remember names like Minturn and Whitcomb. But we look for clues such as references to "the Cal Tech scientist" or "the quake that was to occur by April," for Whitcomb. When we classify responses in this way, it becomes clear that relatively few of the people who remembered a prediction that was later withdrawn had James Whitcomb clearly in mind. In fact the responses identified almost every conceivable prediction source.

A few more people correctly identified Minturn with the disconfirmed prediction, but the number is still small. In both cases larger numbers referred to a forecast issued by a psychic and to the forecast that California will break off from the North American Continent in an earthquake and fall into the Pacific Ocean.

While substantial minorities of the people remember that there have been earthquake "false alarms," their memories of the events are generally vague and fragmentary. And in many instances they associate the false alarms with nonscientific sources.

Finally, the announcement of the southern California Uplift itself may qualify as a sort of slowly developing false alarm. Especially since many people expected a damaging earthquake within a year of our first survey, there may well be a sense that the Uplift was a false alarm. As indicated in Table 18, a few people mentioned the Uplift as an example of a prediction that was withdrawn and as the prediction of an earthquake that didn't happen. In the next chapter we shall examine the trend of answers to identical questions about the Uplift asked in all five surveys. But we also included a question on the subjective sense of changed evaluation of the Uplift in the final interview wave.

The question asked of all respondents who said they remembered hearing of "a bulge in the earth near Palmdale" and realized that scientists were saying that it might be a sign of a coming earthquake, was worded as follows:

> We've been hearing about a bulge in the earth near Palmdale for quite a while now. Compared to when you first heard about the bulge, do you take it more seriously or less seriously now as a sign of a coming earthquake?

Significantly more of the respondents who were being reinterviewed than of the respondents being interviewed for the first time had heard of the Uplift and appreciated its potential significance. Consequently we have kept the

TABLE 19

HOW SERIOUSLY THE UPLIFT IS TAKEN

COMPARED TO WHEN FIRST HEARD ABOUT

Comparative seriousness	Number	Percent of heard	Percent of sample
New sample			
More serious	85	26.4	15.5
About the same	135	41.9	24.5
Less serious	102	31.7	18.5
Total hear of Uplift*	322	100.0	58.5
Not heard of Uplift	228		41.5
Total sample	550		100.0
Reinterviewed sample			
More serious	91	32.7	26.2
About the same	101	36.3	29.0
Less serious	86	31.0	24.7
Total heard of Uplift*	278	100.0	79.9
Not heard of Uplift	70		20.1
Total sample	348		100.0

*Includes only respondents who heard of the Uplift and understood it might signify a coming earthquake.

two samples separate in reporting the findings in Table 19.

In both samples a plurality say they take the Uplift as a sign of a coming earthquake about the same as when they first heard about it. Those who take it more seriously and those who take it less seriously are about evenly balanced. The apparent difference between the new and reinterviewed sample, counting only those who were asked the comparison question, is not statistically significant (Chi-square = 2.962, 2 d.f.). While the proportions who say they take the Uplift more seriously than at first and who say they take it less seriously are quite substantial, there is no evidence of a net change in either direction.

Conclusions

This chapter was intended to establish the background for the next chapter in which we examine changes indicated by questions that were asked repeatedly during the five surveys. Varying degrees of awareness of earthquake-related events have been reported. On the whole the general impression is that nothing has happened with sufficient force to make drastic changes in public awareness and attitude toward the earthquake threat. People have not been sufficiently impressed with false alarms that we should expect any great effect. People sense that media coverage of earthquake topics has declined, and discussion had declined with it. But there is no net loss in desire for media coverage and no net downgrading of the significance of the Uplift. And there appears to have been an increased interest in flooding as a potential consequence of earthquakes and a substantial increase in the size of the minority of respondents who feel that nonscientific earthquake forecasts are receiving insufficient attention in the media.

We were especially interested in this chapter in any tendency for people

TABLE 20

COMPARATIVE SIGNIFICANCE OF INTERPRETED EVENTS

FOR THE EARTHQUAKE PROSPECT LOCALLY

Recognition and belief	Percent of total sample			
	Changes in the Bulge	Bulge is sinking	Earth-quake swarm	Santa Barbara quake
Heard of the event	12.9	16.1	38.7	83.2
Heard interpretation:				
It is a sign quake is coming		3.8	20.0	23.4
It lessens quake prospect		4.3	18.2	13.1
Interpretation is probably true:				
It is a sign quake is coming		2.5	14.2	13.6
It lessens quake prospect		2.0	13.2	7.8

to interpret events as signs concerning the imminence of a destructive earthquake in Los Angeles County. In Table 20 we compare the total impact of the relevant events. The early report of changes in the Uplift and the report that parts of the Uplift were sinking were heard and remembered by only 13 and 16 percent of our total sample, respectively. The earthquake swarm studied by Cal Tech scientists was better known at 39 percent, while 83 percent heard of the neighboring Santa Barbara earthquake.

We did not ask about interpretations of early changes in the Uplift, but we did for the other three events. Very few people heard that sinking in parts of the Uplift might signify the coming quake or that it might signify that the earthquake potential was being relieved, and even fewer thought either of these interpretations was probably true.

Interpretations of the earthquake swarm in the Palmdale region and the neighboring Santa Barbara earthquake were more widely diffused, but still reached only a minority. About one out of five heard that the quake swarm signified the coming quake and a few more heard the same thing about the Santa Barbara earthquake. Smaller numbers heard the opposite interpretation. Approximately one person in every seven in the adult population thought that the respective events probably did signify a coming large earthquake for Los Angeles. About the same proportion, including some of the same people, thought the earthquake swarms relieved pressure and lessened the imminent earthquake danger, while a much smaller fraction thought the Santa Barbara earthquake relieved strain in Los Angeles.

REFERENCE

Slovic, Paul, Howard Kunreuther, and Gilbert White. 1974. "Decision Processes, Rationality, and Adjustments to Natural Hazards," in Gilbert White, editor, Natural Hazards: Local, National, and Global. New York: Oxford University Press, pp. 187-205.

CHAPTER THREE

THE RECORD OF CHANGE AND STABILITY

By comparing responses to the same questions on five separate occasions from February, 1977, to November-December, 1978, we can establish what changes in awareness and response took place in a relatively objective fashion. After the primary field survey of 1450 residents, the goal for each of the four subsequent telephone surveys was to secure a comparable sample of 500 or more new respondents. The actual numbers of completed interviews were 551, 516, 536, and 550, respectively. In order to identify changes in the population at large we used only these new-respondent samples, disregarding samples of reinterview subjects taken at several of the same intervals.

Since we have only five moments in time for comparison, we shall rely principally on inspection of percentage distributions in the analysis. We shall be looking both for trends over the entire study period and fluctuations that might be responsive to specific events. The problem of deciding which changes should be treated as significant and which should not cannot be resolved altogether satisfactorily on statistical grounds. For the analysis of trends, the four intervals between surveys are too few for precise trend analysis. In the absence of prior commitment to hypotheses predicting specific changes during specified intervals, apparent changes that do not fit a long-term trend invite more impressionistic than rigorous analysis.

In keeping with the generally inductive approach of the investigation, we shall not attempt to make precise assessments of statistical significance. However, in order to guard against taking trivial changes seriously and in order to establish moderately uniform standards for deciding what apparant changes to take seriously, we shall report measures of significance. We will not interpret these measures literally, but will use them to set lower limits on the apparent

changes for which we offer provisional interpretations.

The first step in each instance will be to compute Chi-square values for complete series and for selected pairs of surveys. A significant Chi-square based on the complete series provides some assurance that rates are not entirely constant, but it does not guide us in specifying the nature of the trend or other change. While a nonsignificant Chi-square based on a comparison between two surveys precludes our taking that specific difference seriously, a significant Chi-square does not guarantee that we are safe in taking it seriously. Since the five moments can be compared in ten ways, two at a time, the chance of finding a single pair of responses that differ "significantly" is augmented. In general we shall limit the pair comparisons to surveys that are adjacent in time and to comparison between the beginning and concluding surveys.

Whenever there appears to be a fairly simple trend from beginning to end of the study period, we shall also fit a simple curve to the five points and report the goodness of fit. When a simple mathematically defined curve describes the pattern given by a set of points within acceptable confidence limits, the logic underlying that curve gains plausibility as a way of interpreting the trend. Because the number of cases (i. e., time points) is limited to the five data gathering moments within the general study period, any curve will have to describe the pattern of the data with a high degree of accuracy to fall within acceptable confidence limits.

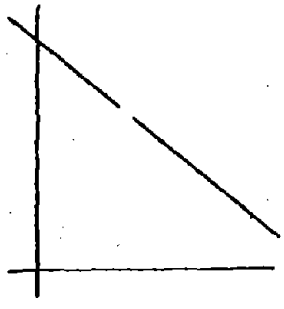
Ascending and descending linear trend lines will be the first choice whenever either appears to be applicable. The linear curve has the advantage of being a simple, single parameter model. It signifies a constant rate of change for each interval of elapsed time.

A second curve, the exponential curve, retains the desirable one parameter characteristic of the linear model, but provides a different description of the trend. The exponential curve is suitable for describing trends in which the

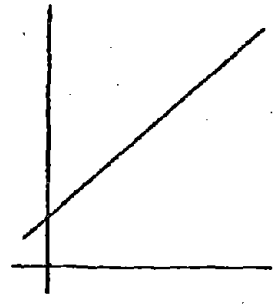
variable either decreases or increases rapidly within the first few time periods, becoming more stable near an asymptote during later time periods. Conversely, the exponential curve can be used to describe trends in which the variable changes minimally during the initial time periods and increases or decreases rapidly during later time periods, approaching an asymptote in the limit. This curve will be particularly useful in describing the trend in variables that are thought to maintain a relatively constant level, except when unusual circumstances upset the balance of forces and temporarily raise or lower their level.

A final curve will be considered in describing trends, but will be used with caution, since it incorporates an additional parameter in describing the data points, and since the theoretical justification for its use is often obscure. The parabola is the common U-shaped curve, and relies on two parameters in describing a trend. The curve may be either concave or convex, and may be centered near any one of the survey moments. When the center (vertex) of the curve is positioned at the middle survey moment (January, 1978), the full U-shaped pattern will be apparent. On the other hand, when the curve is centered earlier or later than the middle survey moment, only a portion of the full U-shaped pattern will show. The apparent curve will then resemble the letter J more than the letter U.

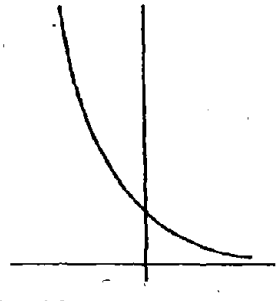
Often when reporting goodness of fit (e.g., sum of absolute errors, sum of squared errors, etc.) there is no compelling reason to choose one, rather than another, summary index. Often the investigator will report several summary indices, to insure that conclusions are not artifacts of the choice of a single index. However, in the present case we are dealing with only a small number of data points, so the measure of fit must take into consideration the number of free parameters used in describing the data.



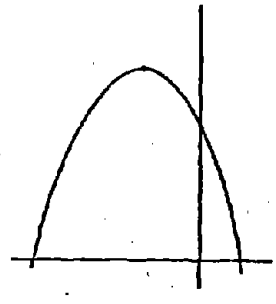
Declining linear trend



Ascending linear trend



Declining exponential trend



Convex parabolic trend

CURVES APPLIED TO CHANGING EARTHQUAKE THREAT RESPONSE

FIGURE 1

Thus our choice of summary index is the F ratio, commonly used in reporting fit in both regression and variance analyses. A significant F ratio will be the basis on which we conclude that there has been a trend of a specified shape.

The general shape of these various curves is given in Figure 1.

Earthquake Awareness

General forecast awareness. The most general indicator of the prevailing state of awareness is the number of people who remember hearing some kind of public announcement forecasting an earthquake or alerting the populace to the possibility of a quake. The same question was asked on all five occasions:

> In the past year or so, have you heard any predictions, statements or warnings about earthquakes in the southern California area? This is, about specific locations, specific time, or from specific people?

Respondents who answered "Yes" were then asked:

> I'd like you to tell me about the predictions, statements, or warnings. Any specific ones, anything at all that you remember.

On the first three occasions interviewers were instructed to record up to five separate answers and space was provided on the interview schedule for five corresponding sets of follow-up questions concerning the announcements. To prevent an overly long interview and because respondents seldom offered more than three answers, only three announcements were recorded in the two final interview waves. In order to establish comparability, we have included only the first three announcements from each of the interview waves in the following analysis of change and stability. For that reason there will be slight differences in the findings from the initial survey as reported in the earlier analysis.

From February, 1977, to January, 1978, there was a dramatic drop in the remembrance of earthquake predictions, near predictions, forecasts, and

cautions (Table 1). The proportion of respondents who could not remember any recent announcement tripled from February to August, 1977, and quadrupled from February, 1977, to January, 1978. The corresponding proportions remain fairly stable for the rest of 1978. Similarly the mean number of announcements remembered drops by 38 percent from February to August, 1977, and by 55 percent from February, 1977, to January, 1978, remaining fairly stable thereafter. The value of Chi-square with eight degrees of freedom, comparing the five surveys, far exceeds the .001 confidence level. A declining linear trend line fits the percent of respondents who reported one or more announcements loosely ($F = 11.30$; 1, 3 d.f.; $p < .05$). But the exponential curve describes the points much better ($F = 2114.56$; 1, 3 d.f.; $p < .001$). The initial high level awareness might plausibly be viewed the consequence of unusual circumstances. As the impact of the special circumstances wore off, the level of awareness declined so as to approach a horizontal line representing an average of about one half an announcement per respondent.

This very clear trend of awareness confirms the impression gained from the media analysis that the year 1976 was a very "busy" year so far as intimations of earthquake danger were concerned, and that 1977 and 1978 were quieter years. Yet there were new announcements during the latter years. Seers continued to issue their forecasts, there were periodic reports on the status of the Uplift, and general reminders continued to be issued. But the same impression was no longer being made on public awareness.

For future reference, we call attention to some of the interpretations that might be justified if other findings provide consistent support. One explanation would be simply that the new developments were less newsworthy because they were repetitions and revisions of prior announcements or because they lacked the urgency of some earlier announcements and the specificity of

TABLE 1

NUMBER OF EARTHQUAKE PREDICTIONS, FORECASTS, AND CAUTIONS HEARD

Number of announcements heard	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
None	13.4	38.9	55.2	55.2	57.8
One	57.4	49.7	35.7	31.7	33.1
Two	23.2	9.6	7.7	10.8	8.4
Three or more	6.0	1.8	1.4	2.3	0.7
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550
Mean announcements per respondent	1.21	.75	.55	.57	.52

the Minturn announcement. A second explanation would be that many people had experienced a kind of "saturation" on the basis of the 1976 announcements, rumors, and devastating earthquakes, and could simply "absorb" no more announcements. A variant on this second explanation would be the suggestion that "saturation" does not necessarily prevent the absorption of any new announcements, but does raise the threshold for significant experience. Announcements that would have made a significant impression before saturation occurred were no longer dramatic enough to create an impression.

A third type of explanation relates experience to its effect in creating conviction. From this point of view, earthquake announcements are significant experiences insofar as they contribute substantially to the individual's judgment as to whether there will be a damaging earthquake soon. Early announcements significantly contributed to a process in which many people thought seriously about the prospect of an earthquake and came to the conclusion that a quake was to be expected. Once that view was established, and so long as the conviction remained, new announcements added little to the process and therefore made little distinctive impression. They were more like the familiar sights that remind the automobile driver that he is still on the right road, without requiring active attention, than like the signs that command close attention while he is trying to find the way along an unfamiliar route.

While entertaining the possibility that explanations such as these are appropriate, we must not overlook the more parsimonious possibility that one or two exceptional and nonrepetitive events accounted for the initially high level of awareness in February, 1977. It is conceivable that without an event such as the Minturn announcement with its extensive legitimation through the media there would only have been a low and stable level of

awareness similar to the level in 1978. As we proceed with further analyses of the data it may be possible to shed light on the relative merits of some of these possible explanations.

Types of announcement. The first question for understanding the lowered awareness is whether the decline applies equally to different kinds of earthquake notices. If we look at the number of references to each type of announcement, relative to the number of respondents, we see at once that all types of announcements were more salient in February, 1977, but the rate and pattern of decline varied considerably (Table 2). The most dramatic decline applies to pseudoscientific announcements and takes place immediately from February to August, 1977. The trend of pseudoscientific announcements is well described by an exponential curve ($F = 56.52$; 1, 3 d.f.; $p < .01$). General or vague announcements also drop substantially, but this occurs almost entirely between August, 1977, and January, 1978. The trend of general announcements corresponds loosely to a declining linear trend line ($F = 18.53$; 1, 3 d.f.; $p < .05$). Scientific and prophetic announcements do not change a great deal, nor according to any easily identifiable pattern. The slight decline in prophetic announcements can be loosely described by an exponential curve ($F = 14.29$; 1, 3 d.f.; $p < .05$). As a result principally of the sharp decline in pseudoscientific announcements, the relative salience of general and scientific announcements shows some increase during the period under investigation.

The patterns of change can be further clarified by looking separately at the four most significant specific earthquake notices (Table 2). Since pseudoscientific announcements have declined most dramatically, it is helpful to compare the two principal pseudoscientific forecasts. References to the Minturn forecast exhibit the major decline from February to August, 1977, and the lesser decline to January, 1978, with which we are already

TABLE 2

TYPE OF PREDICTIONS, FORECASTS, AND CAUTIONS HEARD

Number of announcements heard	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
Relative to number of respondents					
Scientific	18.8	12.7	14.7	15.1	9.3
General	44.4	42.5	27.5	29.5	22.4
Pseudoscientific	45.7	10.9	6.6	4.7	6.5
Prophetic	7.4	6.7	4.7	4.5	4.9
Other	5.2	2.4	1.7	2.8	2.5
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550
Percent of all announcements reported					
Scientific	15.5	16.9	26.7	26.7	20.3
General	36.6	56.5	49.8	52.1	49.0
Pseudoscientific	37.6	14.5	11.9	8.3	14.3
Prophetic	6.1	8.9	8.4	7.9	10.8
Other	4.2	3.2	3.2	5.0	5.6
Total	100.0	100.0	100.0	100.0	100.0
Total announcements	1761	414	285	303	251
Percent of respondents					
Southern California Uplift	6.2	5.6	10.3	11.3	4.7
James Whitcomb	4.8	2.9	1.2	1.3	0.4
Henry Minturn	37.5	6.7	2.5	1.5	2.5
California breakoff	7.3	4.0	3.9	3.2	4.0
Percent of all announcements reported					
Southern California Uplift	5.1	7.5	18.6	21.1	10.4
James Whitcomb	4.0	3.9	2.1	2.3	0.8
Henry Minturn	30.9	8.9	4.6	2.6	5.6
California breakoff	6.0	5.3	7.0	5.6	8.8
Percent of respondents					
Mean classifiable announcements per respondent, omitting Minturn	.84	.68	.53	.55	.43

familiar. Again, attention to the Minturn announcement is well described by an exponential curve ($F = 54.42$; 1, 3 d.f.; $p < .01$). But the folklore about California breaking off and falling into the ocean continues to be news at a fairly stable rate after an initial drop between February and August, 1977. Hence there does not seem to be a disproportionate turning away from pseudo-scientific beliefs in general, but only a declining interest in the Minturn incident.

The obvious next question is whether the passing of the Minturn incident is enough to explain fully the decline in total awareness. We can answer this question simply by computing the mean number of earthquake announcements mentioned by our respondents when references to Minturn are eliminated from the computation. Although the decline is now more linear and less concentrated in the first period, there is a substantial decline with a single interruption of the downward trend between January and July, 1978. The overall relationship as measured by the Chi-square test is highly significant ($p < .001$, 4 d.f.). The trend can be described loosely by either an exponential curve ($F = 28.39$, 1,3 d.f.; $p < .05$) or a declining linear trend line ($F = 27.43$, 1, 3 d.f.; $p < .05$). Since these rates are secured by summing the awareness levels for various kinds of announcements, the ambiguous nature of the trend line may reflect the combination of linear and exponential trends applicable to different types of announcements. But regardless of the precise nature of the trend, the main conclusion is clear. Although the Minturn announcement contributes greatly to the overall trend of awareness, its effect is chiefly to intensify a trend that also characterizes other notices and to exaggerate the loss of awareness between February and August, 1977.

The other two specific announcements in Table 2 are scientific in their origin. The Whitcomb announcement--more often identified as coming from Cal Tech than by reference to Whitcomb's name--exhibited low salience from the

start of our survey period. After August, 1977, and again after July, 1978, the salience declined further. The overall relationship between time and the proportion of respondents mentioning Whitcomb is highly significant ($p < .001$, 4 d.f.). By the end of the study period the Whitcomb "hypothesis test" no longer came to mind when respondents were questioned about earthquake predictions. A declining linear trend line fits the Whitcomb references reasonably well ($F = 34.50$; 1, 3 d.f.; $p < .01$). The Uplift, on the other hand, increased in salience from August, 1977, to July, 1978, with the major increase occurring between August, 1977, and January, 1978. The upward trend appears to be reversed by a substantial drop in the final period. We shall come back to the Uplift later. But for the present, while Minturn is being forgotton most rapidly and Whitcomb less rapidly, while general warning announcements are being mentioned less often, and while other pseudoscientific and prophetic announcements remain fairly constant after the initial drop, the Uplift is the one easily identified topic whose salience increases during a substantial portion of the study period.

We report announcements that identifiably originate from scientific sources separately in Table 3. In spite of the increased salience of the Uplift, the salience of all announcements from scientific sources declines, especially from February, 1977, to January, 1978. Relative to other kinds of announcements, scientific notices may have increased their prominence to a peak in July, 1978, but this is not a strong trend. While the increased salience of the Uplift contributed to a slight shift toward greater salience of scientific than nonscientific announcements, it also signaled a growing tendency for most scientific announcements to be tied to the Uplift.

In the course of analyzing the data from the primary field survey we observed that respondents' own source attributions for earthquake notices

TABLE 3

NUMBER OF SCIENTIFIC EARTHQUAKE PREDICTIONS,

FORECASTS, AND CAUTIONS HEARD

Number of announcements heard	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
	Percent of respondents				
None	56.2	70.0	75.8	72.6	77.1
One	37.2	26.9	22.3	23.3	20.0
Two or more	6.6	3.1	1.9	4.1	2.9
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550
Percent of all respondents who heard one or more announcements of any kind					
None	49.4	51.6	46.8	38.7	45.7
One	43.0	43.4	48.9	52.1	47.4
Two or more	7.6	5.0	4.3	9.2	6.9
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1256	341	235	240	232

do not correspond exactly with our classification of sources. The differences are chiefly of two kinds. Statements that were too vague to be placed in a specific classification were identified as general announcements, but on further questioning respondents attributed most of these notices to either scientific or prophetic sources. And many of the forecasts that we identified as pseudo-scientific in origin--especially Minturn's forecast, the forecast that much of California will break off and fall into the ocean, and the less often mentioned Jupiter effect forecast--were attributed by respondents to scientists.

In Table 4 we report the changes in source attribution. Although the seers and psychics category and the scientific category together now account for from 64 to 74 percent of all attributions, trends are not substantially different from the trends in types of announcements as we classified them. Attributions to seers and psychics and to religious speakers do not appear to vary according to a significant pattern. The "Don't know" response that takes the place of the general announcement was quite stable throughout the study period. Attributions to scientists increased more decisively than reference to notices that we could identify as having scientific origins.

The consistently low level of reference to friends, neighbors, coworkers, and relatives as sources may have 'increased' after the initial survey. The reference to amateur scientist, applying mostly to Henry Minturn, declines over the entire period. This trend is well described by an exponential curve ($F= 41.96$; 1, 3 d.f.; $p < .01$). It is interesting to note that while less than half the people who mentioned Minturn in the first survey when his forecast was still the most salient correctly identified him as an amateur, larger proportions of those who continued to remember Minturn's forecast as the salience declined correctly identified its author as an amateur.

If we attempt to look at the objective classification and subjective

TABLE 4

ATTRIBUTED SOURCE OF PREDICTIONS, FORECASTS, AND CAUTIONS HEARD

Attributed source	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
Scientist	41.9	44.2	47.4	56.8	50.0
Seer or psychic	21.9	23.9	19.6	16.8	23.1
Religious speaker	2.1	1.7	1.1	2.3	4.5
Amateur scientist	8.5	5.8	2.4	1.6	1.1
Friend, relative, neighbor	0.7	2.2	3.2	2.0	3.5
Other, including mixed	6.2	5.5	10.5	3.3	0.7
Don't know	18.7	16.7	15.8	17.2	17.1
Total	100.0	100.0	100.0	100.0	100.0
Announcements	1761	414	285	303	286

source attributions together, we might summarize trends in the following terms. A general decline in remembrance of earthquake predictions, forecasts, and cautions is partly but not entirely explained by the unusual attention focussed on Henry Minturn's forecast that was disconfirmed one to two months before our initial survey. If attention that might have been claimed by another Minturn-type announcement shifted rather than disappeared, it contributed immediately to a relative increase in remembrance of vague general warning statements. The relative salience of secular and religious prophetic forecasts, whether identified as such by our coders or by the respondents' own attributions, seems to be a fairly stable component of all notices remembered. Contradicting the general trend, the proportion of all respondents who mentioned the southern California Uplift actually increased throughout the period of study. This change contributed to a slight relative increase in the prominence of announcements that were identifiably from scientific sources, and a clearer increase in the extent to which respondents think of science as the source for whatever predictions, forecasts, and cautions they have heard.

A final critical component of the announcements people remember is the intensity of the anticipated earthquakes. If we assume that only those earthquakes that are expected to destroy many buildings and take many lives or destroy some buildings and take a few lives are really events of significant social concern, it should be useful to record how many forecasts of such damaging earthquakes were mentioned by the respondents. It is not surprising to observe that the number of respondents who remember one or more announcements concerning a damaging earthquake declined along with the average number of such announcements, especially from February, 1977, to January, 1978 (Table 5). By August, 1977, and throughout the remainder of the study period, the majority of respondents could not recall any recent announcement that referred clearly to a damaging earthquake.

TABLE 5

DESTRUCTIVENESS ASSOCIATED WITH EARTHQUAKE

PREDICTIONS, FORECASTS, AND CAUTIONS HEARD

Destructiveness	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
Announcements of destructive earthquakes heard:					
None	36.4	56.1	69.6	72.8	71.6
One	47.0	39.0	24.8	23.1	22.9
Two	16.6	4.9	5.6	4.1	5.5
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550
Mean number of announcements of destructive earthquakes heard	.80	.49	.36	.31	.34
Destructiveness of earthquakes:					
Destroy many buildings and take many lives	63.8	72.3	71.7	67.7	74.5
Destroy many buildings and take few lives	23.6	18.9	21.9	18.7	17.2
Some damage, no widespread destruction	10.1	6.8	3.5	8.6	5.4
Little or no damage	2.5	2.0	2.9	5.0	2.9
Total	100.0	100.0	100.0	100.0	100.0
Persons stating destructiveness	1363	296	201	198	204
Mean destructiveness	3.49	3.61	3.62	3.49	3.63
Percent of all announcements for which destructiveness is stated	77.2	71.2	69.6	64.9	71.3

The decline might reflect simply the general decline in earthquake forecast awareness, or it might also reflect some change in the relative seriousness of earthquakes that people remember hearing about. There does appear to have been an increase for most of the study period in the number of people who are unable to associate intensity with the announcements they have heard. But when we examine only those announcements for which intensities have been stated, there appears to have been no consistent or clear pattern of change. We conclude that while people have become increasingly unclear about the severity of the earthquake anticipated on the basis of announcements they remember, there has been no trend toward remembering more or less severe earthquake during the period under investigation.

Announcements taken seriously. We have established that there were some changes both in the number and the kinds of earthquake announcements people remembered. It remains to be established whether people took the announcements they heard more or less seriously as time progressed. In Table 6 we observe that there was a steady but relatively slight decline in the number of people who had heard one or more announcements that they took seriously. The decline is only loosely described by a linear trend line ($F = 47.00$; 1, 3 d.f.; $p < .05$). However, if we pay attention only to the respondents who remembered one or more announcements, there is a steady increase in the proportion who took one or more announcements seriously from February, 1977, to January, 1978. This trend is described loosely by a convex parabolic curve ($F = 23.89$; 2, 2 d.f.; $p < .05$). Similarly, the percent of all announcements remembered that were taken seriously rose during the same period from 32 percent to 50 percent, remaining stable to July, then dropping part way back. The latter relationship for the five survey moments is highly significant ($p < .001$).

Perhaps the ultimate measure of significant earthquake announcements is the number that refer to earthquakes of destructive intensity that are taken

TABLE 6

HOW SERIOUSLY EARTHQUAKE PREDICTIONS, FORECASTS, AND CAUTIONS ARE TAKEN

Announcements taken seriously	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
	Percent of all respondents				
None	68.1	72.8	75.9	76.1	81.6
One	26.2	24.9	20.0	20.0	15.1
Two	5.7	2.3	4.1	3.9	3.3
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550
	Percent of all respondents who heard one or more announcements of any kind				
None	63.1	56.0	47.2	46.7	56.4
One	30.3	40.2	43.8	44.6	35.8
Two	6.6	3.8	9.0	8.7	7.8
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1256	341	235	140	232
	Percent of all announcements heard				
Quite seriously	13.2	18.5	20.8	23.9	21.3
Fairly seriously	18.4	21.4	29.4	26.2	20.3
Don't know	3.2	3.1	3.1	6.6	6.3
Not very seriously	28.6	27.4	24.6	23.9	24.8
Not at all seriously	36.6	29.6	22.1	19.4	27.3
Total	100.0	100.0	100.0	100.0	100.0
Number of announcements	1766	416	289	305	286

seriously. The number of respondents who have heard one or more announcements of impending destructive earthquakes that they take seriously appears to have decreased during the study period (Table 7). However this trend is not the result of taking destructive earthquake forecasts less seriously. There appears to have been a modest trend for respondents to take whatever forecasts and cautions concerning destructive earthquakes they have heard more seriously during most of the study period. This overall relationship is only maginally significant ($p < .05$), however.

Once again we see a slight possible change in quality that may counterbalance the decline inquantity of announcements remembered. Whether we consider all earthquake notices remembered or only notices identified with potentially destructive earthquakes, there appears to have been a slight rise in the proportion taken seriously during most of the study period.

Our special concern with how people view scientific announcements is the basis of Table 8. The general decline in forecast awareness is again reflected in a modest decline in the number of respondents who have heard scientific announcements that they take seriously. But the percent of all respondents who have heard any scientific announcements who take one or more of them seriously rises dramatically to January, 1978, then drops consistently during the remaining two periods to a level that is not significantly higher than the rate for February, 1977. The overall relationship between the number of people who have heard a scientific announcement who take one or more of them seriously and the five survey moments is highly significant ($p < .001$).

One feature of this trend is an inverse correlation with the number of people who remember any scientific announcements. From February, 1977, to July, 1978, the fewer the people who have heard any scientific announcements, the more of them have taken seriously what they have heard, and vice versa. Only with the last survey do the two proportions decline together.

TABLE 7

HOW SERIOUSLY PREDICTIONS, EARTHQUAKE FORECASTS
AND CAUTIONS OF DESTRUCTIVE EARTHQUAKES ARE TAKEN

Destructive earthquake announcements taken seriously	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
	Percent of respondents				
None	74.8	81.0	84.7	86.2	86.3
One	21.8	18.3	13.6	11.6	11.3
Two	3.4	0.7	1.7	2.2	2.4
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550
Percent of respondents who heard announcements concerning destructive earthquakes					
None	60.3	56.6	49.7	49.3	51.9
One	34.4	41.7	44.6	42.5	39.8
Two	5.3	1.7	5.7	8.2	8.3
Total	100.0	100.0	100.0	100.0	100.0
Number of announcements	922	242	157	146	156

TABLE 8

HOW SERIOUSLY SCIENTIFIC EARTHQUAKE PREDICTIONS, FORECASTS, AND CAUTIONS ARE TAKEN

Scientific earthquake announcements taken seriously	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
	Percent of respondents				
None	78.9	84.9	83.1	82.6	87.4
One	19.0	13.4	15.7	14.6	11.1
Two	2.1	1.7	1.2	2.8	1.5
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550
Percent of respondents who heard scientific announcements					
None	51.9	49.7	30.4	36.7	45.2
One	43.4	44.8	64.8	53.1	48.4
Two	4.7	5.5	4.8	10.2	6.4
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	636	165	125	147	126
Heard one or more scientific announcements, percent of all respondents	43.8	30.0	24.2	27.4	22.9
Took one or more seriously as percent of those who heard scientific announcements	48.1	50.3	69.6	63.3	54.8

Awareness of the Uplift. We have observed increases in both relative and absolute salience for the Uplift during most of the study period. These trends might indicate that progressively more people have become aware of the Uplift and of its significance and relevance as a possible earthquake precursor during this period of continuing media attention. Alternatively they might indicate merely that the Uplift has become salient to a larger proportion of the people who have heard of it, without any increase in general awareness. In Table 9 we can report the four levels of awareness for the five surveys. Overall the rates are surprisingly stable. The reader is reminded that respondents are divided into four groups, namely those who have not heard of the Uplift, those who have heard of the Uplift but do not realize that it may signify a coming earthquake, those who have head and understood but do not expect damage where they live in case of such an earthquake, and those who have heard and understood and expect damage where they live in case of an earthquake related to the Uplift. None of the types increase or decrease significantly except during the survey of July, 1978. A small but apparently significant increase in all of the "aware" categories occurred between January and July, 1978 ($p < .05$, 1 df) followed by a significant decrease to original levels of awareness by November-December, 1978 ($p < .01$, 1 df). We can search for special circumstances to explain the brief increase in awareness later. But in the absence of a persistent trend we must conclude that the increased salience of the Uplift did not signify any spreading awareness and appreciation of the Uplift in the population at large.

Source of information. In each of the surveys we asked respondents to name their chief source of information for each of the announcements they remembered. In the basic field survey of February, 1977, we found that television was named as the chief source of information more often than all other sources combined. We might conclude from this finding that television is the critical

TABLE 9

AWARENESS OF THE SOUTHERN CALIFORNIA UPLIFT

Extent of awareness	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
Not heard	40.9	41.9	40.3	33.0	41.3
Heard, not understood	16.1	20.5	18.2	19.0	18.7
Heard and understood, not relevant	17.7	14.4	16.7	19.4	16.9
Heard, understood, and relevant	25.3	23.2	24.8	28.6	23.1
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550

medium for communicating any sort of information concerning earthquake danger. But a comparison of information sources over the two-year study period will enable us to determine how stable this overwhelming reliance on television is.

Table 10 reveals the clearest linear trends we have observed up to this point in the analysis. The reliance on television decreased during each of the four periods between surveys, so that proportionate reliance on television in November-December 1978 was only 64 percent of the February, 1977 rate. The overall relationship is highly significant ($p < .001$) and the steady decline fits a linear trend line very closely ($F = 72.03$; 1, 3 d.f.; $p < .01$). Offsetting the decreasing reliance on television is a slightly more erratic but nevertheless striking increase in reliance on newspapers. The proportionate reliance on newspapers in November-December, 1978, is approximately double the rate for February, 1977. This relationship is also highly significant ($p < .001$) and the increase is loosely described by a linear trend line ($F = 29.48$; 1, 3 d.f.; $p < .05$). Although television was cited more than two and a half times as often as newspapers at the beginning of the study period, newspapers were cited slightly more often than television by the end of the period.

Although the changes are more erratic and are not statistically significant, the general trend for radio is similar to the trend for television, and the general trend for books and magazines is similar to that for newspapers. Hence the observed changes might plausibly be described as a shift away from the airways to the printed word as the source of information about the danger from a future earthquake.

In the earlier analysis we called attention to a certain affinity between types of announcement and information sources. Scientific announcements are relatively more often ascribed to newspapers, while general announce-

TABLE 10

CHIEF SOURCE OF INFORMATION FOR EARTHQUAKE PREDICTIONS, FORECASTS, AND CAUTIONS

Source of information	February 1977	August 1977	January 1978	July 1978	Nov/De 1978
All announcements heard					
Television	52.7	45.2	42.9	40.3	33.6
Radio	11.7	9.1	9.4	5.3	7.7
Newspaper	18.7	29.6	27.7	29.5	36.7
Books and magazines	1.9	2.6	1.7	3.9	6.3
People	9.1	9.9	10.0	6.9	7.7
Other	1.5	1.7	2.8	2.6	0.7
Don't know	4.4	1.9	5.5	11.5	7.3
Total	100.0	100.0	100.0	100.0	100.0
Number of announcements	1776	416	289	305	286
Southern California Uplift: spontaneously mentioned					
Television	46.6	35.5	44.8	36.4	22.2
Radio	11.0	3.2	6.9	3.0	11.1
Newspaper	26.0	38.7	37.9	45.5	51.9
Books and magazines	2.7	3.2	3.5	3.0	7.4
People	6.8	12.9	3.5	3.0	0.0
Other	1.4	3.3	1.7	0.0	3.7
Don't know	5.5	3.2	1.7	9.1	3.7
Total	100.0	100.0	100.0	100.0	100.0
Number of announcements	73	31	58	66	27
Southern California Uplift: not spontaneously mentioned					
Television	49.4	36.5	42.9	39.6	38.7
Radio	7.3	7.2	3.6	5.1	4.8
Newspaper	27.3	32.5	36.6	33.8	34.3
Books and magazines	2.1	1.2	3.1	3.7	4.8
People	4.3	9.5	3.1	5.1	5.2
Other	0.5	2.0	0.0	1.1	0.4
Don't know	9.1	11.1	10.7	11.6	11.8
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	626	252	224	275	271

ments are relatively more often ascribed to television. Some of the change in media prominence might have been a consequence of changing types of announcements. A comparison of sources of information concerning the Uplift should help to indicate whether this is the case.

Because people who mentioned the Uplift spontaneously were included in the figures for all announcements remembered, while the larger group who only recalled the Uplift under direct questioning were not, we report the two sets of rates separately. Overall the same trends appear as for all announcements mentioned spontaneously, but the trends are less dramatic. The print media are more often given as chief sources for information about the Uplift by the end of the study period and the airways less often. Thus the shift is not fully explained by the increased salience of scientific announcements. There is a more generally observable shift.

Unfortunately we cannot confidently diagnose the reason for the change. Without the same precise monitoring of television and radio that we have conducted for newspapers, we cannot establish whether television and radio coverage of predictive and near predictive announcements declined. We do have impressionistic evidence to suggest that television and radio editorial policies were reassessed following the extensive attention given to Henry Minturn's forecast, with resulting increased caution about airing any kind of predictive announcement. It is also possible that the credibility of newspapers was increased and the credibility of the airways decreased because of the generally skeptical attitude toward the Minturn prediction taken by newspapers. However this explanation is more difficult to accept in light of the timing of our first survey two months after Minturn's forecast had been disconfirmed, unless such disconfirmations have delayed rather than immediate effects.

Still another explanation could be found in elaborating the idea of affinities between particular media and types of content. It might be assumed that the effect of repeated attention to the same topic leads people to seek more detailed and profound information. Having heard repeatedly that we are overdue for a severe earthquake, people are only attentive to new and elaborated information about the earthquake threat. The printed word can more easily convey such elaborations than television and radio with their brief announcements incorporated in daily news broadcasts. The fact that books, magazines, and newspapers exhibit the same upward trend and television and radio the same downward trend as information sources lends plausibility to this explanation.

Earthquake Concern

We have learned that the awareness and credibility of various kinds of warnings of forthcoming earthquakes have changed both quantitatively and qualitiatively over the 22-month study period. To what extent are these changes matched by corresponding changes in concern and expectation? Apart from the memory of any specific earthquake warning, to what extent is the earthquake problem on people's minds, to what extent do they fear the prospect of an earthquake, and to what extent do they expect a severe earthquake soon?

Salience. All interviews with new respondents commenced without reference to earthquakes as the topic of investigation. Interviews first asked a set of three leading questions designed to elicit references to earthquakes if they were very much on the respondents' minds. Only after these questions were completed was the respondent told that the balance of the survey would deal with earthquakes. If people mentioned earthquakes once or more in answer to any of the three questions, the topic was said to be salient for them. We found a very low level of salience. Only 6.6 percent

of respondents in our basic survey mentioned earthquakes without prompting.

Percentages in Table 11 reveal that, low as it was, the initial figure was higher than in any later survey. Salience dropped by August, 1977, and again by January, 1978, to 50 percent of the initial rate. Subsequently in July 1978 and again in November-December 1978, salience rebounded, but less than half the way to its original level. The overall relationship, however, is only marginally significant, by the Chi-square test ($p < .05$, 4 d.f.), and none of the trend curves fits within acceptable confidence limits. Salience certainly did not increase during the two years. It is possible but not demonstrated that 1977 was a quiet year during the initial low level of salience dropped even lower, and that attention to earthquake news brought a partial recovery of salience in 1978.

Fear and concern. Fear of earthquakes could be viewed as a more general attitude than salience, less affected by warnings of moderate-to-low credibility or specificity. Three questions were used to measure fear and concern over earthquakes. The three items were weighted equally in establishing an index of fear and concern over earthquakes. The resulting index scores were divided into approximately equal quartiles, so as to identify low fear, low-medium fear, high-medium fear, and high fear. Fear registers a significant drop between February and August, 1977 ($p < .01$, 2 d.f.), but remains strikingly stable thereafter (Table 11). The proportion of respondents expressing high and high medium fear is loosely described by an exponential curve ($F = 21.03$; 1, 3 d.f.; $p < .05$). Interpretation of this pattern can best await the review the next two sets of data.

In order to guage people's own assessment of the effect of recent events on their concern about earthquakes, we asked whether their concern had increased, decreased, or remained the same during the preceding year. The majority of

TABLE 11

CONCERN ABOUT EARTHQUAKE DANGER

Type of concern	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
Salience of earthquake concern	6.6	5.1	3.3	4.1	4.7
Fear and concern:					
Low	25.1	30.4	30.6	30.6	32.7
Low medium	31.3	32.6	32.2	32.6	30.0
High medium	17.7	13.3	13.8	14.4	16.4
High	25.9	23.7	23.4	22.4	20.9
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1449	549	516	536	550
Changed concern:					
Decreased	4.2	8.0	8.0	9.1	8.0
Same and Don't know	65.6	77.7	71.5	74.3	75.8
Increased	30.2	14.3	20.5	16.6	16.2
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1444	551	512	536	550

respondents in each survey felt that their concern had neither increased nor decreased. And in each survey more people said their concern had increased than said it had decreased. However, the number who said their concern had increased dropped significantly by half between February and August, 1977. An apparent slight rebound to January, 1978, was not statistically significant. Otherwise the proportion who said their concern had increased did not change appreciably after the drop during the first half of 1977. The overall relationship is highly significant ($p < .001$). But because of the irregularity of the trend, none of the curves fits the data within acceptable confidence limits

Our respondents' own perceptions of change and stability in their concern over the earthquake danger seem to correspond approximately, though not perfectly, with the observed changes in the concern expressed by successive waves of interview respondents. Thus we have reason to be confident that concern had been raised by events in 1976 but dropped back to a stable level by late summer of 1977.

The three items that make up the fear index cohere satisfactorily in the basic survey according to the usual standards for index construction. However, their literal meanings are not identical and it is conceivable that they might respond differently to changing circumstances. Accordingly we have summarized responses to the three items separately in Table 12. The three items do indeed exhibit different responses. For all three items the substantial change occurs between February and August, 1977. Each of these changes is significant at the .001 level when we consider only the two adjacent sets of responses. Respondents in August expressed considerably less fright over the possibility of a damaging earthquake striking southern California. These changes are consistent with the change we reported based on the three items together. But the third item reveals an equally substantial change

TABLE 12

SPECIFIC EXPRESSIONS OF FEAR AND CONCERN

Fear item and extent	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
Feelings about possibility of a damaging earthquake:					
Not at all frightened	14.4	23.4	20.9	23.7	23.1
Not very frightened	22.5	23.9	29.5	22.0	25.6
Somewhat frightened	35.4	29.8	28.3	30.8	30.7
Very frightened	27.3	22.5	21.3	23.5	20.6
Don't know	0.4	0.4	--	--	--
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550
Worry about possibility of damaging earthquake striking southern California:					
Not worried at all	26.0	31.4	29.8	33.0	32.5
Hardly worried	24.3	27.8	32.0	27.6	27.8
Somewhat worried	34.8	31.0	29.9	29.3	32.7
Very worried	14.6	9.1	8.3	9.2	6.4
Don't know	0.3	0.7	--	0.9	0.5
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550
If certain damaging earthquake to occur:					
Be where earthquake would occur	0.7	0.9	0.2	1.1	0.7
Go on as usual	34.3	29.9	26.6	30.2	29.5
Safe place near earthquake	33.6	29.2	34.3	29.1	33.3
Get as far away as possible	29.0	37.2	36.4	36.9	33.8
Don't know	2.4	2.8	2.5	2.7	2.7
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550

in the opposite direction. This item was worded as follows:

> If you were certain that a damaging earthquake was going to occur at a specific time in a place where you live or work would you: try to be where the earthquake would occur, try to get as far away as possible, try to find a safe place near the earthquake, or go on as usual and be wherever you are at the time?

The second response was interpreted as indicative of the greatest fear. The proportion of respondents endorsing this response jumped from 29 to 37 percent, and remained higher than at first, at least until after July, 1978.

Apparently the third item incorporates a critical element other than simple fear and concern, as indicated by the other two items and by the question about changed concern. Perhaps the item reflects the disposition to accept a severe earthquake as a "normal" event, to be dealt with as if it were nothing especially out of the ordinary. The observed change would then signify that a growing number of people were no longer viewing a severe earthquake in this normalized fashion. While this changed perspective was not reflected in a perceived increase in fear and concern, it might be reflected in a greater disposition to act in case the threat were made concrete and imminent by a credible short-term earthquake warning.

Earthquake expectation. Respondents in each survey were asked how likely they thought it was that a damaging earthquake would strike southern California within the next year. The data in Table 13 reveal two different kinds of change. The "Don't know" responses provide the clearest and most sustained trend line. The proportion saying they don't know how likely it is that an earthquake will strike increases between February and August, 1977, and again between January and July, 1978. Uncertainty is more than three times as frequent in late 1978 as in early 1977. The overall relationship is highly significant ($p < .001$) and the trend is loosely described by an ascending linear trend line ($F = 29.48$; 1, 3 d.f.; $p < .05$).

TABLE 13

EXPECTATION FOR A DAMAGING EARTHQUAKE

Probability of earthquake	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
Within one year:					
Definitely not	6.3	5.4	5.4	6.0	4.7
Probably not	44.3	49.2	45.1	45.0	40.0
Don't know	5.5	11.7	12.8	20.0	19.5
Probably will be	38.3	30.9	32.0	26.4	33.4
Definitely will be	5.6	2.8	4.7	2.6	2.4
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1437	537	515	536	550
Within five years:					
Definitely not				15.1	18.9
Probably not				50.8	52.2
Don't know				12.5	12.5
Probably will be				20.3	15.3
Definitely will be				1.3	1.1
Total				100.0	100.0
Number of persons				536	550

Increasing uncertainty seems to be a rather appropriate response to a period of sustained reminder of an undated impending disaster.

The other change is an increase in negative replies and a decrease in positive answers between February and August, 1977, ($p < .01$, 1 d.f.). After this early drop in earthquake expectation there are only nonsignificant oscillations thereafter.

Fear of earthquakes, perceived recent change in concern, and expectation of a damaging earthquake within a year all exhibit the same pattern of a clear drop between February and August, 1977, followed by relative stability for the remainder of the study period. Ths consistency among the three variables makes the changes more obviously interpretable. A substantial segment of the populace are no longer convinced that disaster is imminent in spite of an earlier conviction to that effect brought on by events in 1976. With disaster less imminent they are now less fearful than before.

The proportion of respondents for whom the earthquake threat is a salient problem is so small that connections with more widely experienced earthquake expectancy and fear may be quite tenuous. One plausible interpretation of such a connection, however, is that salience, being rarer, is harder to eradicate than fear and cognitive expectancy. Although salience responds to the same circumstances as fear and expectancy, the response accumulates more slowly. Thus a drop in fear and expectancy that took six months is paralleled by a drop in saliency taking eleven months. On the other hand a series of fairly vague announcements may increase consciousness of the earthquake threat, and thus augment salience, without creating any more definite expectation for an earthquake in the immediate future or arousing correspondingly greater fear.

One year is a fairly unrealistic period within which to expect a damaging earthquake in southern California in the absence of more definite credible predictions than had been issued. But we phrased the question in this way in order to assess the sense of imminence about the earthquake threat. In the last two survey waves we followed the one-year question with an identically worded question referring to a five year period. There is no apparent change between August and November-December, 1978, and we do not know how the questions would have been answered earlier. The figures serve chiefly to emphasize that most southern California residents expect a damaging quake within a few years, if not within a single year.

The Predictability of Earthquakes

Belief in the predictability of events should be affected by experience with predictions, knowledge about prediction techniques and experience, and perhaps by anxiety over the event that might be predicted. During a sustained period of warning when many people expect an earthquake earlier than it occurs, one might expect doubts to arise concerning predictive capability. And following the occurrence of an unpredicted earthquake such as the November quake in nearby Santa Barbara, doubts might be accentuated. On the other hand, earthquake prediction is a fairly new idea and the period since public announcement of the Uplift might serve as a period of familiarization and education for the general public, leading to increased confidence in scientific prediction. Still another line of reasoning leads to the proposition that anxiety undermines confidence. Consequently, the evidence we have already reviewed that fear and concern decreased during the first half of 1977 could be matched by a growth in confidence in earthquake prediction.

Along with faith in earthquake prediction we shall examine confidence in the authorities who produce and manage predictions and explore opinions

concerning the public release of predictions. And we cannot ignore the parallel realm of nonscientific earthquake forecasting. Augmented belief in the predictabilit of events may be expressed simultaneously through faith in both scientific and nonscientific methods of forecasting. If that were the case we should expect to see faith in scientific and nonscientific forecasting rise and fall together.

A contrasting finding that faith in one mode of forecasting earthquakes rises as the other declines could be anticipated from either of two alternative lines of reasoning. An expanding and deepening understanding of earthquakes as natural events and of scientific earthquake prediction should wean people away from faith in the nonscientific forecasting of events, in which case we might expect faith in scientific prediction to rise while faith in nonscientific forecasting declines during the same period. Or we might assume that awareness of the earthquake danger creates a fairly constant demand for the assurance that the disastrous event will be preceded by recognizable warning signs, in which case loss of faith in one mode of prediction should lead to a compensating increased faith in other modes. Accordingly, if doubts about scientific prediction accumulate as people wait for the quake they expect on the basis of the Uplift, faith in nonscientific means of earthquake forecasting might exhibit a compensating rise.

Still another alternative to all of these views is the assumption that faith in scientific prediction is rooted in a stable generalized attitude toward science while faith in nonscientific forecasting is equally rooted in generalized attitudes such as mysticism and populism. If this assumption were correct, faith in both scientific and nonscientific modes of earthquake forecasting should be relatively impervious to the kinds of events we have witnessed during the study period.

Faith in scientific prediction. Respondents in all surveys were asked how accurately they felt that scientists could predict earthquakes at the present

time. All respondents except those who believed scientists could already predict earthquakes "quite accurately" were then asked how accurately they thought scientists would be able to predict earthquakes in the future. The replies are summarized in Table 14.

Faith in the accuracy with which scientists can predict earthquake at the present time exhibits a generally upward trend. The exact pattern of the trend is different depending upon whether we count only respondents who say prediction is "quite accurate" or count both "quite" and "somewhat accurately." Belief that scientists can predict earthquakes quite accurately increases dramatically and steadily, but not until after August, 1977. Belief that scientists can predict earthquakes somewhat accurately or better increases substantially between February and August, 1977, but shows no consistent pattern of change thereafter. This pattern of differential change suggests that two different principles are operating simultaneously. We can rule out those lines of reasoning that posit accumulating doubts as people wait for the long delayed earthquake. The increase in moderate faith in earthquake prediction, corresponding with the simultaneous decline in concern and expectancy, fits the anxiety-reduction hypothesis. The more continuous growth in extreme faith in earthquake prediction fits the pattern of increasing familiarization. The effect was deferred, possibly by the failure of both the Whitcomb hypothesis and the Minturn forecast, since Minturn was widely mistaken for a scientist.

So large a percentage of respondents (from 83 to 87 percent) believe that scientists will eventually predict earthquake at least "somewhat accurately" that there is very little variability during the study period. The small and constant minority who reject the eventual success of science in the realm probably hold fairly deeply seated attitudes of skepticism about science or about the predictability of events, rendering their attitudes on the specific question of earthquake prediction rather impervious to the impact of events during the study period.

TABLE 14

BELIEF IN SCIENTIFIC EARTHQUAKE PREDICTION

Accuracy of prediction	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
How accurately can scientists predict now?					
Quite accurately	5.5	4.4	8.7	11.7	15.1
Somewhat accurately	36.4	48.1	38.5	42.2	43.1
Don't know	1.7	1.8	5.0	3.4	2.7
Not too accurately	38.3	32.6	35.5	33.6	28.4
Not at all	18.1	13.1	12.3	9.1	10.7
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	515	536	550
Quite and somewhat accurately	41.9	52.5	47.2	53.9	58.2
How accurately can scientists predict in the future?					
Quite accurately	42.1	48.0	46.0	48.3	53.3
Somewhat accurately	41.5	37.7	37.3	36.4	33.4
Don't know	3.1	4.0	6.4	4.5	3.5
Not too accurately	9.1	6.3	8.2	8.4	6.2
Not at all	4.2	4.0	2.1	2.4	3.6
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	514	536	550
Quite and somewhat accurately	83.6	85.7	83.3	84.7	86.7
How accurately can scientists predict in the future?--omitting "quite accurately" now:					
Quite accurately	38.8	45.5	40.7	41.4	44.9
Somewhat accurately	43.9	39.5	40.9	41.2	39.4
Don't know	3.2	4.2	7.0	5.1	4.1
Not to accurately	9.6	6.6	9.0	9.5	7.3
Not at all	4.5	4.2	2.4	2.8	4.3
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1371	527	469	473	467
Quite and somewhat accurately	82.7	85.0	81.6	82.6	84.3

If we include respondents who say scientists can already predict quite accurately with those who say they will be able to do so in the future, we find once again an upward trend, but one that is irregular. In spite of the irregularity the data are loosely described by an ascending linear trend line ($F = 11.30$; 1, 3 d.f.; $p < .05$). While this is an appropriate way to describe the trend of faith in ultimate scientific prediction, the trend cannot be understood unless we subtract the effect of increased belief in prediction now. Hence we have recomputed the percentage distributions after removing those respondents who believe that scientists can already predict earthquakes accurately. The result is a pattern quite similar to the one we found for respondents who believed scientists could now predict earthquakes somewhat accurately or better. The significant increase takes place between February and August, 1977, after which there is no clear trend. Very likely the same developments that a enhanced realistically qualified public faith in current predictive capability during the first half of 1977 encouraged a less qualified faith in eventual scientific achievement.

If the gradual and cumulative familiarization hypothesis has merit, it applies only to the belief that scientists can predict earthquakes quite accurately at the present time. But this belief is quite unrealistic and unjustified. Probably most earthquake scientists would not even have agreed that earthquakes could be predicted somewhat accurately at the time of this investigation. We must assume, therefore, that familiarization for this small segment of our respondents is superficial, falling short of the deeper understanding to which we referred. Hearing repeatedly about scientists' efforts to predict earthquakes, without comprehending the message or attending to the qualifications contained in most newspaper accounts, these respondents have simply taken for granted that there is a perfected capability. Since the more realistic views of earthquake prediction, either now or in the future, do not change according to the familiarization hypothesis, there is no evidence

here to support the assumption that deepening understanding led to increased confidence in earthquake prediction during the study period.

Releasing predictions. We determined earlier that nearly everyone favors the public release of predictions concerning which scientists are highly confident. But there are differences of opinion about the release of less confident predictions. Respondents were asked how certain a prediction should be before it is released to the public. The significant break for identifying a trend appears to separate respondents who insist that authorities should be "definitely sure the earthquake will occur" before releasing the prediction from those who would release less certain predictions (Table 15). The proportion of respondents who insist on certainty increases significantly between February and August, 1977, and remains fairly stable thereafter. Thus increased cautiousness corresponds to decreased expectancy and concern and a broadened confidence in earthquake prediction capability.

Withholding information. A common theme in earthquake rumors is the contention that scientists or public officials have unambiguous information indicating that a severe earthquake is imminent, but that they are afraid to tell the public. A period of waiting that undermined confidence in authorities could stir up suspicion that information was being withheld. Respondents were asked whether they thought scientists and public officials were releasing all the information they have on earthquake predictions or holding back information. From Table 15 we see that relatively little change occurred. There is possibly an increase in suspicion that information is being withheld from February, 1977, to January, 1978, followed by declining suspicion to the end of the study period. But the fit between the data and inverted U-shaped parabola does not reach acceptable confidence limits and may be entirely a manifestation of chance.

TABLE 15

RELEASING PREDICTIONS AND WITHHOLDING INFORMATION

Release and withholding	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
How certain to release prediction?					
Definitely sure	30.4	36.5	37.1	36.6	35.8
Quite sure	29.5	29.1	28.4	31.3	31.5
Fifty/fifty chance	23.2	23.0	24.1	19.2	20.5
Somewhat sure	9.1	5.7	3.5	4.1	4.6
Not very sure	4.3	3.3	2.8	3.2	2.9
Shouldn't announce	0.0	0.4	0.6	1.9	2.0
Don't know	3.5	2.0	3.5	3.7	2.7
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	543	510	536	550
Definitely sure and shouldn't announce	30.4	36.9	37.7	38.5	37.8
Holding back information?					
Both giving all	40.1	35.2	34.6	36.4	36.4
Only scientists giving all	5.0	3.1	4.5	6.4	3.6
Only officials giving all	2.5	1.8	1.9	2.4	1.6
Both holding back	43.6	49.0	49.5	44.2	47.7
Don't know	8.8	10.9	9.5	10.6	10.7
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	515	536	550
One or both holding back	51.1	53.9	55.9	53.0	52.9

Nonscientific forecasting. We first approached the question of nonscientific earthquake forecasting by asking the general question: "Are there any other people besides scientists who can sometimes tell when an earthquake is coming?" If the answer was "Yes," respondents were then asked, "Who are these people?" We did not ask these questions in July, 1978, for reasons of general study design, but we do have responses at four intervals of time. As indicated in Table 16, the answers to the general question were quite stable throughout the study period. From 29 to 34 percent of respondents said that there were other people besides scientists who could sometimes tell when an earthquake was coming, and the variation is not large enough to qualify as statistically significant.

The most frequent answer to the follow-up question was some reference to psychics, mystics, clairvoyants, astrologers, and similar types of people. The percent of respondents mentioning this category of forecasters is also quite stable, ranging only from 20 percent to 24 percent.

From the analysis of data in the basic survey we have already learned that more people believe in folk signs--the signs in everyday life by which people can tell for themselves that an earthquake is coming--than believe in the authority of specialized secular and religious prophets. We asked respondents specifically about four signs, namely: unusual animal behavior; unusual weather; premonitions, instincts, or ESP; and unusual aches or pains. In addition we asked if they knew of any other signs. An index of belief in folk prediction was created by simply counting the number of these signs that people acknowledged. From Table 16 there appears to have been no continuous long term trend in this index, but the number of people endorsing two or more folk signs increased from an initial low point to its highest level between February and August, 1977. Belief in folk signs apparently dropped

TABLE 16

BELIEF IN OTHER THAN SCIENTIFIC EARTHQUAKE FORECASTING

Type of forecasting	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
Others than scientists predict earthquakes?					
Yes	30.6	34.3	28.5	--	30.4
No	59.0	52.8	59.1	--	59.4
Don't know	10.4	12.9	12.4	--	10.2
Total	100.0	100.0	100.0	--	100.0
Number of persons	1450	551	515	--	550
Psychics, mystics, etc. predict earthquakes?	20.8	23.6	19.6	--	22.0
Number of folk signs or earthquakes accepted:					
None	18.8	12.7	14.3	--	13.1
One	29.1	27.4	32.8	--	29.3
Two	29.9	32.3	29.5	--	35.3
Three or more	22.2	27.6	23.4	--	22.3
Total	100.0	100.0	100.0	--	100.0
Unusual animal behavior:					
Yes	67.5	75.7	72.0	--	73.5
No	25.3	15.6	17.9	--	20.9
Don't know	7.2	8.7	10.1	--	5.6
Total	100.0	100.0	100.0		100.0
Unusual weather:					
Yes	43.5	46.6	41.4	--	44.4
No	47.9	41.6	48.5	--	48.0
Don't know	8.6	11.8	10.1	--	7.6
Total	100.0	100.0	100.0	--	100.0
Premonitions, instinct:					
Yes	38.5	45.2	41.7	--	44.7
No	54.4	47.5	49.8	--	49.3
Don't know	7.1	7.3	8.5	--	6.0
Total	100.0	100.0	100.0	--	100.0

again between August, 1977, and January, 1978, ending the study period at an intermediate level. The overall relationship is significant ($p < .01$). If we consider only adjacent pairs of responses the initial rise is statistically significant ($p < .01$), but subsequent variations are not.

When we look at the three frequently acknowledged folk signs, we see two that account for the rise in the index. Acceptance of both animal behavior and personal premonitions increased during the first half of 1977, remaining at a higher level than at the start of the study period in spite of some fluctuation. Increases in acceptance of both signs are statistically significant when only the first two surveys are compared (animal behavior, $p < .001$; premonitions, $p < .01$). Acceptance of unusual weather does not change significantly during the study period.

Analysis of belief in the predictability of earthquakes can be completed by looking for changes in the prediction belief typology. Respondents were classified into four belief types. The strictly scientific are those who believe scientists can or will be able to predict earthquakes fairly accurately or better, but do not believe in any other basis for earthquake forecasting except possibly unusual animal behavior, which has been accorded some scientific credibility. Believers accept both scientific prediction and one or more nonscientific basis for earthquake forecasting. The antiscientific reject scientific prediction now or in the future but accept one or more of the other bases for earthquake forecasting, including possibly unusual animal behavior. The skeptics reject all forms of earthquake prediction and forecasting.

There may have been a slight increase in the proportion of believers between February and August, 1977 ($p < .05$), with the increase still in effect at the end of the study period (Table 17). If this shift is more than random

TABLE 17

PREDICTION BELIEF PATTERN

Belief type	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
Strictly scientific	28.0	24.1	26.6	--	24.9
Believer	55.7	61.9	56.6	--	61.8
Skeptic	5.0	2.7	4.7	--	2.4
Antiscientific	11.3	11.3	12.1	--	10.9
Total	100.0	100.0	100.0		100.0
Number of persons	1448	549	514		550

variation, it occurred at the expense of the strictly scientific and skeptic belief patterns. The antiscientific contingent appears to remain constant throughout the study period. The overall relationship between the four types and the four survey moments is only marginally significant ($p < .05$, 9 d.f.).

If we now look at changes in support for both scientific and nonscientific forecasting together, we see two patterns. The fairly continuous increase in the accuracy attributed to scientific prediction capability at the present time is not replicated elsewhere. On the other hand, the pattern of increased faith in the future accuracy of scientific earthquake prediction between February and August, 1977, is paralleled by a similar one-time increase in faith in animal behavior and personal premonition as signs that an earthquake is coming. Overall there may be a slight shift away from both skepticism and the strictly scientific view toward acceptance of a combination of forecasting modes. The slight relative gain for nonscientific forecasting compared with scientific prediction may be explained simply by the very high level of initial faith in the future success of earthquake prediction, allowing less scope for increase than in the case of nonscientific types of forecasting.

On the basis of these patterns we can rule out the suggestion of growing support for one mode of prediction at the expense of contrasting modes. Among the suggestions advanced earlier, the proposition that a reduction in anxiety over the imminent prospect of disaster facilitates growth of the conviction that the future is fundamentally predictable seems most consistent with the second pattern. The failure of belief in nonscientific methods of forecasting to parallel the more continuously expanding faith in current scientific earthquake prediction lends further plausibility to the familiarization interpretation.

Actions and Action Orientations

The final set of comparisons over the course of the study period deal with action and attitude toward action for the purpose of mitigating the earthquake hazard. Underlying action and inaction should be an attitude concerning whether anything can be done to reduce the hazard. A long period of waiting without much evidence that anything significant is being done to reduce the hazard might contribute to the growth of fatalistic attitudes. On the other hand, if the waiting period is also a period of public education in which people become increasingly well informed about the nature of earthquake risk and how to minimize it, fatalism should decline. The level of individual and household preparedness should respond inversely to the level of fatalism about earthquakes. But preparedness might also exhibit an initial spurt of activity followed by gradual deterioration in the state of preparedness in the absence of reinvigorated motivation.

Fatalism about earthquakes. Four items were used to provide a measure of fatalism about the consequences of earthquakes. The resulting index reveals a rather slight but continuous increase throughout the study period (Table 18). Although the changing percent of respondents with high and high-medium scores can be loosely described by an exponential curve ($F = 11.30$; 1, 3 d.f.; $p < .05$), the overall relationship as measured by the Chi-square test with four degrees of freedom is not significant. There is no support here for the assumption that waiting has been a period of learning. Although the shift is slight and the trend is of doubtful or borderline significance, whatever change has taken place is in the direction of discouragement over the possibility of doing anything to save lives and property.

Personal and household preparedness. The index of personal and household earthquake preparedness is based on sixteen measures that are commonly

TABLE 18

FATALISM AND PERSONAL PREPAREDNESS

Attitude and action	February 1977	August 1977	January 1978	July 1978	Nov/Dec 1978
Earthquake fatalism:					
Low	25.4	19.1	22.9	25.2	24.6
Low medium	20.9	24.0	20.3	17.8	16.7
High medium	35.1	40.2	39.0	33.8	37.1
High	18.6	16.7	17.8	23.2	21.6
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1443	545	516	535	550
High and High medium	53.7	56.9	56.8	57.0	58.7
Earthquake preparedness:					
Low	24.8	12.0	20.3	15.7	17.6
Low medium	24.6	21.2	23.5	22.6	25.5
High medium	24.2	27.8	24.4	28.5	24.5
High	26.4	39.0	31.8	33.2	32.4
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550
Preparedness measures taken for future earthquake:					
Low	51.0	41.0	50.2	37.3	37.8
High	49.0	59.0	49.8	62.7	62.2
Total	100.0	100.0	100.0	100.0	100.0
Number of persons	1450	551	516	536	550

recommended to the public. When some of these measures are unavailable to a respondent because of household size, home ownership, or presence of children in the household, the index score is adjusted so as to insure every respondent an equal chance to earn a maximum score. A slight increase in preparedness scores from the beginning to the close of the study period may be significant ($p < .05$ when only the first and last surveys compared). But the striking changes are between February and August, 1977, and between August, 1977, and January, 1978. The proportion of respondents with and high and high-medium scores increased by sixteen percentage points during the first interval ($p < .001$). During the remainder of the first year, scores declined significantly ($p < .001$) but not all the way to the original level. The subsequent fluctuation is not statistically significant.

There is support in these data for the spurt-of-preparedness hypothesis, though the decline after the spurt comes all in one interval rather than being continuous throughout the remainder of the study period. The spurt came during the same period when fear and imminent expectancy were declining while a sort of generalized belief in the predictability of earthquakes was increasing. This finding should not be altogether unexpected on the basis of our speculative interpretation of the increased disposition to "get as far away as possible" in the event that an earthquake were predicted credibly. Since this increase could not be explained as a manifestation of increased fear, we suggested that it might be interpreted as a sign that a damaging earthquake was increasingly viewed as an event that could not be treated as "life as usual," but required extraordinary action. That the spurt of preparedness occurred during the same interval of time is certainly consistent with this interpretation.

It is inherently difficult to measure the extent to which people have prepared for an earthquake because many of the measures people are urged to

take would likely have been taken for other reasons. When respondents were asked about each measure they were asked whether they had taken the indicated step "because of a future earthquake or for some other reason." The findings reported on the preceding pages take account only of whether each measure has been taken or not, disregarding the reason. The preparedness index was constructed in this way so as not to penalize respondents who were already prepared for a wide range of exigencies and therefore had less left to do specifically for an earthquake. But if the changes in preparedness already described were responsive to the earthquake threat, an index that includes only measures taken "because of a future earthquake" should exhibit the same pattern of change.

Index scores do change according to a similar main pattern, but with a different outcome. The spurt of preparation between February and August, 1977, is replicated ($p < .01$). The subsequent deterioration of preparedness to January, 1978, is also repeated, but with preparedness dropping more nearly back to the starting level ($p < .01$). Thereafter, however, preparedness rebounds with an even stronger spurt between January and July, 1978 ($p < .01$), and remains at the new high level.

Changes in the things people report having done because of a future earthquake may consist of two components. Taken at face value the respondents' statements indicate measures that they would not have taken except as steps to mitigate earthquake risk. But the decision process is often not so simple that attention to a single consideration determines whether a measure is taken or not. Actions people take often result from the cumulative impact of several considerations, and the individual cannot accurately distinguish the crucial ones from the incidental ones. Hence changes in what people claim to have done because of the earthquake prospect may merely reflect their changing attributions.

groups these were, whether anything could be done for them prior to an earthquake. Because of increased sensitization to the earthquake threat, people may attribute actions that they would actually have taken regardless of the earthquake threat, to a concern over a possible impending earthquake.

Comparing the index of total preparedness with the index based on actions taken and attributed to the prospect of a future earthquake provides a rough basis for distinguishing the two kinds of changes. Insofar as changes in the two indexes are parallel, it is plausible to conclude that changing attention to the earthquake prospect as an extraordinary rather than normal event has been expressed through correspondingly changed levels of preparedness. Insofar as changes in the index of measures taken because of a future earthquake occur without parallel changes in the comprehensive index we can plausibly interpret these shifts as reflecting changed attributions rather than actions. When the data are interpreted in this way the dramatic preparedness spurt and subsequent deterioration during 1977 do seem to be true changes in the state of preparedness caused by changing attention to the earthquake prospect as an extraordinary event. But the subsequent rise and persistence in preparedness levels attributed to concern over a future earthquake are not fully paralleled by changes in actual preparedness levels. Hence during the second half of the study period we see an augmented tendency to explain preparedness actions on the basis of the earthquake threat, rather than a true increase in levels of preparedness. Like most of our findings, these may be interpreted as encouraging or discouraging. It does seem clear that the early peak of preparedness (which was not terribly high in absolute terms) was not sustained, though it may be encouraging that the overall trend was slightly upward. The discrepancy between the trends of actual preparedness in the second year and preparedness attributed to the earthquake prospect suggests that people are fooling themselves

accentuated an individualistic, everyone-for-himself outlook

about their levels of preparedness, or responding to a felt social pressure to be earthquake-prepared by redefining their own motivations rather than by actually taking protective actions. While these interpretations seem fairly compelling, their acceptance does not preclude a more optimistic assessment of public readiness to act in case of a true emergency, such as a credible warning of imminent earthquake danger. The earlier spurt of preparedness should have familiarized people with some of the steps they might take, making it easier for them to retake them in a more credible emergency. And the greater tendency to attribute measures actually taken to the earthquake concern may enhance the availability of that motivation as a basis for stimulating further action. Appeals to the motivation to prepare for a damaging earthquake would then be more effective in the event of a credible future emergency.

If the foregoing highly speculative interpretations are valid, our assessment of the state of public preparedness would differ according to whether we think of an earthquake striking without further advance warning or an earthquake following a few days of advance warning. At the end of 1978, the public were only a little better prepared for an unheralded earthquake than they were in August, 1977. But they may have been better prepared by experience and attitude to respond expeditiously and appropriately to a credible short-term earthquake warning than they were at the start of our study period, and at least as well prepared as they were in August, 1977.

The Posture toward Altruism

In Part Five we raised the question of whether there were any signs of potential altruism as a force in a community confronted with an earthquake prediction. Respondents in our basic field survey were asked whether some groups of people were in greater danger than others from earthquakes, which

groups these were, whether anything could be done for them prior to an earthquake, and whose responsibility it was to do something about their hazardous conditions. This extended line of questioning was not repeated in the next three interview waves, but was included again in the final wave. While we cannot look for trend lines as we have done with variables measured on all five occasions, we can compare responses at the twenty-one-month interval. Again we have used only the 500 newly interviewed respondents in November-December, 1978, to guard against possible reinterview effects on variables of this kind.

The question could be raised whether the potential for an altruistic response in southern California reported in the earliest survey was affected by the recency of heightened public attention to earthquake hazard and threat. Since the survey upon which this analysis was based was conducted between January and March, 1977, immediately following two widespread rumoring episodes in October and November and the December 20 prediction of Henry Minturn, were the awareness of endangered groups and the optimism concerning the meliorability of their earthquake hazards related to the recently aroused, widespread concern that a major earthquake could strike southern California in the near future? If it were related, what effect did the recency of heightened concern have on the community's posture toward altruism?

Under a condition of heightened threat, awareness of endangered groups and a belief in collective solutions of their problems could have increased. Such heightened concern could create an "artificially" or temporarily high belief in the collective ability to safeguard endangered groups against a potential catastrophic event over which they had no control. Conversely, it could be argued that this condition of threat reduced the belief in altruistic, collective solutions to earthquake-related problems. Although optimism was generally expressed, a less threatening situation could result in an even higher level of collective altruism being found. Intense anxiety might have accentuated an individualistic, everyone-for-himself outlook, while subsequently

lessened anxiety could have facilitated the growth of collective and altruistic orientations.

Table 19 presents the distribution of responses to the question whether some groups were in greater danger from a future damaging earthquake or whether the danger was the same for everyone. Surprisingly, there is a slight but significant ($X^2 = 12.624$, $p < .01$) increase in the number of socially aware respondents (i.e., those aware of the endangerment of certain groups) during the follow-up survey. This change might indicate that a moratorium in short-term, dramatic events (and their concurrent media attention) is not unfavorable to a broadening awareness of conditions that might affect different social groups adversely.

As seen in Table 20, the relative frequency with which different endangered groups were mentioned also changed during this period. Only references to people who lived in hillside homes did not change significantly. Both specific references to unsafe structures (old or pre-1933 buildings and high-rise structures) declined quite dramatically ($X^2 = 69.86$ and $X^2 = 31.57$ respectively, with one degree of freedom) although both were still among the most frequently mentioned endangered groups.

Those who live below dams, the elderly, the disabled, and those who are institutionalized were similarly mentioned by significantly smaller proportions of the respondents during the later survey. The decline in reference to people who live below dams appears to contradict the finding of increased discussion of dams and flooding reported in the preceding chapter. The present evidence supports the suspicion voiced in the last chapter that people were talking

TABLE 19

BELIEF THAT SOME GROUPS ARE IN GREATER DANGER FROM A DAMAGING EARTHQUAKE AT TWO PERIODS OF TIME

	February 1977	Nov/Dec 1978
Some in greater danger	62.9	69.7
Danger same for all	34.6	25.6
Don't know	2.5	4.7
Total	100.0	100.0
Total number	1450	550

TABLE 20

GROUPS IDENTIFIED AS IN SPECIAL DANGER

AT TWO PERIODS OF TIME

Type of endangered group	February 1977		Nov/Dec 1978		Percent change
Unsafe structures		36.0		25.1	
Old/unsafe/pre-1934 buildings	19.1		11.5		-24.2*
Apartments/high-rise	16.9		13.6		
Unsafe locations		24.9		39.2	
Proximity to disaster agent (by fault, near epicenter)	8.6		16.0		5.8#
Flooding (below dams, near water)	6.8		5.9		-5.9*
High density areas	4.8		11.4		7.1*
Hillside homes	4.7		5.9		1.2
Personally and socially impaired		18.7		23.4	
Elderly	9.9		7.4		-10.3*
Disabled	7.3		3.5		-10.5*
Poor	1.5		12.5		17.3*
Institutional settings		12.3		7.2	
Children in schools	6.5		4.2		-7.7*
People in hospital/ prisons/ group residential facility	5.8		3.0		-8.0*
Other	8.1	8.1	5.1	5.1	-10.0*
Total	100.0	100.0	100.0	100.0	
Total number of responses	2007		594		

1. Percent changes refers to change in percent of all socially aware who mentioned the category from early 1977 (N = 912) to late 1978 (N = 383).

* Change was significant at the .01 level

Change was significant at the .05 level

more about flooding but not about the potential collapse of dams in an earthquake.

Of those who are endangered because of personal attributes -- those who are personally or socially impaired and those in institutional settings -- only the poor show a significant ($X^2 = 105.40$, df = 1, $p < .01$) increase in the percentage of the socially aware who are cognizant of their plight. While it is difficult to link this increased awareness of the poor to any particular change in earthquake related coverage or topics, it may be linked to a national increase in concern about inflation and the declining ability of citizens to be as self-sufficient as in previous times. It could be, as suggested by Mazur and Leahy (1978), that national level issues and concerns often have an impact on local issues to which they may not be directly related. In any event, the poor have become the third most likely group to be mentioned with respect to earthquake endangerment, in contrast to being the least likely group to be mentioned in early 1977.

Only two other groups showed significant gains in the proportion of mentions received, those who are in close proximity to the disaster agent and those residing in high density areas. Precise reasons for these shifts in awareness are not apparent either in terms of changes in earthquake-related coverage or national (or non-local) concerns that might have some effect on awareness of these categories of endangered groups.

The range of social awareness decreased over the two year period (Table 21), dropping from a high of nine endangered groups mentioned by a respondent during the first survey to a high of only five groups mentioned during the follow-up survey in early 1979.

TABLE 21

NUMBER OF ENDANGERED GROUPS MENTIONED AT TWO PERIODS OF TIME

Number of groups	February 1977	Nov/Dec 1978
None	37.1	30.4
One	24.3	41.6
Two	18.4	19.1
Three	11.3	7.6
Four	4.6	1.1
Five	2.1	.2
Six	1.1	
Seven	.6	
Eight	.4	
Nine	.1	
Total	100.0	100.0
Total number	1450	550

Although a slightly smaller percentage of respondents mentioned no groups during the second survey, a much larger percentage (41.6/24.3 percent) mentioned only one endangered group. During the lapsed time, some breadth of awareness of endangering conditions appears to have been lost. Although there was generally a higher percentage of respondents who were aware of some particular endangering condition or attribute, fewer were aware of more than one endangered group.

One possible explanation for this shift may be the decrease of media attention to and informal discussion of earthquake topics which would, in all likelihood, focus on particular earthquake hazards. As communication channels switch to other subjects, one's breadth of awareness may decline.

A second factor which may be influencing this "increased awareness-decreased breadth" pattern is the increase in membership claimed in an endangered group. If, over this two year time period, respondents had increasingly identified themselves with a particular endangered group, their awareness of others may have declined.

Table 22 indicates that there has been no decrease in the range (already quite small) of the number of endangered groups in which respondents were claiming membership, although there was a slight, but significant ($X^2 = 6.06$, $df = 1$, $p < .05$) shift in the number who identified themselves as members of one (as opposed to no) group in the 1979 survey.

Table 23 compares the percentages for those who claimed membership in particular endangered groups for the two surveys. When the memberships claimed by all of the socially aware are compared for 1977 and 1979, the pattern of changes appears to approximate the shifts in mentions of endangered groups. Fewer respondents were claiming to be endangered because of unsafe structures, while all categories referring to hazardous locations showed increases in members. However, when the number claiming membership relative to the number mentioning that particular endangered group is compared, none of these groups sustained any significant change in the proportion claiming to be members,

TABLE 22

NUMBER OF ENDANGERED GROUPS IN WHICH

RESPONDENTS CLAIMED MEMBERSHIP AT TWO PERIODS OF TIME

Number of groups	February 1977	Nov/Dec 1978
None	82.2	76.2
One	16.0	21.9
Two	1.6	1.6
Three	.2	.3
Total	100.0	100.0
Total number	893	383

TABLE 23

PERCENTAGE OF SOCIALLY AWARE WHO CLAIMED MEMBERSHIP IN AN ENDANGERED GROUP AT TWO PERIODS OF TIME

Endangered group	Percent of All Socially Aware[1] Mentioning a Group: February 1977	Nov/Dec 1978	Percent change[2] by group
Unsafe structures			
Old/unsafe/pre-1934 buildings	26.0	10.1	2.7
Apartments/high-rise	14.7	6.7	-.3
Unsafe locations			
Proximity to disaster agent (by fault, near epicenter)	16.4	24.2	8.5
Flooding (below dams, near water)	6.2	7.1	12.0#
Hillside homes	1.7	2.0	2.5
High Density	3.9	11.1	9.0
Personally and socially impaired			
Elderly	9.0	9.1	12.4#
Disabled	5.1	2.0	3.4
Poor	.6	14.1	14.4#
Institutional settings			
Children in schools	2.3	3.1	8.9
People in hospital/prisons/ group residential facility	1.1	1.0	3.8
Other	13.0	10.1	19.2*

1. Percentage refer to the number who claimed membership in each particular group out of the total number of respondents who claimed membership in any group (177 in 1977, 99 in 1978).

2. Percent change is based on the total number who mentioned a particular endangered group in 1977 and those mentioning the group in 1979.

* Change was significant at the .01 level.

\# Change was significant at the .05 level.

with one exception, namely flooding.

Those who believe that people living below dams are endangered declined significantly in 1979 (Table 20), while the number claiming to be endangered from flooding increased significantly. While the general awareness of flooding danger was related to community concern and media coverage about earthquake topics, the people who actually live in areas of potential flooding have become more aware of this hazard. One reason for increased awareness by this endangered group may be the severe flooding in Los Angeles County during 1977 and 1978. Although not related to earthquakes specifically, the experience of living in an area that could be affected by such a natural disaster may have made residents aware of an aspect of their environment which previously had not been considered salient.

For those whose response to an earthquake may be impaired, either by social or physical factors, we see little overall change in the identification by the elderly and the disabled that they are endangered relative to all of the other socially aware. However, for those mentioning the elderly, there was a significantly larger proportion claiming membership in 1979 than in 1977.

As seen in Table 20, there was a dramatic increase in the number of respondents who mentioned the poor as endangered, a shift which was paralleled by a significant increase in the number claiming membership in this group.

Patterns of awareness and endangerment. From these findings, we may conclude that some patterns of social awareness and personal endangerment are related in various ways to a heightening of community concern about earthquake threat (see Figure 2).

Pattern 1: Complete earthquake threat orientation. The most frequent pattern identified was a decrease in awareness of endangered groups (i.e., in the mention of specific groups), with a stable proportion over time in the numbers claiming to be members of those groups. This shift indicates that both general

Awareness of An Endangered Group in 1979

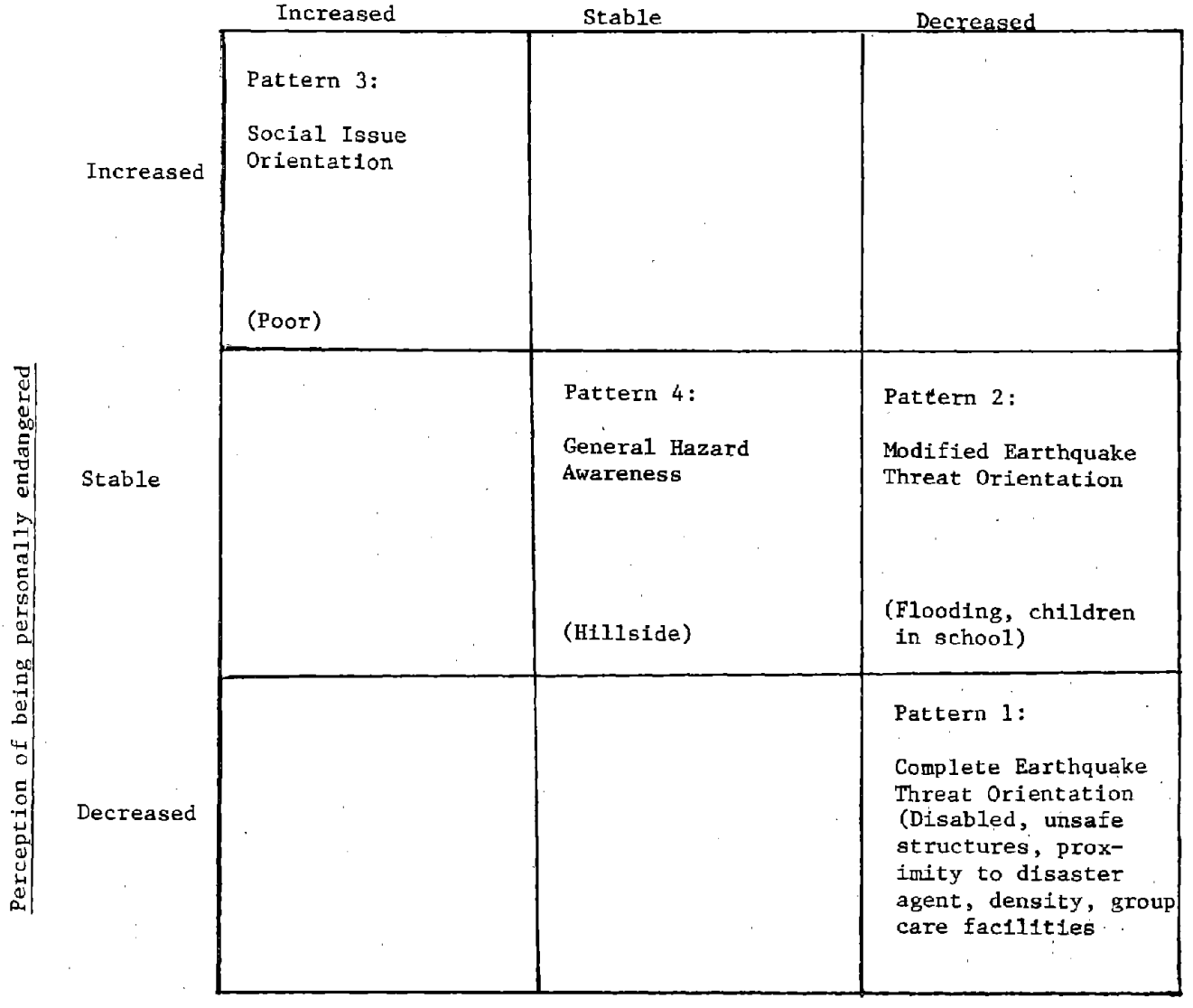


FIGURE 2

PATTERNS OF CHANGE IN SOCIAL AWARENESS AND PERCEPTION OF PERSONAL ENDANGERMENT

awareness and perceptions of personal endangerment declined over time. In order for the proportion of members to the aware to remain stable over time, membership claims for a specific group would have had to decline proportionally to the decrease in the references to that group. (For this reason, Pattern 1 has been placed in the Decreased-Decreased cell in Figure 2.)

It appears, then, that both perceptions of personal jeopardy and awareness of others' endangerment were directly related to the aroused concern about earthquake threat in Los Angeles during 1976 and early 1977. Once this concern "peaked" following Minturn's December prediction, a specific awareness of endangerment for self and others declined. Concern for the majority of the endangered, then, can be expected to fluctuate with the degree of community arousal about earthquake threat. In great part, the basis for a posture toward altruism -- a broad awareness of endangered others -- is missing in 1979. Also missing perhaps is the motivation for individual preparation -- a perception of living at risk with regard to earthquake hazards.

Pattern 2: Modified earthquake threat orientation -- The next most frequent pattern of awareness involved a decrease in the mentions of two groups -- those who live in areas of possible flooding and those with children in school -- with a proportional increase in the numbers of those claiming membership in these groups, Pattern 2 has been located in the Decreased-Stable cell of Figure 1 because even though the proportion of members increased relative to overall mentions of these groups, the number of respondents claiming to be members remained similar (thus resulting in an apparent increase in awareness of personal endangerment).

Unlike Pattern 1, perceptions of personal jeopardy did not fluctuate over time. While awareness of earthquake dangers declined among the general population, the saliency of these two conditions as threats remained constant

for people who believed they would be directly affected by these conditions. We have already discussed why flooding may have retained its 1976 levels. In a similar manner, a general concern for children in school may have been generated by the school desegration issue which reached a peak in Fall, 1978 when a busing plan was initiated for the Los Angeles Unified School District. During the summer of 1978, a frequent concern voiced by parents opposed to busing dealt with the distance between the child's new school and home, making it difficult for the parent to respond to an emergency situation if the child were in school. One such emergency mentioned was a large magnitude earthquake. As with the personally-relevant flooding concerns, school busing worries may have generated an awareness of the effects an earthquake would have on children in school. Those who claimed membership may have been sensitized to the personal endangerment a destructive earthquake could cause through concern about a more immediate problem.

Pattern 3: Change related to a topical social issue or concern -- Given the overall decline in community concern with and media coverage of earthquake topics, it was surprising to discover an increased awareness of the poor as an endangered group. Because this shift was substantially explained by the increase in those claiming membership, the poor seem to be a primarily self-interested group. As such, their awareness may be more closely related to concerns about the general impairment of their ability to function adequately on a day-to-day basis in inflationary times than to their ability to handle extreme problems such as a destructive earthquake. In this pattern, the perception of personal inability to plan successfully for an earthquake event may lead to the increased awareness of themselves as an endangered group. For the self-identified poor, the current economic conditions of society seem to be the larger salient social concern which led to their initial references to themselves as "poor."

Pattern 4: General hazard awareness -- The final pattern identified was one of stability, both of awareness and self-endangerment. Since there was

no shift on either of these dimensions for people who live in hillside homes, this condition is probably not related to a heightening of media or community concern about earthquake hazards specifically. Instead, this category of people may be seen as generally endangered by many different disaster agents (e.g., flooding, fire, landslides, erosion), for awareness is low but stable over time.

Perceptions of collective responsibility. With respect to the respondents' beliefs about the meliorability of hazardous earthquake conditions, we found that the high degree of optimism expressed in 1977 has remained constant or, for those living close to faults and those living in high density areas, has actually increased significantly (Table 24). The only substantial (but not significant) decline in the belief or meliorability which occurred was for those who live below dams; again, perhaps, because of the destructive flooding which had recently occurred in Los Angeles. But even for those who are exposed to flooding dangers, four out of every five people who mentioned this hazard were confident that something could be done for them before another earthquake occurred.

This finding suggests that optimism for taking corrective measures is not "artificially" high during periods of heightened awareness of threat. During a period of relative "threat neutrality" like that in late 1978, there was even higher optimism about the utility of taking hazard-reducing actions. The meliorablity component of the community's posture toward altruism may be even stronger in the absence of a heightened threat condition, although the situational conditions necessary for the mobilization of these sentiments may not exist during a low-threat period.

The attribution of responsibility for taking these safety measures is still heavily weighted toward governmental bodies in late 1978 (Table 25). However, a few interesting shifts in attribution have occurred over the two year period concerning personal responsibility. The most striking change which

TABLE 24

PERCEPTION OF MELIORABILITY OF EARTHQUAKE DANGERS FOR SPECIFIC ENDANGERED GROUPS AT TWO PERIODS OF TIME

Endangered Group	Percentage of those expressing a belief in meliorability: Jan/March 1977	Nov/Dec 1978	Percent of[1] change
Structural			
Old/unsafe/pre-1934 buildings	90.9	88.2	-2.7
Apartments/high-rise	79.9	87.7	7.8
Unsafe locations			
Proximity to disaster agent (by fault, near epicenter)	75.6	92.6	17.0*
Flooding (below dams, near water)	91.2	80.0	-11.2
High density	81.4	94.1	12.7#
Hillside homes	84.0	88.6	4.6
Personally and socially impaired			
Elderly	88.4	95.5	7.1
Disabled	89.0	95.2	6.2
Poor	86.7	90.5	3.8
Institutional settings			
Children in schools	92.3	96.0	3.7
People in hospital/prisons/ group residential facility	92.2	100.0	7.8
Other	71.6	86.7	15.1

1. Percent change is based on the total number who mentioned a particular endangered group in 1977 and those mentioning the group in 1979.

* Change was significant at the .001 level

\# Change was significant at the .05 level

TABLE 25

RESPONSIBLE AGENTS FOR SPECIFIC ENDANGERED GROUPS: NOVEMBER-DECEMBER 1978

Endangered Groups	Responsible agent								
	Own Respon-sibility	Friends/ Family	Local Govt.	Local State/ Federal	Indiv./ Govt.	Prop. Owners	Admin./ Mgrs.	Other	Total
Structural References									
Old/Unsafe/Pre-1934 buildings	6.7	0	31.6	50.0	8.3	1.7	1.7	0	100.0
Apartments/High-rise	17.4	0	29.0	29.0	4.3	16.0	0	43	100.0
Ecological References									
Proxmity to disaster agent (by fault, near epicenter)	20.7	1.2	24.1	40.2	10.3	0	2.3	1.2	100.0
Flooding (below dam, by water)	14.3	0	35.7	46.4	0	0	0	3.6	100.0
High density areas	11.1	0	42.9	38.1	3.2	3.2	0	1.5	100.0
Hillside homes	36.7	0	36.7	20.0	6.6	0	0	0	100.0
Physically/Socially impaired									
Elderly	0	21.4	28.6	38.1	4.8	0	7.1	0	100.0
Disabled	0	5.0	25.0	35.0	10.0	0	25.0	0	100.0
Poor	10.9	0	26.6	56.3	3.1	0	0	3.1	100.0
Institutional settings									
Children in schools	0	12.5	45.9	20.8	0	0	20.8	0	100.0
People in hospitals/ prisons/ group residential facilities	0	0	27.8	22.2	11.1	0	38.9	0	100.0

occurred is the decline in the belief that endangered group members are solely responsible for their own safety. This decline occurred for every group, with the exception of those who live in hillside homes, an increase of only about one percent. For those who are endangered because of a personal attribute -- the physically or socially impaired and the institutionalized -- personal responsibility disappears completely as a response category. Again, however, the poor are an exception to the overall pattern.

Part of the decline in this category, however, was accounted for by increases in the belief that the amelioration of these hazardous conditions is the joint responsibility of both the group members and the government. This shift in attribution was particularly apparent for those who live in close proximity to a disaster agent, for the disabled, and for those in group care facilities.

Since the mobilization of altruistic sentiments relies heavily on the belief that the endangered are not solely responsible for correcting their own condition, an analysis was done to determine whether attributions of personal responsibility had changed significantly over the two year period. No significant changes were discovered for any endangered group mentioned (Table 26). However, when the typology of belief in the collective meliorability of all endangered groups was compared for 1977 and 1979 (Table 27). a marginally significant ($t = -1.86$, $p < .05$) shift was found. If this difference between the typology distributions over time can be taken seriously, a greater number of respondents in late 1978 had adopted a collectively-oriented attribution of responsibility for the endangered groups they were aware of than in early 1977.

Although some groups are still seen as having some responsibility for their own safety, it is encouraging to note that there is a greater acceptance of the belief that earthquake hazards may require collective action to

TABLE 26

ENDANGERED GROUPS AS RESPONSIBLE FOR MITIGATING

THEIR OWN HAZARDS, AT TWO PERIODS OF TIME

Endangered group	Percentage attributing responsibility to the endangered themselves		
	Jan/March 1977	Nov/Dec 1978	Percent change
Structural			
Old/unsafe/pre-1934 buildings	10.8	6.7	-4.1
Apartments/high-rise	22.1	17.4	-4.7
Unsafe locations			
Proximity to disaster agent (by fault, near epicenter)	23.1	20.7	-2.4
Flooding (below dams, near water)	24.2	14.3	-9.9
High density	11.8	11.1	-.7
Hillside homes	35.5	36.7	1.2
Personally and socially impaired			
Elderly	3.4	0	-3.4
Disabled	5.4	0	-5.4
Poor	11.6	10.9	-.7
Institutional settings			
Children in schools	8.4	0	-8.4
People in hospital/prisons/ group residential facility	1.9	0	-1.9

TABLE 27

TYPOLOGY INDICATING BELIEF IN COLLECTIVE MELIORABILITY OF ENDANGERED GROUPS - 1979 SURVEY

Category	N	Percent
1. Those who think nothing can be done	31	8.1
2. Something can be done	343	89.6
A. Totally individuals' responsibility "Individualists"	40	10.4
B. Mostly individuals' responsibility "Individually Biased"	22	5.8
C. Mostly others' responsibility "Collectively Biased"	8	2.1
D. Totally others' responsibility, Limited social awareness (Mentioned one or two groups) "Collectively Oriented"	242	63.2
E. Totally others' Broad social awareness (3-8 Groups) "Collectively Oriented"	31	8.1
Missing cases[1]	9	2.3
Total	393	100.0

[1]Missing cases resulted from "don't know" responses or errors by the interviewers.

ameliorate dangerous conditions. This is, we believe, a positive sign that hazard reduction is seen as a reasonable area for further governmental action. Also, with the right social conditions, the collectively-oriented posture toward altruism could result in community actions (or support for more governmental action) on the behalf of earthquake endangered groups.

REFERENCE

Mazur, Allan and Peter J. Leahy. 1978. "The Rise and Fall of Protest Activity Against Four Technologies," paper presented at the American Sociological Association, San Francisco, September.

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CHAPTER FOUR

THE NEW YEAR'S DAY EARTHQUAKE OF 1979

The Earthquake

At 3:14 p.m. on January 1, 1979, an earthquake which measured 4.6 on the Richter scale caused windows to break and minor rock slides in Malibu and Santa Monica. The tremor, described as moderate, was felt from San Diego to Santa Barbara. The quake lasted 40 seconds and was followed by over 100 aftershocks the same day, the largest of which measured 3.4. A Caltech spokesperson said the quake was centered in the ocean floor about four miles south of Malibu in Santa Monica Bay. It was reported that fire, police, and newspaper switchboards as far inland as Riverside and San Bernardino were swamped with calls "ranging from the curious to the fearful." The quake was felt and commented upon by NBC reporters in the press box at the Rose Bowl where the USC-Michigan game was in progress.

Damage was minor and there were no injuries. A plate glass window at a variety store in Santa Monica shattered as did store windows in parts of Culver City. Cracked windows were reported as far from the quake's epicenter as Seal Beach and Buena Park. Rock slides were localized in the Malibu Canyon area. Only one minor power outage was reported. Hundreds of spectators watching firemen battle a fire at the Thrifty Drugstore at 326 Wilshire Blvd., reportedly panicked and fled when the earthquake struck. Fire officials reported that men, women, and children ran screaming in all directions when the tremor occurred No one was reported injured in the flight from the scene of the blaze.

Several reports quoted a police spokesperson as saying, "Most people who felt it--and that sure wasn't everybody--pretty much shrugged and remembered they were in southern California and let it go at that." All monitored

newspapers carried reports of the quake's occurrence. The Tribune, Outlook, Herald Examiner, La Opinion and Valley News reports appeared on the front pages. Photographs of broken store windows were included in the Times, Outlook, Examiner and Valley News.

Aftershock activity continued into March. Significant shocks included a 3.1 Richter quake which occurred on January 3 (L.A. Times, La Opinion, SMEO, SGVT, 1-4-79) and a 3.8 on January 15 (Herald Examiner, SMEO, SGVT, 1-15-79; La Opinion, Valley News, L.A. Times, 1-16-79). A 3.1 aftershock occurred January 29 (SMEO, Herald Examiner, SGVT, 1-29-79), and two quakes registering 3.7 and 2.8 were reported in early March (Herald Examiner, 3-5-79; L.A. Times, 3-6-79). Twenty-three articles reported the New Year's Day quake and its aftershocks. The L.A. Times carried six reports, the Santa Monica Evening Outlook five, the Herald Examiner four, the San Gabriel Valley Tribune three and the Valley News two.

Various aspects of the New Years Day quake were discussed in a Santa Monica Evening Outlook feature article by Karen Kenney. Researchers said Kenney, can usually determine the location, direction, and time of a quake within twenty-four hours. It would be some time, however, before seismologists could locate the underwater fault slippage responsible for the January 1 quake. Anne Blanchard, a research assistant at Caltech's seismology lab said that the fault could be identified only if it broke the surface. An underwater epicenter, Blanchard pointed out, was more difficult to locate. The quake which measured 4.6 on the Richter scale may have lacked sufficient intensity to cause a surface rupture. Lindley Williamson, a county engineer, was asked by Kenney if such an offshore quake could cause severe slides. He responded that "an earthquake of this size will not cause anything to fall that probably was not on the verge of falling anyway." Earl Schwartz, chief of the Los Angeles City Building and Safety Department's Earthquake Safety Division assured homeowners that

most houses in the Los Angeles area are earthquake resistant but warned that chimneys could present a problem. "Chimneys that aren't properly reinforced or anchored can come down. In some cases, it might be advisable to reduce chimney height." Schwartz also recommended cabinet latches which won't shake open and securi heavy furniture to the wall. Tips on what to do during a quake were offered by Mike Regan, Los Angeles Civil Defense Coordinator. "Get into a doorway or under a desk if inside, if outside, stay in the car or walk to an open space." Other tips included keeping a flashlight, radio, and family disaster plan in good working order. West Los Angeles Animal Shelter Supervisor George Weissman suggested that residents be aware of altered behavior in their pets. Just before a quake said Weissman, " a cat might show you more attention than it ususally does." An educational psychologist advised parents to explain the quake to children even if it is done in very simple terms. A brief article which accompanied Kenney's feature announced the availability of the Fil Drukey series on individual preparedness for an earthquake entitled "Common Sense and Earthquake Survival." The guide was offered through the Outlook for $1.50 (SMEO, front, 1-3-79).

Mike Wyma, in his column in the Valley News, noted that many Californians were under the care of a variety of different analysts and therapists for such disorders as phobias of driving, flying, using elevators, sleeping, talking, and even eating. "Given this," he said, "it seems odd that so few of us are frightened of earthquakes, at least before they happen." The New Years Day quake should have served as a reminder that quakes have the potential for "abrupt, uncontrollable destruction (and) should be quite scary." Wyma advised that southern Californians "would do well to treat quakes with the same sensible aplomb as they do the other imminent dangers they recognize and try to control" (Valley News, 1-3-79).

A Valley News editorial cited the New Years quake as a reminder "that earthquakes can strike at any time in California without warning." The editors hoped that the quake would serve to speed up the pace of work toward "saving as many lives as possible in the event of a killer quake" and scientific work toward accurate earthquake prediction (Valley News, 1-3-79).

The foregoing statement describes the earthquake as it was presented to the newspaper-reading public during the days and weeks after it occurred. A briefer account by Waverly J. Person, with the magnitude upgraded, appeared a few months later in the regular bimonthly summary of earthquakes in the U. S. Geological Survey's Earthquake Information Bulletin. We present that summary in full.

> The State of California experienced a number of earthquakes during the first 2 months of the year. The first earthquake to cause minor damage occurred On January 1 at 3:15 p.m. PST, alarming some of the fans at the Rose Bowl game in Pasadena. The magnitude 5.0 earthquake was centered about 25 kilometers southwest of Santa Monica in the Santa Monica Bay. Minor damage on the Modified Mercalli Intensity Scale (MM) was reported at Canoga Park, El Segundo, Granada Hills, Hawthorne, Los Angeles, La Verne, La Mirada, Northridge, Studio City, Sherman Oaks, and Woodland Hills. The quake was felt strongly over a wide area of the southern part of the State including Kern, Kings, Orange, Riverside, Santa Barbara, San Bernardino, San Diego, and Ventura counties. A number of aftershocks followed; the largest was a magnitude 3.9 at 3:29 p.m., 15 minutes after the main shock. The aftershock was felt strongly in the area, but no additional damage was reported.

The Survey

An essential feature in the design of the research on which we are reporting was that we should be prepared for contingencies that might substantially affect public response to the earthquake threat. Interview schedules prepared, pretested, and printed in sufficient numbers, and sampling plans were established so that telephone interviewing could begin within a few days after any one of five contingencies occurred. Four of the hypothetical contingencies did not occur. The four would have consisted of a destructive earthquake in Los Angeles County, the issuance of a new or much intensified earthquake prediction or warning,

the cancellation or substantial downgrading of a prediction or near prediction, and the disconfirmation of a prediction by the passage of the predicted date without a corresponding earthquake. The fifth contingency was the occurrence of a moderate but nondestructive earthquake, strong enough to occasion more than perfunctory reporting in the media, and felt throughout the County. The New Year's Day earthquake qualified unambiguously under the criteria we had established. New Year's Day fell on Monday, and was, of course, a holiday. The decision to proceed with the survey was made by telephone among the investigators that afternoon and evening, and the machinery was set in motion Tuesday morning. A few changes were made in the schedule to fit the circumstances, and all copies were hand corrected within the three days following. Interviewing by telephone began on Monday, January 8, and was completed by January 26. We had established that it was essential to complete the interviewing expediously, before the memory and effects of the nondisastrous quake faded. The same random-digit dialing sampling procedure used in securing the new samples in the four preceding interview waves was followed. A total of 519 interviews were completed, all with respondents who had not been interviewed previously. Had the earthquake occurred earlier we might also have reinterviewed a sample of previous respondents. But it was not feasible to do so at this stage in the total research program.

The aims of the survey were to determine how the history of public earthquake alerts since the Uplift was announced nearly three years earlier influenced reactions to a moderate but nondisastrous earthquake, and to examine awareness and response to the continuing earthquake threat as potentially affected by the occurrence of such an earthquake.

The Earthquake as an Event

Out of the sample of 519 respondents, 71 percent had felt the earthquake, another 27 percent had heard about it afterwards and two percent still did not know there had been an earthquake at the time of the interview (Table 1). These

TABLE 1

AWARENESS OF THE NEW YEAR'S DAY EARTHQUAKE

Awareness	Number	Percent
Felt the earthquake	367	70.7
Didn't feel, but knew about quake	142	27.4
Didn't know quake occurred	10	1.9
Total	519	100.0

last ten respondents were dropped from further questioning, except concerning demographic characteristics. Different sequences of questions were addressed to respondents who had felt the quake and respondents who had not felt it but subsequently learned about it.

Respondents who felt the quake were asked next:

> Thinking back to your experiences in that earthquake, which of the following best describes your first feelings? Would you say you were: Very frightened and upset, Somewhat frightened and upset, Not very frightened and upset, Not at all frightened and upset, or Did you enjoy the experience?

This distribution of responses (Table 2) is skewed, with about two thirds expressing little or no fear at the time of the quake. About one person in twelve acknowledged having been very frightened.

For comparative purposes we have included two other sets of figures. First is the distribution of responses to a question about feelings during past earthquakes, asked of all respondents in the February, 1977, basic field survey who said they had experienced one or more earthquakes. Second are the responses of people in the present sample who knew about the New Year's Day quake to the question asked later in the interview:

> Which of the following best describes your own feelings about the possibility of experiencing a damaging earthquake--that is, one strong enough to destroy buildings and cost lives--in the near future? . . .

The comparison underlines that the New Year's Day quake was taken very much in stride, that it did not evoke the fear that the idea of an earthquake as a disastrous event stirs in most people. The contrast may be exaggerated, however. Both of the comparison questions omitted the word "upset" and asked only about being frightened.

As further indications of the extent to which the earthquake was experienced as an extraordinary event rather than a minor ripple in the round of life, we asked whether the respondents who felt the earthquake attempted to contact anyone personally about the earthquake and whether they turned on

TABLE 2

FEAR OF EARTHQUAKES

Extent of fear[a]	New Year's Day quake[b]	Previous earthquakes[c]	Future damaging quake[d]
Very frightened	8.7	32.0	28.3
Somewhat frightened	25.3	26.8	35.9
Not very frightened	25.1	19.8	16.9
Not at all frightened	35.4	17.9	18.1
Enjoyed the experience	5.5	2.7	--
Don't know, not answered	0	.8	.8
Total	100.0	100.0	100.0
Total number	367	1333	509

a. Answers to the question about the New Year's Day quake included the phrase, "and upset."

b. This column includes respondents who personally felt the quake.

c. This column includes all respondents in the 1977 basic field survey who had experienced any earthquakes.

d. This column includes all respondents in the current survey who felt or knew about the New Year's Day earthquake. Enjoyment was not included as an optional response to the prospect of a future damaging earthquake.

television or radio or paid special attention in order to hear news about the quake. The questions were as follows:

> Thinking back to the hour or so after the earthquake struck, did you try to contact someone to get more information or because you were concerned about them? (Yes; No)
> Who were you trying to contact?
>
> After the quake did you turn on the TV or radio purposely to get more information about the quake? (If TV or radio already on but started listening more intently or turning channels to get quake coverage, code "yes" response.)

Only one person in eight made any effort to contact someone either for information or because of concern for their welfare (Table 3). The number may be less than expected for other comparable tremors because of the time and day. At 3:00 PM on a holiday when many families were gathered about television sets watching the annual Rose Bowl football classic, fewer than the usual number of households had their members scattered in different locations. More than half the calls that were made were to members of extended family networks. The only other substantial category consisted of friends and neighbors. Personal detachments from the world of work is suggested by the absence of any efforts to reach coworkers.

On the other hand, nearly half of the respondents who felt the earthquake had their curiosity or concern aroused sufficiently to turn on or pay closer attention to the television or radio for news about the earthquake (Table 4).

If we think of this tremor as the most severe jolt in Los Angeles County in several years, capable of doing minor damage and sharp enough that people could plausibly wonder whether they were peripherae of a destructive quake, we can place these responses in context. Apparently there was considerable interest in knowing more about the quake, but rather little concern once the fear during the moment of impact had dissipated. Public discussion of the earthquake threat posed by the Uplift and the local seismic gap had not undermined a prevailing tendency to respond in a restrained but mildly vigilant manner.

TABLE 3

EFFORTS TO CONTACT PEOPLE AFTER THE EARTHQUAKE WAS FELT

	Number	Percent
Tried to contact someone?		
Yes	46	12.5
No	320	87.2
Not answered	1	.3
Total	367	100.0
Whom tried to contact:[a]		
Adult in household	5	12.2
Child(ren) in household	4	9.8
Relatives not in household	26	63.6
Friends and neighbors	13	31.8
Coworkers	0	0
Other	1	2.4

a. Percentage base is 46, the number of persons who made efforts to contact someone. Percentages total more than 100 because a few people tried to make contacts in more than one category.

TABLE 4

TURNING ON TELEVISION OR RADIO FOR INFORMATION

Turned radio or TV on?	Number	Percent
Yes	178	48.5
No	188	51.2
Not answered	1	.3
Total	367	100.0

Even though relatively few people made special efforts to contact friends, relatives,and associates about the quake, the majority of people who didn't personally feel the tremor first learned about it through personal contact rather than from the media (Table 5). We must assume from this observation that the quake was a common topic of conversation during the hours after impact, though not specifically the occasion for seeking people out. This informal dissemination took place within a few hours after the quake. Learning about the quake at second hand, some time after the event, very few people tried to get in touch with friends, relatives and associates. But fully a third did seek more information by way of television or radio.

One indication of interest in knowing about the earthquake is the accuracy with which people identified the magnitude of the tremor. The gradations on the Richter scale have no commonsense meaning, so there is no reason for people to make reasonable estimates unless they have either paid attention to the magnitude as announced in the news or familiarized themselves with the scale sufficiently that they could make acceptable guesses. More than half of the 509 respondents who felt the quake or otherwise knew it had occurred correctly identified the magnitude as falling between 4.0 and 4.9. An interesting feature of the distribution of responses is the fact that many more people underestimated than overestimated the magnitude. This observation contradicts any assumed tendency to sensationalize earthquake experience. And it seems consistent with the low level of fear that people reported feeling during the quake. In connection with both findings we should bear in mind that the vigor of the earth's movement declines as the shock waves radiate from the epicenter, so most of our respondents would not have experienced the full force of the tremor. But if they underestimate the magnitude for this reason, it is clear that a large minority of respondents were assigning a magnitude on the basis of their own or their associates' estimation, derived from their own experince of the impact.

TABLE 5

SOURCE OF AWARENESS AND RESPONSE BY RESPONDENTS

WHO DID NOT FEEL THE EARTHQUAKE

Awareness and response	Number	Percent
How did you find out?		
Media as source	60	42.3
Personal contact	81	57.0
Personal observation	1	.7
Total	142	100.0
When did you first become aware?		
Up to six hours after	110	77.5
6 to 24 hours after	25	17.6
More than 24 hours after	7	4.9
Total	142	100.0
After becoming aware, did you try to contact someone?		
Yes	6	4.2
No	136	95.8
Total	142	100.0
Whom tried to contact:		
Adult or child in household	0	0
Relatives not in household	4	66.7
Friends and neighbors	1	16.7
Coworkers	2	33.3
Turned radio or TV on?		
Yes	48	33.8
No	94	66.2
Total	142	100.0

TABLE 6

ESTIMATED MAGNITUDE OF THE NEW YEAR'S DAY EARTHQUAKE

Magnitude	Number	Percent
2	11	2.1
3	113	22.2
4	292	57.4
5	32	6.3
6	16	3.1
7	2	.4
8	1	.2
9	0	0.0
10	1	.2
Don't know and no answer	41	8.1
Total	509	100.0

If this is true, some appreciation of the empirical meaning of Richter scale values must have become an earthquake-subculture element in southern California.

Finally, we asked all 509 respondents who knew there had been an earthquake two questions about tangible effects:

> During this earthquake, was the home you were living in damaged enough to need repairs?
> Did you have any personal property damage during this earthquake?

Five people told the interviewers their homes were damaged and six that they suffered damage to personal property.

Was the Earthquake Predicted?

Although it is clear that the New Year's Day earthquake was not predicted in the scientific community, it would not be altogether unreasonable for people to make a connection between the earthquake and one or more of the vague or specific forecasts and near predictions that had circulated during the preceding three years. All 509 respondents who felt or learned about the earthquake were asked:

> As I read the following, tell me which of these statements applies to this recent earthquake:
> This earthquake is most likely one that was predicted;
> Although there have been predictions of earthquakes, I'm not sure whether this was one that was predicted;
> Although there have been predictions of earthquakes, this most likely wasn't one that was predicted; or I don't know of any predictions.

As indicated in Table 7, the majority of respondents didn't know of any predictions, while another 20 percent were aware of predictions but thought that the New Year's Day quake was not predicted. This left 122 respondents who, or nearly a quarter of the sample, who were not prepared to rule out the possibility that it had been predicted. Three quarters of these were not sure, leaving 29 respondents who connected this earthquake with a prediction. For this last small group we tried to find out the sort of prediction they had in mind.

TABLE 7

WAS THE NEW YEAR'S DAY EARTHQUAKE PREDICTED?

Predicted?	Number	Percent
Most likely one that was predicted	29	5.7
Not sure	93	18.3
Most likely wasn't one that was predicted	102	20.0
I don't know of any predictions	285	56.0
Total	509	100.0

The majority of the 29 had in mind a prediction made within the preceding twelve months, with relatively little difference between the time the prediction was issued and the time they first heard of it (Table 8). None thought the prediction had been issued less than a week before, or had first heard of the prediction that recently. The time span from one week to one year rules out the original announcement of the Uplift, Whitcomb's near prediction, and Minturn's forecast for most of the respondents. It also underlines the suggestion that warnings lose their effectiveness after six months to a year and are replaced in public attention by more recent notifications. The fact that a few people heard about the supposed prediction after the earthquake indicates that there must have been some discussion following the quake of the possibility that it had been predicted.

Half of those who had any idea of the source of the prediction attributed it to a scientist (Table 9). Another third ascribed it to a seer or psychic. As before, we find that the principal rival to scientific prediction is the secular prophecy. Although we found earlier that considerable credibility is accorded to the amateur scientist, no other amateur has attracted wide public attention since Henry Minturn. The religious prophets do not rival the secular prophets in the arena of natural events.

Most respondents could not state the grounds for the prediction, and most of those who offered grounds gave answers that derived more from folk wisdom than from scientific understanding. Television is not credited as the source of information to the extent that it was in connection with predictive announcements in general and the Uplift. Radio assumes special prominence, perhaps because of the popularity of free-wheeling "talk shows" in which people telephone the station to express opinions and relay rumors about current events. If these supposed predictions came disproportionately from offbeat sources, they were still not conveyed in most instances through the interpersonal exchange

TABLE 8

ADVANCE NOTICE OF THE NEW YEAR'S DAY EARTHQUAKE

Period of advance notice	How long before the earthquake:	
	Prediction was made public	Respondent first heard prediction
12 months or longer	10.4	13.8
7 to 12 months	10.4	3.4
1 to 6 months	17.2	10.4
2 weeks or more	10.4	10.4
1 week	17.2	17.2
24 hours or more	0	0
No announcement was made	6.9	--
Didn't hear until after earthquake	--	20.7
Don't know	27.5	24.1
Total	100.0	100.0
Total number	29	29

TABLE 9

SOURCE AND GROUNDS FOR PREDICTION

Source and grounds	Number	Percent
Type of person who made prediction:		
Scientist	12	41.4
Seer or psychic	8	27.6
Religious speaker	1	3.4
Amateur scientist	1	3.4
Friend or relative	2	6.9
Don't know	5	17.3
Total	29	100.0
Evidence on which prediction was based:		
Fault movement	2	6.9
Natural history of quakes locally	2	6.9
Earthquakes in other places	2	6.9
Research studies	2	6.9
Astronomy	2	6.9
Premonitions, psychic feelings	3	10.4
Bible	1	3.4
Don't know	18	62.1
Total[a]	(29)	(100.0)
Your chief source of information:		
Television	4	13.8
Radio	7	24.1
Newspaper	6	20.7
Magazine	4	13.8
Family member	1	3.4
Friend or neighbor	3	10.4
Other	1	3.4
Don't know	3	10.4
Total	29	100.0

a. Items total more than 100 percent because three people gave more than one answer.

that is the principal medium for rumor diffusion.

Respondents were asked whether the earthquake had occurred when it was predicted to occur, where it was predicted to occur, and with the predicted magnitude. Answers to these questions bring us closer to understanding how definite an idea of the prediction people had when they said the New Year's Day earthquake was predicted. Most of the answers were "don't know." The largest number, or about half, thought the earthquake had occurred at or near to the predicted location (Table 10). Only half as many thought it occurred at or near to the predicted time. People who thought the time or place had been wrongly predicted apparently were consistent in not saying the New Year's Day earthquake was one that had been predicted, since no one gave negative answers to these two questions.

Three people thought that the magnitude was less than predicted. The fact that so few people gave this answer underlines the general conclusion that people were not relating their answers to even vaguely accurate conceptions of the most publicized announcements either by scientists or nonscientists. Statements based on the Uplift consistently referred to highly destructive earthquakes, and the more widely publicized prophetic announcements dealt with disastrous quakes.

When asked whether they knew specifically who predicted the quake, only three people gave specific answers. One person gave what was probably the most credible answer, namely, the Soviet scientist. Since the time window for the Soviet forecast ended at year's end, an informed person might plausibly have concluded that this quake corresponded to the Soviet scientist's forecast, but at a reduced magnitude. The other answers were Jean Dixon, a popular psychic who makes periodic forecasts, and another name that we could not identify. When asked at the close of this sequence of questions whether there was anything else important about the prediction, one person mentioned the

TABLE 10

CREDIBILITY OF THE PREDICTION

Credibility	Number	Percent
Quake occurred:		
When predicted	4	13.8
Close to predicted time	3	10.4
Quake occurred:		
Where predicted	12	41.4
Close to predicted location	2	6.9
Quake magnitude was:		
About as predicted	8	27.6
Less than predicted	3	10.4
Before the quake, how seriously did you take the prediction?		
Quite seriously	7	24.2
Fairly seriously	5	17.2
Not very seriously	6	20.7
Not seriously at all	6	20.7
Don't know and no answer	5	17.2
Total	29	100.0

southern California Uplift.

If all of this information is pieced together, it is clear that while many people ascribe predictions to scientists, those who thought this earthquake had been predicted had mostly vague ideas, elaborated with the help of folk wisdom and conveyed through media sources that may have involved disproportionate reliance on radio and magazines, most remembered the prediction as being of recent origin. Since the number of cases is too small for differences to reach acceptable levels of statistical significance, the observations about media sources must be viewed as merely suggestive. The Uplift was mentioned only once, and not at all in response to a question about the grounds for the prediction. The recency ascribed to predictions by most respondents further rules out the Uplift as the recognized basis, unless respondents remembered only recent commentaries on the Uplift. The most plausible basis for a positive answer, the Soviet scientist's forecast, was mentioned explicitly by only one respondent. The most plausible interpretation of what respondents were doing is that most of them remembered recent discussions that were stimulated by, but detached from, one or more of the earlier scientific or nonscientific announcements or the recent Soviet scientist's forecast. Much in the same way that many people think that California is still due to break off and fall into the Pacific Ocean, not realizing that the forecast was to have been realized in 1969, the old forecasts are constantly dusted off and presented in new guizes. As they are detached from their origins, they are fleshed out with folk ideas about the local recurrence of earthquakes, the relation to earthquakes elsewhere in the world, the effects of heavenly bodies, and similar ideas. Some such devolution into folk knowledge seems to lie behind most of the cases in which the moderate New Year's Day quake was thought to have been predicted.

A final question was asked in this series:

Before the earthquake, how seriously did you take this prediction?

As indicated in Table 10, a fair share of respondents who thought the quake had been predicted acknowledged that they had not taken the prediction very seriously beforehand. This finding seems to rule out any assumption that believing the quake had been predicted was necessary to prevent dissonance for respondents who had previously been committed to the truth of some outstanding prediction. Only the one quarter of the respondents who had taken a relevant prediction very seriously could be candidates for such an explanation. The majority seem to have been aware of some vague forecast about which they felt ambivalent, and which they connected with the earthquake after it happened. Some of the remaining respondents only heard of the supposed prediction in the course of discussion or through the media in the aftermath of the earthquake.

The 195 respondents who had heard of some prediction but either were not sure or thought the New Year's Day quake was probably not predicted were asked the question:

> Why do you think this (may not be) (isn't) the earthquake that was predicted?

Answers were recorded verbatim and classified into the major categories in Table 11. The answers are especially informative concerning what view respondents have concerning the prediction process. Just over one half of these respondents find that an essential ingredient of the prediction process has been omitted. The largest segment--over a third of the subsample--assume that the medium-to-long-term prediction will be followed up by a short-term warning when the earthquake is imminent. Another substantial segment assume that the vague or incomplete near predictions and forecasts will be followed up by more precise notices, presumably before the quake occurs. It is striking that of the 224 respondents in all who say they are aware of some prediction in effect at the time of the earthquake, 101 or 45 percent interpreted existing predictive

TABLE 11

WHY THE NEW YEAR'S DAY EARTHQUAKE IS NOT ONE THAT WAS PREDICTED

Reason	Number		Percent: both reasons
	First reason	Second reason	
No advance warning given	68	0	34.9
Magnitude not as predicted	56	3	30.3
Location not as predicted	6	1	3.6
Scientists not specific	33	2	17.9
Other	8	0	4.1
Don't know and no answer	24	0	12.3
Total	195	(6)	103.1

announcements and forecasts as only preliminary warnings.

This prevalent interpretation of existing announcements would contribute greatly to explaining why very few people have made serious preparations for an earthquake and why awareness of the Uplift and predictive announcements in general are so weakly related to both action and concern. They seem to be interpreting the announcements they have heard as forewards to the more significant message that will be forthcoming at the appropriate time. Where did people get this idea? Statements about scientific predictions have not contained explicit assurances that imminent warnings can be issued. Even the prospect of developing the scientific capability to issue imminent as distinct from longer term predictions has not received serious attention in the media. And in the case of secular prophetic forecasts, there is usually only the single "revealed" announcement.

Possibly the frequent example of successful earthquake prediction in the People's Republic of China in which evacuation warnings were issued a few hours before the event have been accepted as the model for earthquake prediction by some. Possibly the occasional explanation by scientists that the true earthquake prediction specifies place, time, and magnitude has lead some people to assume that such details will be forthcoming. But it seems unlikely that so widespread an assumption could be explained by the kind of sophisticated awareness required for these two propositions to hold true. Either or all of three other explanations probably have more general applicability. First, analysis of media content in Part Two has revealed the pattern of warnings softened by reassurances. In effect people are repeatedly told, first, that a great disaster will befall southern California in the not-too-distant future, but second, that they should not get upset but should "sit tight." This combination of messages obviously makes no sense unless it is read as meaning that people

need not take drastic action because someone dependable is looking after them. The message that something terrible will happen, but there is no need to do anything drastic yet, seems to imply the additional promise that you will be advised when the time for action is at hand. Second, the long- or medium-term earthquake warning is quite unsatisfying because it is not feasible to sustain disruption of normal routines for extended periods of time. If we assume that warnings are only meaningful when the nature of appropriate protective responses is clear and those responses are feasible, they can be made meaningful by assuming that the real warning will be forthcoming later, at a time when action is indicated and feasible. The assumption that specificity and an imminent warning will follow may be an automatic product of the process of trying to translate an otherwise meaningless announcement into a meaningful one. Third, we have observed earlier that the majority of people look toward the government to take all or part of the responsibility for issuing earthquake predictions, and that in other respects people look toward government for leadership and action. Thus far, near predictions and forecasts are not perceived as having originated with government but to have been the work of scientists or prophets. There may be an implicit but widespread assumption that when the critical time arrives, major government officials--line rather than staff--will take charge.

Returning to Table 11, we also learn something about the kind of earthquake that many people expect on the basis of extant forecasts and near predictions. Only a few less than one third of the respondents who doubt that the New Year's Day earthquake corresponds to any advance notice that they had heard do so because they expected a much stronger quake.

Earlier in the report we observed a widespread tendency for respondents to translate scientific communications and even prophecies by seers into personal knowledge, and the widespread acceptance of personally observable signs such as unusual behavior and one's own strong premonition. We concluded this investigation

of whether people thought the earthquake had been predicted by asking the strictly personal question:

> Just before this recent quake, did you have any idea that an earthquake was about to happen? (If "yes";)
> What gave you this idea?

Only about one person in twelve claims to have had an idea that an earthquake was about to happen. Whatever tendency there may be for people to reconstruct prior events so as to convince themselves that they foresaw the future is restricted to a very small segment of the population, at least with respect to a relatively inconsequential earthquake such as this one. However, this still includes more people than stated that the quake had probably been predicted, emphasizing again the predilection for personal knowledge.

What grounds do members of this small population segment give for their convictions? In Table 12 the answers have been arranged in approximate order from the more external, sharable, and verifiable sources to the more internal and private and least verifiable sources. No references to scientific announcements were made. Answers that could have been derived from scientific ideas such as seismic gap theory are used with a constricted time window that lacks scientific foundation. At the other pole, personal intuition and observation of unusual animal behavior account for five eighths of the first answers and nearly half of all answers. What we see here is not qualitatively different from what we have found in the population at large. But the people who claim advance intimations are drawn disproportionately from one end of a continuum, relying most heavily on folk wisdom and private personal experience.

Interpreting the Earthquake

In Chapter Two we asked how respondents interpreted reports that portions of the southern California Uplift were sinking, reports of a wave

TABLE 12

PERSONAL INTIMATIONS THAT AN EARTHQUAKE WAS ABOUT TO HAPPEN

Intimation and grounds	Number	Percent
Did you have any idea?		
Yes	42	8.2
No	466	91.6
Not answered	1	.2
Total	509	100.0
What gave you this idea?		
Coverage of predictions by news media	4	9.5
Forecast by psychic, seer, or astrologer	2	4.7
Fault movements	1	2.4
Increased frequency of quakes	2	4.7
Earthquake elsewhere	1	2.4
Local earthquake history	2	4.7
Locale is overdue for a quake	1	2.4
Unusual animal behavior	7	16.7
Past quake experience of respondent	2	4.7
Personal intuition of self, relative, or friend	22	52.4
Other, including vague references	7	16.7
Total[a]	(42)	121.3

a. The total exceeds 100 percent because respondents were permitted to give as many as three answers.

of micro-tremors in the uplifted zone, and occurrence of a damaging earthquake in nearby Santa Barbara. We found repeated evidence that many, though not most, respondents had been exposed to discussions relating these events to the prospect of a destructive earthquake in Los Angeles County. We followed a similar but elaborated procedure with respect to interpretations of the New Year's Day earthquake.

Respondents were asked about four interpretations of the earthquake that the investigators had themselves seen or heard expressed. Alternative replies were simplified slightly by comparison with earlier questioning. The full questioning sequence was as follows;

> People are saying different things about this recent quake. Have you heard anyone say: "Now that we've had an earthquake recently, there probably won't be a big one for quite a while." (Yes or No)
> Do you remember any particular people who were saying this?
> What do you think about this statement? Do you think: It is true; It might be true, but you're not sure; or It is false?
>
> Have you heard anyone say that this recent earthquake could be a sign that a bigger one is coming soon? (Yes or No)
> Do you remember any particular people who were saying this?
> What do you think about this statement? Do you . . .
>
> Do you remember anyone saying that the recent earthquake doesn't make any difference in whether there will be a big earthquake soon?
> Do you remember any particular people who were saying this?
> What do you think about this statement? Do you . . .
>
> Have you heard anyone say that this earthquake was an aftershock of the 1971 San Fernando earthquake?
> Do you remember any particular people who were saying this?
> What do you think about this statement? Do you . . .

From Table 13 the reader can see that the view of the New Year's Day quake as a precursor is much more widely diffused than the other views, and the aftershock interpretation is least known of all. Still, only a few more than a third of the sample remember hearing the precursor interpretation, so we must remember that we are speaking of a substantial minority rather than an outright majority who have heard the precursor interpretation expressed.

TABLE 13

AWARENESS AND CREDIBILITY OF INTERPRETATIONS

OF THE NEW YEAR'S DAY EARTHQUAKE

Interpretation and credibility	Number	Percent of sample	Percent of heard
Interpretation heard:			
Won't be big quake soon	37	7.3	
Sign bigger quake coming soon	184	36.1	
Doesn't make any difference	38	7.5	
Aftershock to San Fernando quake	26	5.1	
Remembers who was saying it			
Won't be big quake soon	28		75.7
Sign bigger quake coming soon	144		78.3
Doesn't make any difference	29		76.3
Aftershock to San Fernando quake	17		65.4
Won't be big quake soon:			
Is true	5	1.0	13.5
Might be true	11	2.2	29.7
Is false	16	3.1	43.3
Don't know	5	1.0	13.5
Total	37	7.3	100.0
Sign bigger quake coming soon:			
Is true	47	9.2	25.6
Might be true	93	18.3	50.5
Is false	23	4.5	12.5
Don't know	21	4.1	11.4
Total	184	36.1	100.0
Doesn't make any difference:			
Is true	10	2.0	26.3
Might be true	19	3.7	50.0
Is false	6	1.2	15.8
Don't know	3	.6	7.9
Total	38	7.5	100.0
Aftershock to San Fernando quake:			
Is true	1	.2	3.8
Might be true	12	2.3	46.2
Is false	9	1.8	34.6
Don't know	4	.8	15.4
Total	26	5.1	100.0

Some indication of how clearly the discussion is preserved in memory comes from the proportions able to remember who expressed each of the interpretations. If there is any tendency for people to claim falsely that they have heard various interpretations in order not to seem uninformed in the interviewer's eyes, it could be revealed by large proportions of respondents who couldn't remember where they heard the view expressed. Actually, fairly high proportions claim to remember the sources. Actually, fairly high percentages claim to remember the sources. Percentages are about the same for the three versions of the quake's significance with respect to future earthquakes. Fewer people claim to have heard the aftershock interpretation and fewer of them say they remember the source. There is more reason to be skeptical about replies concerning the aftershock interpretation than there is for the other interpretations.

Diffusion and belief are two different matters. It is of interest that interpretations are being circulated, whether they are believed or not. But how seriously people treat the interpretations is also important. From the right hand column of Table 12 it is clear that the majority of people do not accept any of the interpretations unqualifiedly. The definite opinion that the interpretation is true ranges from a low of four percent for the aftershock version to highs of 26 percent for the precursor and no-relationship interpretations. Considerably larger proportions in each instance acknowledge that the interpretation <u>might</u> be true. Combining responses, a nearly identical 76 percent accord some credibility to the precursor interpretation and to the no-relationship interpretation. Only small percentages unqualifiedly reject either of these views. Considerably larger proportions are prepared to reject the neutralization and aftershock interpretations. The neutralization view is especially unpopular, though approximately equal proportions entertain the possibility that it is correct and reject the view outright.

In making these observations we are counting believers, disbelievers, and uncertains as fractions of the various number who have heard the several interpretations. Measured in this way, credibility is similar for the precursor and no-relationship interpretations. But if we take into account the much wider dissemination of the precursor interpretation, using percentages in the middle column, far more people accorded simple or qualified credibility to the precursor interpretation than to either the no-relationship or neutralization views or to the aftershock interpretation. Out of the entire sample, 27.5 percent have assigned at least qualified credibility to the precursor interpretation, contrasted to 5.7 percent for the next most popular view.

A more comprehensive view of the impact of the interpretation process comes from looking at the alternative interpretation process in combination. Because the aftershock interpretation is not specifically an alternative to the other three, and is least disseminated and accepted, we have treated only the first three interpretations in combination. The first and third columns in Table 13 indicate the extent and kind of single and multiple exposure that people in the sample have received. Approximately 42 percent of the respondents have heard one or more of the interpretations, and most of these have heard only one. The number of cases that fall in each of the eight possible combinations of the three interpretations is very close to what would be expected on the basis of the individual dissemination rates for the three interpretations in chance combination (Expected values are not reported in the table). There are consistent small excesses of observed over expected frequencies in all of the "one" or "none" combinations, adding up to only about three percentage points of difference. There could be a weak tendency for respondents <u>not</u> to hear more than one interpretation, or not to remember more than one.

The second and fourth columns of Table 14 count only respondents who believe a given interpretation is true or might be true, and thus indicate the distribution of credible interpretations. Again the observed and expected frequencies are quite similar, and there is apparently no systematic effect favoring or disfavoring any particular interpretation in one combination as compared with others. However, there is again a consistent set of small differences, but this time such that slightly fewer than expected accord credibility to each instance of a single interpretation while slightly more than expected accord credibility to each of the four combinations of two or all three interpretations.

Table 15 permits us to complete the analysis by relating credibility to the combinations actually heard. Examining this table against the background of the previous analysis we are lead to three general findings. First, people are apparently discriminating in what they will and won't believe. Among 171 people who were exposed to just one of the three interpretations, those who heard that a large earthquake was coming soon and those who heard that the New Year's Day quake made no difference were disposed to accord conditional credibility to what they heard. But those who heard that the smaller quake neutralized the threat of a larger one were inclined to disbelieve what they heard. Of the 161 people who heard both that a big earthquake was coming soon and that there wouldn't be an earthquake soon, none credited the latter interpretation to the exclusion of the former.

Second, exposure to contradictory communications does not lead to increased skepticism about all communications. The apparent effect is in the opposite direction, although it is not statistically significant. While 25.7 percent of the 171 people who heard only one of the interpretations rejected what they heard, only 14.3 percent of the 42 people who heard two

TABLE 14

AWARENESS AND CREDIBILITY OF COMBINATIONS OF INTERPRETATIONS OF THE NEW YEAR'S DAY EARTHQUAKE

Interpretations	Number		Percent	
	Heard	Credible	Heard	Credible
Number of interpretations:				
None	296	346	58.1	68.0
One	171	142	33.6	27.9
Two	38	20	7.5	3.9
Three	4	1	.8	.2
Total	509	509	100.0	100.0
Specific interpretations:				
None	296	346	58.1	68.0
No big quake soon	16	5	3.1	1.0
Bigger quake soon	143	120	28.1	23.6
Makes no difference	12	17	2.4	3.3
No big quake soon and bigger quake soon	16	9	3.2	1.8
No big quake soon and Makes no difference	1	1	.2	.2
Bigger quake soon and Makes no difference	21	10	4.1	1.9
All three	4	1	.8	.2
Total	509	509	100.0	100.0

TABLE 15

CREDIBILITY BY EXPOSURE TO INTERPRETATIONS OF THE NEW YEAR'S DAY EARTHQUAKE

Interpretations given credibility	Interpretations heard						
	No big quake soon	Bigger quake soon	Makes no differ.	No big/ bigger soon	No big/ no differ.	Bigger soon/no differ.	All three
None	68.7	21.7	16.7	12.5	(1)	9.5	(1)
No big quake soon	31.3			0	0		0
Bigger quake soon		78.3		31.3		14.3	0
Makes no difference			83.3		0	28.6	(1)
No big quake soon and bigger quake soon				56.2			0
No big quake soon and Makes no difference					0		(1)
Bigger quake soon and Makes no difference						47.6	0
All three							(1)
Total	100.0	100.0	100.0	100.0	(1)	100.0	(4)
Total number	16	143	12	16	1	21	4

Only inapplicable cells have been left blank.

or more interpretations rejected all of them. This observation has important bearing on communication policy. The fear is often expressed that if members of the public are exposed to contradictory interpretations of events many will respond with a skeptical rejection of all interpretations. That fear would plainly not have been justified in this instance.

Third, a very frequent response by people exposed to contradictory interpretations is to conclude that both should be regarded as potentially true. Numbers are too small for comparisons, except to observe that viewing two contending interpretations as both potentially true is as frequent, if not more frequent, as accepting one interpretation and rejecting the other, and far more frequent than rejecting both. Thus presenting people with contending interpretations makes a net contribution to openmindedness rather than skepticism.

These findings are consistent with those reported in Chapter Two for the sinking of the Uplift, the micro-quake swarm, and the Santa Barbara earthquake.

We return now to the question of where the interpretations of the New Year's Day earthquake came from. We noted in Table 13 that from 65 to 78 percent of respondents who remembered hearing any specific interpretation said they remembered the source. Again, we shall omit the aftershock interpretation and concentrate on where people find help in relating a moderate earthquake to the future prospects of a destructive quake. The sources to which people ascribed the three interpretations appear in the second, third, and fourth columns of Table 16. The significance of these responses is made apparent by the comparison with the figures in the first column, reporting answers to a question on the chief source of information about the southern California Uplift asked later in the same survey.

The issue can be stated as whether people got the ideas and information

TABLE 16

SOURCE OF INFORMATION ABOUT SOUTHERN CALIFORNIA UPLIFT AND THE NEW YEAR'S DAY EARTHQUAKE

Information source	Chief source concerning Uplift	Interpretations of the New Year's Day Earthquake		
		No bigger quake soon	Big quake coming soon	Makes no difference
Detailed percentages				
Media	84.0	10.8	5.3	5.5
Books & Magazines	3.7	--	--	0.5
Authorities	--	2.7	--	2.2
Family & relatives	2.1	8.1	2.6	6.6
Friends & neighbors	3.7	37.9	31.6	35.2
Coworkers & classmates	1.7	16.2	36.8	28.0
Don't know, others	4.8	24.3	23.7	22.0
Total	100.0	100.0	100.0	100.0
(Total number)	(294)	(37)	(182)	(38)
Summary percentages				
Media, publications, authorities	87.7	13.5	5.3	8.2
Lay people	7.5	62.2	71.0	69.8
Don't know, others	4.8	24.3	23.7	22.0

they used in trying to make this earthquake meaningful in relation to the more significant prospect of a destructive earthquake from relatively authoritative sources or from rumor. In our interviews with comparable samples of Los Angeles County residents during the preceeding two years the media--television, radio, and newspaper--were consistently given as the principal sources of information about future earthquake prospects. We asked the people in our New Year's Day earthquake sample whether they had heard of the southern California Uplift (Palmdale Bulge) and what was their chief source of information about it. True to the pattern in our previous interviews, 88 percent named the media or magazines and books as their chief sources. Only seven and one half percent named friends, relatives, or coworkers. But when we asked where they had heard interpretations of the New Year's Day earthquake, the answers were quite different.

On the average, fewer than ten percent named the media, books and magazines, or an authoritative source. Even with a sizable group unable to remember the source, over two thirds named lay people as their source. The most frequent answers were friends and coworkers. The significance of the small quake for the future had been the topic of widespread discussion at work and among friends. Without guidance from authoritative sources, relayed through the media, people turned to friends and coworkers for their interpretations.

Consistent with these findings, the investigators personally heard rumors about supposed earthquake forecasts during the month of January. The rumors were reported with a sense of conviction and concern. In light of a widespread disposition to interpret the New Year's Day earthquake as the harbinger of a major disaster, there is little wonder that people were unusually susceptible to such rumors.

Effects on Awareness and Concern

Awareness of the Uplift. If the earthquake was followed by a wave of

informal discussion on whether it was predicted and its significance for the future, interest in the southern California Uplift might have been stimulated and awareness increased. Not all questions used in the other surveys to measure awareness of the Uplift were asked in this survey, but responses can be compared for those that were. In Table 17 we see that the proportion who say they have heard of the Uplift is about the same as it was in the final wave of regular interviewing a month or two earlier and in the basic field survey two years earlier. Similarly, the proportion who understood that scientists viewed the Uplift as a possible earthquake precursor is not significantly changed. Whatever discussion was stimulated by the earthquake did not enlarge the circle of people who were aware of the Uplift or its possible meaning.

Even if discussion did not expand awareness of the Uplift, it might have altered its credibility as an earthquake sign. A comparison of how seriously respondents took the Uplift as an earthquake sign before and after the earthquake produces a mildly ambiguous result (Table 17). In this tabulation we omit both respondents who have not heard of the Uplift and respondents who say definitely that scientists do not view it as an earthquake sign. An apparent slight increase from early 1977 to late 1978 in the proportion who took the Uplift quite seriously as an earthquake sign is not statistically significant. Following the New Year's Day earthquake there is a fairly substantial drop in the proportion who take the Uplift quite seriously. If the distribution is dichotomized between respondents, the decline is not statistically significant. The finding must be that the net change in the proportion who take the Uplift seriously could be a sampling fluctuation. However, if only respondents who take the Uplift quite seriously are separated from all others, the drop following the New Year's Day earthquake is significant (Chi-square = 7.150, 1 d.f., $p < .01$).

Since we did not ask respondents in this survey for a general enumeration of predictive announcements they remembered, awareness of the Uplift

TABLE 17

AWARENESS OF THE UPLIFT AT THREE PERIODS OF TIME

Awareness	February 1977	Nov/Dec 1978	January 1978
Not heard	40.9	41.3	42.2
Heard but not understood	16.1	18.7	18.7
Heard and understood	43.0	40.0	39.1
Total	100.0	100.0	100.0
Total number	1450	550	509
Taken as a sign of a coming earthquake:			
Quite seriously	21.5	26.0	16.7
Fairly seriously	33.8	32.0	35.7
Don't know	5.6	7.7	5.4
Not very seriously	27.0	26.3	26.5
Not seriously at all	12.1	8.0	15.7
Total who heard and understood	100.0	100.0	100.0
Total number	768	300	294

was determined by asking all respondents if they remembered "hearing about a bulge in the earth near Palmdale in the Mojave Desert." After asking the standard questions on what scientists were saying the bulge signified and how seriously they took the bulge as an earthquake sign, we then asked two questions relating the earthquake specifically to the Uplift.

> Do you think the recent earthquake was the one some people expected on the basis of the Palmdale Bulge?
>
> Now that we've had this recent earthquake, would you say that: The danger from the Bulge is over, or the Bulge will cause more earthquakes?

These questions are partially redundant with the earlier questions dealing in more general terms with whether the earthquake was predicted and with the interpretations being placed on it. But they were included because of our special interest in the Uplift.

From Table 18 we see that only 8.5 percent of all respondents who appreciated the possible significance of the Uplift associated it even tentatively with the New Year's Day earthquake. Most respondents categorically rejected any association. Half reject categorically the conclusion that the danger of earthquakes from the Uplift is over as a result of the New Year's Day earthquake, but 40 percent are unwilling to take a position on the second question. Close to ten percent are willing to entertain the possibility that the danger from the Uplift has been relieved by the small quake.

With the New Year's Day quake's epicenter placed in the Santa Monica Bay, one might assume that any connection with the Uplift would have been easily dismissed. Because of the vagueness of the conceptions most people have of the Uplift and of the advertised earthquake threat, many did not make such a dismissal. Even the small number in the sample who accept the implausible connection represent a considerable body of people.

In summary, the New Year's Day earthquake has had no apparent effect

TABLE 18

THE RELATIONSHIP OF THE NEW YEAR'S DAY EARTHQUAKE

TO THE SOUTHERN CALIFORNIA UPLIFT

Relationship	Percent of total sample	Percent of heard
Was recent quake the one expected on basis of Palmdale Bulge?		
Yes	3.1	5.4
Yes, but there may be others	1.8	3.1
No	34.0	58.8
Don't know	18.9	32.7
Not heard of Bulge	42.2	--
Total	100.0	100.0
Total number	509	294
Now that we've had recent earthquake:		
Danger from bulge is over	1.8	3.1
Recent quake may be the one expected	3.7	6.4
Bulge will cause more earthquakes	28.9	50.0
Don't know	23.4	40.5
Not heard of Bulge	42.2	--
Total	100.0	100.0
Total number	509	294

on the awareness of the Uplift or its general credibility as an earthquake sign. However, significantly fewer people seem willing to assign it high credibility. The earthquake appears to have induced a more reserved attitude toward the Uplift as an earthquake precursor. This earthquake is not generally associated in popular thinking with the Uplift, though an unusually large minority of respondents are unwilling to take positions on questions dealing with whether there is or is not an association. Although we have not asked respondents to explain their answers, we find it plausible that the vagueness of people's understanding concerning the Uplift and the ominous significance attached to it prevent this large minority from drawing the obvious conclusion of no connection. Reduction in the number who take the Uplift quite seriously and large numbers of indecisive positions concerning the relationship between the Uplift and this minor earthquake provide some consistency in the view of how the earthquake affected awareness and appreciation of the Uplift.

Fear, concern, and expectation. In Chapter Three we reported that expressed fear and concern over the prospect of an earthquake declined in the first half of 1977 and remained fairly stable thereafter, but that the disposition to flee the anticipated site of an earthquake increased. If we compare responses soon after the earthquake with responses just a few weeks earlier, we observe that expressions of fear in answer to each of the three questions increased (Table 19). Each of the shifts is highly significant (Chi-square, 1 d.f., = 14.391, 12.534, 12.918, respectively; $p < .001$ for all three shifts). Similarly, the sense of recently increased concern about a damaging earthquake striking southern California increased significantly (Chi-square = 14.923, 2 d.f., $p < .001$). The evidence is consistent that the short-term effect of a moderate but nondestructive earthquake was to intensify fear and concern over the prospect of a damaging earthquake.

When we compare the New Year's Day quake sample with the sample from nearly two years earlier, the results are more complicated. For feelings

TABLE 19

EARTHQUAKE FEAR AND CONCERN AT THREE PERIODS OF TIME

Type of fear or concern	February 1977	Nov/Dec. 1978	January 1978
Feelings about experiencing a damaging earthquake:			
Very frightened	27.3	20.6	28.3
Somewhat frightened	35.4	30.7	35.9
Don't know	.4	0	.8
Not very frightened	22.5	25.6	16.9
Not at all frightened	14.4	23.1	18.1
Total	100.0	100.0	100.0
Possibility of damaging earthquake in near future:			
Very worried	14.6	6.4	13.2
Somewhat worried	34.8	32.7	36.9
Don't know	.3	.5	.4
Hardly worried	24.3	27.8	26.1
Not worried at all	26.0	32.6	23.4
Total	100.0	100.0	100.0
If damaging earthquake certain, would try to:			
Get far away as possible	29.0	33.8	44.8
Don't know	2.4	2.7	2.1
Find safe place near earthquake	33.6	33.3	27.9
Go on as usual	34.3	29.5	24.0
Be where earthquake would occur	.7	.7	1.2
Total	100.0	100.0	100.0
In past year your concern about damaging earthquake striking southern California has:			
Increased	30.2	16.2	23.2
Remained about the same	65.6	75.8	72.9
Don't know	0	0	0
Decreased	4.2	8.0	3.9
Total	100.0	100.0	100.0
Total number	1450	550	509

about a damaging earthquake and worry over the possibility of a damaging earthquake, fear and concern have simply returned to the level that prevailed at the start of the investigation. We assumed that the flurry of near-predictions and devastating foreign earthquakes during 1976 had raised concern to an unusual level, after which concern had slackened to a stable level. If this assumption is correct, the New Year's Day earthquake was sufficient to push concern back up to the same unusual level. On the other hand, while the number of people who felt that their concern had recently increased was greater after the quake, it was still significantly less than in February, 1977 (Chi-square = 9.327, 2 d.f., $p < .01$). Fewer people had the sense of being recently stirred than earlier. If we take both patterns seriously, either the fact that people had been through a period of more intense concern two years earlier or the fact that the stimulus this time was only a single event lead them to underestimate the extent to which they had become fearful again.

The shift in the disposition to get away from the earthquake site exhibits still a third pattern. The shift following the earthquake is the intensification of a moderate trend that occurred after the first survey. We interpreted this trend as a growing tendency not to accept a potentially damaging earthquake as a routine event. This tendency accelerated at the same time that other indications of earthquake fear and concern were declining, suggesting a reflective effect that develops more slowly than the arousal of fear and concern. It is plausible to think of simple emotional effects as intensifying and declining with passing events, while reflective effects are cumulative in nature. One effect of the New Year's Day earthquake may have been to encourage further reflection, leading more people to recognize that a damaging earthquake should be treated as an extraordinary event or crisis rather than an occasion to be approached routinely.

If fear has been rearroused by the earthquake, it is because of a significant increase in the proportion of respondents who expect a damaging earthquake soon? Has widespread discussion of the possible meaning of this earthquake as the precursor to a larger quake been converted into a more widespread anticipation of a serious earthquake soon, which in turn causes more fear and concern? Table 20 presents the answers to the standard question used in all surveys concerning the likelihood of a damaging earthquake within a year. Contrary to the assumption underlying the foregoing questions, the expectation for a damaging earthquake appears to have declined rather than increased since the last regular survey (Chi-square = 7.543, 2 d.f., $p < .05$). Expectation is down also by comparison with basic field survey (Chi-square = 53.784, 2 d.f., $p < .001$).

At first glance it appears contradictory that fear should rise while the imminent expectation of a serious earthquake declines. However fear should respond to the conception of an event as well as to the imminence with which it is expected. The spread of the conviction that a severe earthquake should not be approached by continuing with life as usual seems to say more about the conception of an earthquake than about its imminence. The occurrence of a quake that was not quite strong enough to do significant damage seems to have awakened more people than before to the realities of a severe earthquake. But it is not immediately clear why the earthquake should have caused a net decrease in the number of people who expect a damaging earthquake soon. Few people interpreted the earthquake as a sign that the danger of a destructive earthquake was more remote than previously, while many interpreted it as a sign that the danger was more immediate. Apparently many people's responses to different questions have remained cognitively segregated. When focusing on the meaning of the recent earthquake people reach one conclusion. When thinking about the prospect of an earthquake in the abstract they reach a different

TABLE 20

EXPECTATION OF A DAMAGING EARTHQUAKE AT

THREE PERIODS OF TIME

Expectation	February 1977	Nov/Dec. 1978	January 1978
Definitely within the next year	5.6	2.4	3.4
Probably within the next year	38.3	33.4	28.9
Don't know	5.5	19.5	15.0
Probably not within the next year	44.3	40.0	48.7
Definitely not within the next year	6.3	4.7	4.0
Total	100.0	100.0	100.0
Total number	1437	550	501

conclusion. A plausible but entirely speculative interpretation would be that fear can lead to denial, and that denial is easier when the question disembodies the event from the context than when it is asked in explicit reference to the meaning of a significant recent event.

The Predictability of Earthquakes

Scientific prediction. Throughout this examination of response to the New Year's Day earthquake we have stressed the contribution of forecasts and near predictions to the setting in which the event occurred. If people have become familiar with the idea of earthquake prediction only during the previous three or four years, any personal experience with successful or unsuccessful prediction could modify the prevailing faith in prediction. If we assume that the New Year's Day earthquake was substantial enough to arouse emotions and provoke reflection, the failure to predict it might weaken the confidence of some people in scientific earthquake prediction capability.

We included in the interview the standard pair of questions about belief in scientific prediction capability at present and in the future. A slight apparent decrease in faith in current prediction capability since the previous survey does not reach the five percent confidence level and should therefore be disregarded (Table 21). But faith in future prediction capability did decrease significantly between the last regular interview wave and the New Year's Day earthquake survey (Chi-square = 7.999, 1 d.f., $p \leq .01$).

This pair of findings seems opposite to what might have been expected. The failure of scientists to predict a moderate earthquake seems to tell more about the current state of scientific prediction than about its eventual accomplishments. One explanation for the finding may lie simply in the proportion of respondents who expressed faith in scientific prediction in the two time frames. Before the earthquake the community was close to consensus in expressing faith

TABLE 21

FAITH IN SCIENTIFIC EARTHQUAKE PREDICTION

AT THREE PERIODS OF TIME

Attitude toward prediction	February 1977	Nov/Dec. 1978	January 1979
How accurately scientists can predict earthquakes now:			
Quite accurately	5.5	15.1	15.6
Somewhat accurately	36.4	43.1	37.7
Not too accurately	38.3	28.4	27.4
Not at all	18.1	10.7	13.8
Don't know	1.7	2.7	5.5
Total	100.0	100.0	100.0
Total number	1450	550	507
How accurately scientists will be able to predict earthquakes:			
Quite accurately	42.1	53.3	44.4
Somewhat accurately	41.5	33.4	38.3
Not too accurately	9.1	6.2	6.3
Not at all	4.2	3.6	3.3
Don't know	3.1	3.5	7.7
Total	100.0	100.0	100.0
Total number	1450	550	507
Were scientists and public officials giving public all information about earthquake predictions, or holding back?			
Both giving all	40.1	36.4	46.2
Only scientists giving all	5.0	3.6	1.2
Only officials giving all	2.5	1.6	1.2
Both holding back	43.6	47.7	32.7
Don't know	8.8	10.7	18.7
Total	100.0	100.0	100.0
Total number	1450	550	507

that somewhat accurate prediction would be achieved eventually. Consensus publics usually include many people who have not given much thought to the question nor made up their minds independently. These are the people who are likely to have second thoughts when events seem to challenge their belief. Faith in current prediction capability was much more selective and established beliefs may be less vulnerable to minor events.

It is important to note that the shift after the earthquake is not a simple linear decrease in faith in eventual prediction. There is no increase in the ten percent who were negative about prediction at the close of 1978. The substantial drop in respondents who believe that earthquake prediction will eventually be quite accurate is offset by increases in "somewhat accurately" and "don't know" responses. The effect of the unpredicted quake has been to replace certainty with uncertainty.

Is information being withheld? With over half the respondents expressing belief that scientists can already predict earthquakes somewhat or quite accurately and holding to that conviction after an unpredicted quake, one might plausibly expect to find widespread suspicion that information was being withheld from the public. The question used in previous surveys was modified to specify the period before the earthquake:

> Before this recent quake, do you think that scientists and public officials were giving all the information they had on earthquake predictions, or were they holding back information?

It would be consistent with the persistence of faith in current prediction capability if the conviction that scientists and public officials had been withholding prediction information from the public were more prevalent after the earthquake. But again, exactly the opposite is true. The proportion of respondents who believe that both scientists and officials were telling all that they knew before the earthquake increased substantially from 36 to 46 percent (Chi-square = 10.048, 1 d.f., $p < .01$). The decrease in proportion

who believe that either or both scientists and officials were withholding information is even greater, with the balancing change consisting of an increase in the number of "don't know" responses.

Again, the shift, following the earthquake, of a substantial number of previously suspicious people toward either uncertainty or a definite conviction that all was told is difficult to understand. If the consequences of the earthquake had been more serious, we might have expected increased expression of trust in responsible leaders as part of community integration in a crisis. The New Year's Day earthquake hardly seems to qualify as a crisis. Nevertheless, if the augmented fear of a future earthquake was sufficient to provoke measurable denial, expressed through a net decline in the imminent expectation of a damaging earthquake, it may also have been sufficient to foster the abandonment of divisive distrust in the interests of crisis unification.

It seems more likely that the grounds for suspicion were aired and found wanting in informal post-earthquake discussion, though it is not clear how this would have happened.

Still another plausible explanation is that respondents gave a more restricted meaning to the question because of the opening phrase, "Before this recent quake." If we assume that suspicion generally applies to the withholding of information about impending disaster, there is less likely to be suspicion that information about relatively benign future events is being withheld. If the question had been read as referring only to knowledge about the coming New Year's earthquake, the decreased expression of distrust would have to be dismissed as an artifact. This explanation loses some credibility, however, since it provides no explanation for the increased proportion of "don't know" responses. Both of the other explanations deal more adequately with the augmented "don't know" response, since weakened conviction about a previously held viewpoint often leads to uncertainty before outright reversal of opinion takes

place.

The pattern of findings concerning the effects of the New Year's Day earthquake on faith in scientific prediction and trust that prediction information is not being withheld from the public contains several surprises. We have speculated about the findings, not because we have confidence in any of the suggested explanations, but because the findings present a challenge to the obvious that must be confronted, in later research if not now.

Folk signs. The principal rival grounds for anticipating an earthquake are the supposed folk signs, of which unusual animal behavior, earthquake weather, and personal premonition are the major examples. If people felt that they had personally been able to apprehend the signs that an earthquake was coming when scientists were not able to do so, the weakened faith in the long-term prospects for scientific earthquake prediction might be part of a shift toward greater reliance on folk signs. On the other hand, if people were convinced that neither folk signs nor science foretold the recent earthquake, the effect might be decreased faith in both grounds for prediction.

We already know that a mere eight percent of our respondents claimed to have had any idea that an earthquake was about to happen, and that the majority of these people credited personal intuitions while seven people credited unusual animal behavior (Table 12). These references to quake signs, however, were secured in response to open-ended inquiry and were not related to the extent to which people believed in folk signs. To complement these items we asked the following pair of questions, the first of which is the standard item used in four of the five previous surveys:

> As I read each of the following, please tell me if you think people can use any of the following signs in their daily lives to tell when an earthquake might be coming: Unusual animal behavior; unusual weather; premonitions, instincts, or ESP; unusual aches or pains; any other signs?

> Prior to this recent quake, did you personally see or feel any of the following signs which could have signified that an earthquake might be coming? (same list as above)

From Table 22 we see that the majority of people express belief in unusual animal behavior as an earthquake sign, and substantial minorities believe in premonitions and earthquake weather. But relatively few people claim personally to have perceived these signs. In absolute numbers more people claim to have noticed earthquake weather than animal behavior or premonitions. And relative to the number of believers, both earthquake weather and promonitions were experienced by more people than animal behavior. We were impressed by the growing faith in current scientific earthquake prediction capability in the absence of new successes with earthquake prediction, as reported in Chapter Three. It is clear from the present findings that belief in folk signs does not depend upon their successful use in every instance of an earthquake. From 83 to 91 percent of the believers in each of the four folk signs continue to believe in spite of their not having observed the sign prior to the New Year's Day earthquake.

The difficulty with investigating the use of folk signs is that respondents often "recognize" the presence of earthquake signs retrospectively, without having anticipated the earthquake. A partial check on how prevalent this practice has been is provided by comparing answers to the direct question about signs in daily life with reasons given earlier in the interview for anticipating that an earthquake would occur. In the third column of Table 22 we have repeated the frequencies with which premonitions and animal behavior were mentioned as they appeared in Table 12, but restated as percentages of the total sample. It is possible that one or two people may have mentioned earthquake weather or unusual aches and pains, but the numbers were too few for separate coding. Nearly four fifths of the recognitions of unusual animal behavior appear to have

TABLE 22

SIGNS IN DAILY LIFE FOR PREDICTING EARTHQUAKES:

BELIEF AND PERCEPTION

Folk sign	Percent who believe in the sign	Percent who perceived the sign before the earthquake	Gave as reason for anticipating
Unusual animal behavior	68.4	6.5	1.4
Earthquake weather	43.4	7.5	--
Premonition, instinct, ESP	43.8	5.3	4.3
Unusual aches or pains	8.8	1.2	--
Other signs	2.9	.8	--
Base for percentages	509	509	509

been retrospective, as were all or nearly all of the references to earthquake weather. This finding underlines the nonspecificity of "unusual" animal behavior and earthquake weather. On the other hand, the number of spontaneous references to premonitions is rather close to the number given in answer to direct questioning. This observation lends itself to either a sympathetic or skeptical interpretation. The sympathetic interpretation would continue the logic applied to animal behavior and weather. While the latter apprehensions were mostly retrospective and therefore of no use in forecasting the earthquake, a number of people did genuinely experience premonitions and therefore anticipate the earthquake. The skeptical interpretation would be that it is easier to deceive oneself about a completely subjective experience such as a premonition than about the perception of an objectively observable and potentially verifiable phenomenon such as some specific animal behavior or weather pattern. The objective anchorage helped people keep what they recognized retrospectively separate from what they experienced before the event. Without objective anchorage the separation was lost in the case of premonitions.

It is also possible that believers in animal behavior and earthquake weather include more people who have some sophistication about science and logic and are therefore on guard against retrospective distortions than the believers in premonitions.

We have established that belief in folk signs can withstand failure to perceive such signs in advance of a single earthquake and that most of the recognition of folk signs, except possibly in case of premonitions, is retrospective rather than prospective. But we have not yet determined whether the net faith in folk signs was affected by the earthquake following the New Year's Day earthquake is in each case within one percentage point of what it was near the end of 1978. Plainly the earthquake had no effect on these

beliefs. An apparent drop of five percentage points in acceptance of unusual animal behavior as an earthquake sign does not reach the five percent confidence level and should be ascribed to chance fluctuation. Hence our conclusion must be that the belief in folk signs was not significantly affected by the earthquake, even though the overwhelming majority of believers failed to observe the folk signs, even retrospectively. In this respect folk signs and current scientific prediction capability are alike in remaining unaffected by failure to anticipate the earthquake on either grounds. Only the certainty of quite accurate eventual prediction by scientific methods has been brought into question as a consequence of reflection on this unpredicted earthquake.

Action and Action Orientations

Common sense provides contradictory hunches about the effects of a not-quite-damaging earthquake on personal preparedness and the demand for government action. On the one hand there might be a lulling effect. In this instance the reports of increased fear and concern render the reasoning that leads to this expectation implausible. On the other hand, if the earthquake is viewed as a near miss, it could alert people to the need for action. The nearby damaging Santa Barbara earthquake had little effect of this kind on our respondents, but personal experience may be more important than second hand experience, even if less intense. But our earlier finding that personal experience with earthquake loss but not mere experience with earthquakes affects action responses would call this expectation into question. Our evidence about response to the New Year's Day earthquake suggests increased fear and realism combined with greater uncertainty. Under various conditions this kind of response could lead to increased vigilance and demand for action or to despair concerning the possibility of effective action. The coupling of increased fear and a disposition

to view this earthquake as the precursor to a more disastrous quake with reduction in the prevalence of the view that the destructive quake will come within a year seems to fit better with the latter expectation. In that case we should hardly see a net increase in preparedness, and might even witness a decline in conviction concerning the utility of public hazard mitigation measures. It should be clear from these ramblings that we have no basis for advancing a firm statement of expectations concerning the effects of the New Year's Day earthquake on personal preparedness and support for public action.

Personal preparedness. On Thursday, January 18, 1979, the Los Angeles Herald Examiner published an editorial which read in part as follows:

> The New Year's Day earthquake--and subsequent aftershocks--prompts an editorial updating the advances in quake prediction--and damage-limitation--techniques.
>
> Needless to say, those techniques are far from precise. Scientists are learning about quakes, but their forecasting capabilities are still no more reliable than the president's economic forecasters. As a result of which, the pragmatists in our midst have flooded us with mail, wondering what to do when an earthquake strikes.

The balance of the editorial outlined the steps recommended by the U.S. Geological Survey, comparable to those included in our standard inventory question. If the flood of letters is indicative of a public mood, we should find evidence that the level of personal and household earthquake preparedness rose following the earthquake.

In order to sharpen the focus on the effect of the New Year's Day earthquake we revised the wording of the main question and of the responses from which respondents were to choose.

> I'm going to read you a list of preparation suggestions that have been made by various agencies and groups who are concerned with earthquake preparedness. As I read each of the following, please tell me if you had done any of these things in preparation before the recent earthquake, or whether you have done these things since the recent earthquake and in preparation for a future earthquake, or for some other reasons.

Respondents were asked to choose among the following answers: before the

earthquake and done in preparation for a future earthquake; before the earthquake but done for other reasons; since the earthquake in preparation for a future earthquake; since the earthquake but for other reasons; have no idea; have no plan to do so. In order not to complicate the choices unmanageably we omitted the explicit opportunity to say that measures not taken were still planned.

In Table 23 we report what respondents said they had done, but with response categories collapsed. Because very few people indicated any steps they had taken since the New Year's Day earthquake in preparation for a future earthquake, we have simply listed numbers rather than percentages of respondents giving this response. To facilitate interpretation, we have listed the measures in declining order with respect to the number of respondents who have taken them in preparation for a future earthquake, since the recent quake. Although the numbers are small and rank orders are subject to sampling fluctuations much greater than the differences observed, we can not overlook the fact that the three measures that are specifically concerned with family plans are in the first three positions. Although only about half the respondents live in households with children, the greatest number have responded to the earthquake by instructing children on what to do in an earthquake. Making family emergency procedures and plans for post-quake reunion come next in order. Although the more formal steps of attending neighborhood meetings and establishing neighborhood responsibility plans were not stimulated by the quake, there was some less formal exchange of information and advice among neighbors. Only one person was stirred to inquire about earthquake insurance and no one bought earthquake insurance because of the New Year's Day earthquake.

While very few people claim to have been stirred to action by the earthquake, we can still compare the state of preparedness as measured independently before and after the earthquake. These comparisons are presented in Table 24,

TABLE 23

PREPAREDNESS MEASURES TAKEN SINCE NEW YEAR'S DAY EARTHQUAKE

Preparedness measure	Number	Percent		
	Taken since earthquake for future earthquake	Taken before quake	Taken since quake	Not taken
Instruct children what to do in an earthquake	11	36.3	2.2	61.5
Family plans: emergency procedures at residence	9	34.4	2.2	63.4
Family plans for reunion after quake	8	13.3	2.0	84.7
Contact neighbors for information	7	8.4	2.0	89.6
Rearrange cupboard contents	6	14.1	1.4	84.5
Have working battery radio	4	66.8	2.4	30.8
Have working flashlight	3	83.9	2.0	14.1
Store water	3	15.7	.6	83.7
Store food	2	29.5	.4	70.1
Have first aid kit	2	67.2	1.0	31.8
Inquired about earthquake insurance	1	12.6	.2	87.2
Attended neighborhood meetings	1	1.6	.4	98.0
Replaced cupboard latches	0	10.4	.2	89.4
Set up neighborhood responsibility plans	0	4.1	.2	95.7
Structurally reinforced home	0	6.3	.2	93.5
Bought earthquake insurance	0	9.6	0	90.4

TABLE 24

PERSONAL AND HOUSEHOLD PREPAREDNESS MEASURES TAKEN

AT THREE PERIODS IN TIME

Preparedness measure	February 1977	Nov/Dec. 1978	January 1979
Have a working flashlight[a]	71.5	75.2	85.9
Have working battery radio[b]	54.6	58.9	69.2
Have first aid kit[c]	54.1	61.4	68.2
Store food	26.8	30.0	29.9
Store water	17.1	21.3	16.3
Rearrange cupboard contents	15.7	17.2	15.5
Replace cupboard latches	10.1	10.9	10.6
Inquired about earthquake insurance	13.8	14.7	12.8
Bought earthquake insurance	12.8	14.0	9.6
Structural reinforcement of home	11.0	14.7	6.5
Instruct children what to do during an earthquake	28.2	36.2	38.5
Make family plans for reunion after an earthquake	13.5	17.8	15.3
Family plans for emergency procedures at residence	24.8	34.0	36.6
Contact neighbors and friends for information and ideas	9.8	10.2	10.4
Set up neighborhood responsibility plans	4.0	4.0	4.3
Attend neighborhood meetings	1.7	2.0	2.0

a. Difference between Nov/Dec. 1978 and January 1979: Chi-square = 18.091, 1 d.f., $p < .001$.

b. Difference between Nov/Dec. 1978 and January 1979: Chi-square = 11.582, 1 d.f., $p < .001$.

c. Difference between Nov/Dec. 1978 and January 1979: Chi-square = 4.934, 1 d.f., $p < .05$.

with measures listed in our usual groupings. Of the sixteen measures, only three show significant changes since late 1978. In spite of the clear pattern in Table 23, the significant changes do not apply to any of the leading items there. The numbers claiming to have taken any of the measures in response to the New Year's Day quake are too small to contribute significant differences from prior rates. And it is possible that some of the people who instructed their children or made family plans had done so earlier, but did so again because of the quake. In the latter instance they would not have contributed to a net increase in frequency.

The three significant differences occur within a single cluster of measures. We have no ready explanation for the highly significant increase in the number of people who have working battery-operated radios and working flashlights, unless these are frequently given as Christmas gifts. The smaller and marginally significant increase in possession of a first aid kit hardly seems susceptible to the same explanation. Only three, four, and two people, respectively, claim to have taken these measures since the New Year's Day earthquake in preparation for a future earthquake. Regardless of the reason given, less than a quarter of the observed increase can be explained by the acquisition of these items since the New Year's Day earthquake. We can only assume that some extraneous event such as Christmas giving during the month of December has boosted public preparedness since the previous survey, unless we assume that <u>reporting</u> action rather than <u>actual</u> action was augmented by the earthquake. Removal of the face-saving opportunity to state than an action not yet taken was still planned might have spuriously augmented the positive answers. But if this were so, it should have applied to most of the measures and not just these three. Indeed, if shame over nonperformance were a factor, it should have applied more strongly to such items as instructing children and making family plans than to such value neutral items as having a

working flashlight. Hence we reject this explanation as implausible.

It is still plausible however, that reported possession of these items was up without a corresponding increase in actual possession. These are items that can be "around the house" without all members being aware of them. If the earthquake had stimulated some stock taking, someone might have rescued flashlights and radios from drawers and cupboards where they were half forgotten, and realized that the bandaids and other medical supplies in the bathroom cabinet constituted a minimal first aid kit. Other items would not be equally susceptible to discovery in the course of stock taking. If this interpretation is true, it would signal a genuine increment of preparedness triggered by the earthquake. Even though people had not newly acquired these items, by becoming aware of their availability in the household they were made ready to use them in an emergency. Either this explanation or the Christmas-gift explanation seems most plausible. We regret that it is not possible to choose between them.

Whichever explanation we prefer for the increased mention of flashlights, radios, and first aid kits, we must conclude that the New Year's Day earthquake had very little effect on personal and household preparedness in general. The quake affected how people felt about a more serious earthquake and changed their feelings about what to do if an earthquake were imminent. While the fear may have been translated into some limited stock taking concerning preparedness, it did not move people who had not done so to take hazard mitigating measures in preparation for an earthquake.

Disposition to move. Included in the background items for each survey was the question:

> Within the next 5 years how likely is it that you will move from (named community of residence) or beyond a three-mile radius from your present home?

TABLE 25

DISPOSITION TO MOVE FROM THE LOCAL COMMUNITY

AT THREE PERIODS OF TIME

Probability of moving	February 1977	Nov/Dec. 1978	January 1979
Definitely move	18.9	21.1	21.4
Probably move	25.9	28.5	24.3
Don't know	5.1	3.1	5.6
Probably not move	29.4	26.0	31.2
Definitely not move	20.7	21.3	17.5
Total	100.0	100.0	100.0
Total number	1450	550	519*

*The ten people who didn't know there had been an earthquake were asked all background questions, but have not been included in other tabulations in this chapter.

In the basic field survey we asked people who thought they might move why that was so, and counted the small number who mentioned the earthquake danger as a reason for moving. The followup question was not asked in the New Year's Day earthquake survey because of time limitations. But it is still worth noting whether there was any net increase in the number of people giving serious consideration to moving following the first substantial and county-wide earthquake in several years. From the percentages in Table 25 it is clear that the disposition to move has been remarkably stable throughout the study period. There are no differences among the three periods of time that even approach statistical significance.

Attitude toward government action. At various places in our total investigation we have been impressed with the tendency for people to look toward the government to deal with earthquake preparedness. Support for government action exceeds personal and household preparedness, at least at this verbal level. If the inertia or devaluation of personal preparedness renders it relatively insensitive to events, the reliance on government action might make it more sensitive to events. Whatever effect the New Year's Day earthquake had might be registered more clearly on attitudes toward government earthquake hazard mitigation measures than on personal preparedness.

Because of the known disposition of survey respondents to endorse government programs to solve problems, we called for "investing large amounts of money" into the respective government programs. Although it was not included in all surveys, the same question about four kinds of programs was included in the basic field survey, the late 1978 survey, and the New Year's Day earthquake survey. The results are presented in Table 26. Measures are arranged in descending order of popularity. This order of preference remains constant for three periods of time. The two building safety measures are always more popular than the two having to do with prediction and warning. Enforcing building safety codes

TABLE 26

SUPPORT FOR GOVERNMENT SPENDING FOR EARTHQUAKE HAZARD MITIGATION AT THREE PERIODS OF TIME

Measure and importance	February 1977	Nov/Dec. 1978	January 1979
Enforce building safety codes			
Very important	64.5	64.0	44.6
Important	26.2	23.6	33.0
Somewhat important	5.0	6.7	11.6
Don't know	1.3	1.8	2.2
Not very important	1.7	2.4	3.5
Not important at all	1.3	1.5	5.1
Total	100.0	100.0	100.0
Loans to rebuild unsafe structures			
Very important	48.4	42.9	33.8
Important	32.4	29.5	39.3
Somewhat important	8.7	12.9	13.0
Don't know	2.3	2.7	3.5
Not very important	3.9	6.7	3.7
Not important at all	4.3	5.3	6.7
Total	100.0	100.0	100.0
New systems for issuing earthquake predictions			
Very important	27.7	27.8	24.4
Important	37.3	35.3	32.6
Somewhat important	16.4	18.2	16.5
Don't know	3.3	3.8	4.7
Not very important	9.1	9.6	12.6
Not important at all	6.2	5.3	9.2
Total	100.0	100.0	100.0
Prediction studies			
Very important	26.1	25.6	21.4
Important	32.2	23.3	28.5
Somewhat important	20.4	28.7	22.4
Don't know	1.8	1.3	3.7
Not very important	9.8	13.1	12.8
Not important at all	9.7	8.0	11.2
Total	100.0	100.0	100.0
Total number	1450	550	509

is viewed more favorably than making loans for strengthening buildings, and devising better systems for releasing warnings and predictions is preferred to prediction studies. But in all instances the balance is much more favorable than unfavorable.

The significance of each change has been tested by dichotomizing the distribution at the point that most nearly creates equal parts above and below the division. Between late 1978 and early 1979 there is quite a substantial drop from 64.0 percent to 44.6 percent in the proportion of respondents who say it is very important to spend large amounts of money on enforcement of building safety codes and building repairs (Chi-square = 39.380, 1 d.f., $p < .001$). The reduction from 42.9 to 33.8 percent who say spending on loans to rebuild or reinforce unsafe structures before an earthquake is very important is less substantial but still significant (Chi-square = 8.898, 1 d.f., $p < .01$). It is less clear whether support for the two kinds of measures involving prediction has also declined. A small decrease in the number who say that investing money for establishing new systems for issuing scientific earthquake predictions is important or very important from 63.1 to 57.0 percent is marginally significant (Chi-square = 3.875, 1 d.f., $p < .05$). And a trivial increase from 48.9 to 49.9 percent who find investment for prediction studies important or very important is clearly not statistically significant.

The phenomenon here resembles that of the difference between faith in current and eventual scientific earthquake prediction capability, namely that as views approach consensus they are more susceptible to disaffection on the basis of a disruptive event. Those who endorsed prediction studies were already a selected group and their convictions were not likely to be shaken by an event of less than crisis proportions. But there may have been a band wagon effect in the high rate of support for building code enforcement as an earthquake mitigation measure which was undermined in some fashion by the earthquake.

Conclusions. Although the New Year's Day earthquake was taken very much in stride and was not experienced with as much fear as people ascribe to past earthquake experiences or express over the prospect of a future damaging earthquake, it aroused considerable interest in the quake itself and its possible significance in relation to the anticipation of a more destructive quake in the near future. And it had an unsettling effect on several fairly well established attitudes about earthquake matters. The quake apparently undermined certainty about the significance of the southern California Uplift as an earthquake precursor, the eventual accuracy with which scientists will be able to predict earthquakes, and the value of the most popular earthquake hazard mitigation measures by government agencies. Fear of a future destructive was intensified as was the disposition to see a damaging earthquake as a crisis event, even though confidence that the predicted destructive earthquake would come within a year declined. Altogether the evidence fairly comprehensively refutes the lull hypothesis--that an earthquake of near-miss intensity lulls people into a false sense of security. At most the effect on personal and household preparedness was limited to some stock-taking with trivial numbers of people reassessing family plans for coping with an earthquake. An unsettling effect rather than either a lulling or heightened-vigilance effect seems to describe the consequences of the New Year's Day earthquake most comprehensively. The unpredicted near-miss wakened many people to the realization that a severe earthquake could not be treated as a normal occurrence and that accepted views about earthquake prediction and mitigation were uncertain. Since the quake was not a fearsome experience for most people, the increased fear of future quakes was probably an indirect effect, brought on by the reflection and uncertainty provoked by the earthquake.

Although we cannot rule out alternative interpretations, the data suggest the possibility that even the weak crisis atmosphere provoked by this

earthquake may have produced some closing of ranks, some subjective movement in the direction of community solidarity. The significant reduction in suspicion that scientists and officials were withholding predictive information before the earthquake is a surprising finding susceptible to this interpretation. Since the quake was overwhelmingly recognized as not having been predicted, while there was no reduction in the extent of belief in current earthquake prediction capability, there is justification for treating incipient solidarity as one plausible but unconfirmed interpretation of the data.

In the course of the analysis, at least four other findings emerged, mostly lending confirmation to findings already derived from other evidence in the course of this investigation. First, the tendency to personalize understanding remarked earlier was noted again. Although the total numbers were small, more people claimed to have had a personal idea that the earthquake was coming before it happened than claimed that the quake had been predicted. Second, there was widespread public concern over the meaning of the quake in relation to the prospect of future earthquakes in southern California. In the absence of authoritative attention to this question through the media, people turned to rumor as the prime source for ideas to be used to interpret the earthquake. Third, exposure to contradictory interpretations of the earthquake's meaning did not foster skepticism toward all interpretations, and may actually have augmented the disposition to treat alternative interpretations with an open mind.

Finally, a new observation of great importance emerged unexpectedly in the course of analysis. When people explained why they did not consider that this was an earthquake that had been predicted, it became clear that many if not most people were implicitly treating the near predictions, forecasts, and cautions they remembered as preliminary announcements. They assumed that these announcements were intended to alert them to be listening for short-term

warnings that would be forthcoming when the time for action was at hand. This assumption would explain much inaction. And since scientists and government officials do not generally make any such assumption, this finding exposes an important realm of miscommunication and misunderstanding between authorities and the public.

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CHAPTER FIVE

THE FALSE ALARM EFFECT OF NEAR PREDICTIONS

A reason often given for delaying the release of earthquake predictions and near predictions is the prospect of a false-alarm or cry-wolf effect. The assumption is that like the peasants who came to help the boy who cried wolf, people will no longer respond to warnings of earthquakes or other disasters if warnings have been issued once or twice with no ensuing catastrophe. The cry-wolf effect is taken for granted to such an extent that policy debates typically weigh disillusionment as an assumed cost in assessing the benefit/cost ratio from issuing a warning, rather than questioning whether the effect will actually occur. The purpose of this chapter is to follow-up the brief comments in Chapter Three with a more comprehensive assessment of the hypothesized false-alarm effect.

Although we cannot test the effects of a single dramatic false alarm with the present data, we can test the effects of what may be a slowly developing false alarm. The year 1976 in southern California was a year marked by unusual media attention to the earthquake danger. News media reported an exceptional number of disastrous earthquakes, of which the quakes in the People's Republic of China, Guatemala, and northern Italy attracted the most attention. Against this background, there were three unprecedented instances of earthquake prediction and near prediction. Announcement of the southern California Uplift in February, James Whitcomb's "hypothesis test" in April, and extensive media attention to the short term prediction by pseudo-geophysicist Henry Minturn in November and December constituted three distinct

earthquake alarms. But 1977 and 1978 were relatively quiet years so far as disastrous earthquakes are concerned. In December, 1976, Whitcomb withdrew his near prediction that an earthquake would occur by April, 1977. Minturn's prediction was disconfirmed when December 20, 1976, came and went without a significant earthquake in Los Angeles. No new predictions or near predictions of moment were issued in 1977 and 1978. Only the southern California Uplift remained as a threat, with periodic reassessments of its extent and significance to remind the public of its existence and potential. As the months passed without a significant earthquake in the Los Angeles area, the 1976 alarms might have progressively taken on the character of false alarms or at least premature alarms. We shall examine more closely than in Chapter Three the applicability of the concept of a slowly developing false alarm to the shifts in public confidence from February, 1977, to November and December of 1978.

An irregular panel design was employed in gathering data on change and stability. Besides the one new sample of 500 adults in each wave, reinterviews were conducted with a subsample from the initial group in the second and fourth followups, and with a second subsample from the initial group in the first followup. In addition there were reinterviews during the second followup wave with the new sample from the first followup. With these data we can not only observe the trends in replies to a set of questions that were included in each wave of interviews, but we can compare people who changed with people who did not change on the basis of information secured in the initial interviews. This chapter will be devoted principally to the latter type of analysis, identifying the kinds of people whose responses were most likely to have changed.

If we are to test for slowly developing false alarm effects, we must first demonstrate that there were initial expectations that could be progressively disconfirmed by events. If the alarm was not taken seriously in the first place, there would be no meaningful test of a false alarm effect. It is worth repeating here the critical question, which will also be a major dependent variable, that was asked in the initial survey and repeated in all followup intervals.

> Looking ahead, how likely do you think it is that there will be a damaging earthquake in southern California within the next twelve months? Do you think there will: Definitely be a damaging earthquake within the next year, Probably be a damaging earthquake within the next year, Probably not be a damaging earthquake within the next year, or Definitely not be a damaging earthquake within the next year?

A total of 43.4 percent of the sample said there either definitely or probably would be an earthquake during the next year. These people registered a sufficiently definite expectation to have experienced disconfirmation by February or March of 1978, and to have experienced non-continuous months of disconfirmation by the time of our final wave in November and December of 1978. Many of this 43 percent may have expected the earthquake in less than a year, and may have been anticipating the event since February, 1976, or more likely April, when the media first took the threat seriously. For these people the near predictions could have turned into false alarms as early as during the interval between the basic field survey and the first follow-up wave in late summer of 1977.

Theories and Hypotheses

The assumption that the extended period of unfulfilled expectation should lead to disillusionment and other false-alarm effects accords well with common sense. But a closer examination requires that we specify more clearly the reasons for anticipating or not anticipating a false-alarm effect.

In the course of specifying the reasons, we should also establish the basis for a series of hypotheses concerning differential susceptability to false-alarm effects. The peasants in the folk tale exhibited consensus in disregarding the shepherd boy's third plea for help. In real life we suppose that some peasants would have disregarded the second call while others would still have responded to a third or even fourth call.

Nonsupporting analogies. There are several partially analogous situations in which the commonsense false-alarm effect does not prevail. There is an imperfect analogy to the practice of evacuating buildings in response to telephoned bomb threats. Hundreds if not thousands of buildings have been evacuated in the United States in recent years, though only a trivial fraction of the threats have been shown to have any foundation. Yet we continue to evacuate. Because of legal and political liability in case a valid threat should be ignored, building owners have an added incentive to proceed with evacuation. Furthermore, in a few dramatic instances buildings have been bombed. Nevertheless, evacuation is often costly and at least inconvenient, and the extent to which people accept the necessity to cooperate is difficult to reconcile with a hypothesized false-alarm effect.

In the Port Jervis study (Danzig, Thayer, and Galanter, 1958), rumors that the dam above the city had broken were rife for some time without people acting on them. These first rumors had clearly been disconfirmed by the lapse of time. But when a fireman travelled through town spreading the rumor anew there was widespread evacuation. Rather than disillusioning people, the earlier disconfirmed warnings may have heightened the readiness for eventual response. They clearly must not have lessened readiness to accept what people mistook for an official warning.

In cities subjected to wartime bombing people return to dangerous locations and assume a superficially casual attitude toward the threat following a succession of near-miss experiences. But they have typically acquired semi-automatic adaptive responses that enable them to respond effectively when the danger is unusually great (MacCurdy, 1943). In this and other instances the false alarm or near miss may provide the occasion for perfecting and routinizing response rather than leading to disillusionment.

There are many imperfections in the analogies we have cited. But the examples serve to indicate that the assumption of a false-alarm effect cannot be taken for granted on empirical grounds. More direct evidence comes from a Japanese study (Institute for Future Technology, 1978), conducted after warnings about possible aftershocks to the January 14, 1978 Izu earthquake had given rise to exaggerated rumors. Even though the rumors caused unnecessary anxiety and were subsequently disconfirmed, most people were positive toward publicizing predictions in the future.

Theories of the false alarm. The most powerful theoretical ground for belief in a false alarm-disillusionment effect is reinforcement theory from psychology. Nevertheless, it is not entirely clear that one would predict disillusionment on the basis of reinforcement theory after only one or two earthquake predictions had been disconfirmed. Strong reinforcements are built up by a pattern of irregular reinforcement in which not all relevant instances are positively reinforced, and learning based in irregular reinforcement is more difficult to extinguish than learning based on consistent reinforcement. It is also not clear whether reinforcement theory is applicable at all to the earthquake prediction situation. Reinforcement theory generally assumes repeated reinforcement and repeated confirmation or disconfirmation. The small number of critical events in the earthquake prediction scenario

hardly seem to qualify.

An examination of the traditional folk tale suggests that a crucial element is missing when false-alarm effect is equated with cry-wolf effect. In the folk tale there were not only no wolves when the boy cried out, but the boy knew that there were no wolves. The tale is not primarily a story of alarms that were disconfirmed, but a story of deliberate deception in issuing an alarm. If the folk tale is a repository of accumulated folk wisdom, then trust or mistrust of the motives of the person who signals the alarm is the critical variable in determining whether disillusionment occurs or not.

There are at least three types of theory that lead to a prediction of no disillusionment in case of just one or two false alarms. The first we shall call value immunization theory. In Los Angeles, after Henry Minturn had been exposed as a pretender to scientific credentials and the date of his predicted quake (December 20, 1976) had passed uneventfully, there were some newspaper items criticizing scientists for attacking Minturn on the ground that it is better to be forewarned and prepared than to be unprepared, even if there is no quake. The same attitude often protects vigilantes whose victims are found to be innocent. A deep moral conviction that the aims are morally righteous immunizes the actor from negative evaluation in case the results of the action are not as anticipated. We might call this a moralistic anti-pragmatism. The tenet is that it is always good to do a good thing, no matter whether the effect is good at the time or not. If this theory is correct and applicable, a strong belief in the importance and merit of earthquake preparedness would neutralize the false-alarm effect.

A second type of theory, and the one we take most seriously, can be called sensitization and rehearsal theory. Beliefs and behavior patterns are learned gradually rather than instantaneously. The first reaction to

hearing a certain type of alarm is incomplete assimilation, failure to comprehend its full significance, and a tendency to treat it as information of only tangential importance. Full assimilation and learning is facilitated by an opportunity to reflect on the new information and its significance, an opportunity to act on the new information so that it becomes tangible rather than abstract, and an incentive to act and reflect on the possibility of "what if it happened and we hadn't acted?" According to this approach, the false alarm that is taken seriously makes the danger real for the first time so that quicker and more automatic response is possible next time. Also, a critical obstacle to responding to any new threat is uncertainty over what to do and how to do it. The rehearsal, like a drill under realistic conditions, helps to answer these questions and reduce the seriousness of the obstacles to action.

A third theory is relative gratification. For persons who greatly fear danger, failure of the danger to materialize is sufficient relative gratification to counterbalance the costs including wasted adaptive behavior and unproductive anxiety. For example, after southern California brush fires, survivors who lose their homes are often quoted as saying that since they and their families got out alive, the loss of the house is minor by comparison to this blessing.

While each of these theories has been noted only superficially, and each would lead to a somewhat different predicted effect in the earthquake situation, there are sufficient grounds here for careful attempts to establish whether there is or is not a false-alarm effect under various conditions, and to ferret out the mechanisms that account for whatever effect is observed.

Hypotheses of differential response: predisposing conditions. Drawing upon the foregoing theories and analogies and other sources, we have formulated a series of hypotheses concerning differential susceptibility fo a false-alarm

effect. Not all can be tested using our data. But they are listed in the interest of stimulating further thought and research on this important question. Two sets of hypotheses concerning the mechanisms in change will be examined. The first set identifies predisposing conditions, on the assumption that people vary in their predisposition to change when subjected to a common change-disposing experience. The second set identifies the causally effective aspects of experience that might precipitate the observed changes.

Predisposing conditions: a.) People who distrust the source or agency of the warning are especially likely to experience disillusionment in the event of a false alarm. This hypothesis is inspired by analysis of the cry-wolf tale, with the obvious insincerity of the boy who cried wolf. A question in the initial survey on whether scientists and public officials are holding back information and whether they are doing so out of self-interest is our indicator of trust and distrust.

b.) People who initially hold very strong beliefs in the rightness and importance of earthquake preparedness are less likely than people who do not share such convictions to experience disillusionment in the event of a false alarm. This hypothesis is based on the value immunization theory discussed previously. Questions in the initial survey dealing with the importance of government preparedness and altruistic concern for classes of potential earthquake victims could provide a basis for testing this hypothesis.

c.) People who fear earthquakes intensely are less likely than other people to experience disillusionment in the event of a false alarm. This hypothesis is based on the relative gratification theory, also discussed earlier. The index of fear based on answers to the three questions on fear and concern will be used in testing this hypothesis.

d.) People who are initially ambivalent about the warning are more likely to experience disillusionment in the event of a false alarm than people who are firmly convinced. The assumption here is not merely that people with initially strong convictions will continue to believe in the warning, though with possibly lessened conviction, but that they will retain their strong convictions. This hypothesis applies a widely held theory that firmly held beliefs and attitudes are more stable than weakly held beliefs and attitudes. An example of its use is the hypothesis that defectors from social movements are most often adherents who were initially only half convinced of the value of the movement cause (Toch, 1965).

Consideration of this fourth hypothesis underlines the observation that one can approach the false alarm problem as a distinctive phenomenon or as an instance of the more general problem of the stability of attitudes and beliefs. The first three hypotheses were derived from the more specific consideration of response to disconfirmation of an alarm, though the reasoning can be restated in more general terms. The fourth hypothesis, however, is clearly based on a more general consideration of the conditions that contribute to stability and instability of a wide range of beliefs, of which accepting a warning is only one. The remainder of the hypotheses are similarly derived from broader theories, deemphasizing the distinctiveness of the false alarm effect.

e). People with less prior earthquake experience are more likely to experience dissillusionment in the event of a false alarm than people with more experience. The assumption is that prior experience with earthquakes leads people to form relatively stable expectations that are not easily upset by a single disconfirmation, while people without experience have no such stable anchorage for their convictions. The battery of earthquake-experience

questions, combined into several indices of experience, provides the means for testing this hypothesis.

This hypothesis may be inapplicable to the current data and the situation from which they were drawn. Experience with earthquakes is different from experience with predictions and warnings of earthquakes to come. The latter type of experience would be most relevant to the hypothesis since it is belief in earthquake prediction rather than in the eventual occurrence of an earthquake that is at issue. But no one has had the opportunity to gain experience with scientifically-based predictions because none has been publicly released in the United States. All that we can test is the weaker hypothesis that experience with earthquakes contributes to the stabilization of beliefs and attitudes concerning earthquakes and that this effect is generalized to the unfamiliar topic of earthquake prediction and warnings.

f.) People who are less informed about earthquakes are more likely to experience disillusionment in the event of a false alarm than people who are better informed. The rationale is similar to the argument for the preceding hypothesis. Questions that assess people's awareness of the earthquake prospect can be used in testing this hypothesis. Again, information about earthquake prediction would provide a more decisive test than information about earthquakes in general.

g.) People who are dependent primarily on word of mouth for their information and attitudes are more likely to experience disillusionment in the event of a false alarm than people who rely more on public or formal media sources. The assumption here is that with relatively responsible and professional control of the media, rumor is more likely to spread by word of mouth than through the media. Hence, word of mouth is likely to be more volatile and responsive to such events as disconfirmation. Questions on the chief source of information about earthquake predictions and near predictions were

included in the initial survey, and people can be classified and ranked according to the relative importance of word of mouth and other information sources.

h.) People with low commitment to the local community are more likely to experience disillusionment in the event of a false alarm than people with stronger commitment. The assumption here is that community involvement and commitment are stabilizing forces, dampening what might otherwise be wide swings of opinion concerning the future of life in the local community. The index of community involvement was computed from six items of information secured in the initial interviews.

Hypotheses of differential response: causally effective aspects of experience. If there is a general decline in belief in the prospect of an earthquake or in earthquake prediction as the result of a slowly developing false alarm, or if there are substantial numbers of individuals who exhibit such declines, it is still necessary to identify the causally effective aspects of the false-alarm experience. Each of the following hypotheses specifies one of the potentially causally effective aspects. Although the question in each instance concerns the mechanism of change, the hypotheses must be formulated with reference to individuals. The assumption in each case is that we can distinguish between persons who are subject to the mechanism in question and persons who are not, and that change will occur among the former more often than among the latter.

The hypotheses divide first of all into two groups. On the one hand it may be the personal awareness that a prediction or warning has been disconfirmed that leads to disillusionment. Not everyone may have realized that a disconfirmation has taken place, or gained a clear understanding of a specific instance of disconfirmation. Hypotheses i, j, and k apply this premise.

On the other hand, the loss of conviction may come from the fact that less is being said and heard about the prospect of a damaging earthquake than previously. Hypotheses l and m incorporate this premise. Under the first premise, the false alarm effect may be produced by a single event that dramatically and decisively disconfirms the alarm. On the other hand, also under the first premise, the false alarm effect may be produced by a sort of creeping disconfirmation. Hypotheses i and j incorporate the former assumption and hypothesis k incorporates the latter.

i). People who remember that James Whitcomb made and later withdrew a near prediction in 1976 are more likely to have experienced disillusionment than people who do not remember that this happened.

j.) People who remember that Henry Minturn made a prediction that was disconfirmed by failure of the quake to occur when predicted are more likely to have experienced disillusionment than people who do not remember this sequence. Two questions were included in the final wave interviews for the specific purpose of testing these two hypotheses. Each question asks if people remember one of these kinds of happenings, and determines whether they remember anything of the associated events.

k.) People who have changed their views about the Uplift over an extended period of time are more likely to have experienced disillusionment. With appropriate controls and cautions, the question of subjective change mentioned earlier can be used in testing this hypothesis.

l.) People who sense that media coverage of the possibility of a damaging earthquake in southern California has declined are more likely to have experienced disillusionment.

m). People who sense that word-of-mouth discussion of the possibility of a damaging earthquake in southern California has declined are more likely

to have experienced disillusionment. As before, these questions distinguish reliance on formal media from reliance on word of mouth. Two questions in the final wave interview ask specifically whether media coverage and talk with family and friends, respectively, has been more, less, or the same as formerly.

Findings

A conclusive test of hypotheses concerning a false-alarm effect would require the issuance of two or more alarms of equal intensity and potential credibility, at separate intervals of time, and under conditions that were otherwise equivalent. It would be necessary to measure response to each of the alarms for quantitative, and possibly qualitative, comparison. We cannot satisfy the first set of conditions adequately, but we can use our content analysis of media attention to earthquake topics to assess impressionistically the intensity of the notices and the comparability of circumstances. We do not have data indicating response to the original warning announcements in 1976, but we can observe the trend of responses for nearly two years beginning one year after the first announcement. The concept of the slowly developing false alarm provides whatever justification there is for this procedure.

The conditions for a slowly developing false alarm appear to have been present--announcement of the Uplift, coupled by repeated declarations that Los Angeles County was overdue for a great earthquake and reports on the rapidly developing scientific earthquake prediction capability, leading nearly half the population to expect a damaging earthquake within a year, followed by an extended period of seismic inactivity.

Trends for several variables over the two-year period, using only the samples of new subjects each time, were examined in Chapter Three in order to judge whether the anticipated false-alarm effect occurred. Substantial

declines were observed between early 1977 and mid 1977 in the expectation of a damaging earthquake within a year, in expressed fear and concern over a future damaging earthquake, in reporting a recent increase in concern over the earthquake prospect, and in willingness to have uncertain predictions released to the public. For the remaining year and a half, including the period during which the one-year expectation would have been objectively disconfirmed, these variables remained relatively stable. In the separate survey conducted directly after a moderate earthquake (magnitude 4.6) struck the area on New Year's Day, 1979, reports of increased recent concern rose again significantly, but not to the original level. Trends in personal and household preparedness for the 21 months were ambiguous, but there appears to have been a spurt followed by an offsetting decline and only minor fluctuations thereafter. Other variables underwent no significant change during the two-year period. These included the measure of awareness and appreciation of the Uplift, and belief that scientists and public officials were withholding information from the public. Two variables exhibited changed in directions opposite to what might be expected in case of a false alarm. Estimates of the accuracy with which scientists can predict earthquakes at present increased significantly between early and mid 1977 and possibly again between early and late 1978. Faith in the eventual accuracy of scientific earthquake prediction suffered a significant setback to the early 1977 level immediately after the unpredicted New Year's Day earthquake of 1979, but not during the slowly developing false alarm period.

These findings hardly constitute consistent evidence for a slowly developing false alarm effect. The reverse pattern for faith in scientific earthquake prediction is difficult to reconcile with the anticipated false alarm effect, especially since it was at least partially responsive to scien-

tists' failure to predict a moderate earthquake. Most of the variables that do conform to expectation show an early short-term drop rather than the anticipated long-term or delayed decline. Hence our preliminary doubts about the certainty of a false alarm or cry-wolf effect in case of an unconfirmed or disconfirmed earthquake warning are reinforced. Nevertheless, some individuals may have experienced the events as a false alarm, even though the pattern was not prevalent. Two of the variables for which change occurred in the predicted direction merit closer examination. Since level of fear is an important independent variable in the analysis, we shall not complicate matters by treating it also as a dependent variable.

The wording for the question on earthquake expectation has already been presented. Beside the significant drop in expectation between early and mid 1977, followed by fluctuation around a horizontal trend line, this variable exhibited another kind of change. The number of people saying they didn't know whether a damaging earthquake was likely or not followed an ascending trend line throughout the two years. "Don't know" responses increased significantly between early and mid 1977 and again from early to mid 1978. Perhaps the more authentic false alarm effect is continuously spreading uncertainty rather than outright reversal from belief to disbelief.

Complementing the question on expectation was the question dealing with affect.

> During the past year would you say your concern about a damaging earthquake striking southern California has: Increased, Decreased, or Remained about the same?

In order to broaden the basis for the analysis, we included awareness of the Uplift and the index of personal and household preparedness, even though they did not exhibit false-alarm effects in the aggregate.

Predisposing conditions. For testing the specific hypotheses about susceptibility to false alarm effects, we used a sample consisting of 425 subjects who were first interviewed in early 1977 and reinterviewed in mid 1977, and repeated the test on a second subsample from the early 1977 survey, who were reinterviewed in January, 1978. The general procedure followed was to divide the sample into two subsamples according to subjects' replies at time one on the independent variable, and then compare the two subsamples for the amount and direction of change in the dependent variable between time one and time two. The procedure for operationalizing the first hypothesis can serve as an example. "People who distrust the source or agency of the warning are more likely to experience disillusionment in the event of a false alarm." Respondents were divided into high trust and low trust subsamples, according to whether they felt scientists and officials were withholding information from the public when first interviewed in early 1977. Within each subsample we recorded the distribution of people whose expectation for a damaging earthquake within a year increased, was unchanged, and decreased. The hypothesis would be confirmed if significantly more respondents reported reduced expectations of an earthquake among the low trust subsample than among the high trust subsample.

A second procedure was also followed, incorporating a slightly different assumption. The first procedure rests on the assumption that false alarm effects should be produced among respondents who were initially skeptical by increased skepticism concerning the likelihood of an earthquake, as well as among those who initially expected an earthquake. The second procedure rests on the assumption that only respondents who initially accepted the earthquake prospect should exhibit false-alarm-induced disillusionment. The second procedure can be illustrated using the same hypothesis. The high trust and

low trust subsamples were reduced in numbers to include only respondents who said there definitely or probably would be an earthquake at time one. We then compared the percent in each reduced subsample who still expected an earthquake at time two. The hypothesis would be confirmed if significantly more respondents still expected an earthquake at time two among the high trust subsample than among the low trust subsample.

Not all the hypotheses were suitably operationalized, but we have used seven variables to test several of them. The six-item index of favorability toward science and the question whether public officials and scientists are telling the public all they know about earthquake predictions are both relevant to trust, as used in hypothesis a. The index of favorability toward public release of earthquake predictions, the index of earthquake fatalism, and again the index of favorability toward science assess the positive importance of earthquake prediction, as incorporated in hypothesis b. The three-item index of fear and concern corresponds well with the independent variable of earthquake fear in hypothesis c. The index of earthquake experience is appropriate for hypothesis e, and the index of community attachment for hypothesis h.

The first procedure for testing the hypotheses is illustrated in Table 1, using the independent variable of favorability toward science. The four sets of responses listed in the left margin were cross tabulated between time one and time two. Each cell in the cross tabulation constitutes an increase, decrease, or lack of change from time one to time two. These cross tabulations were made separately for respondents with more and less favorable attitudes toward science. If the hypothesis is correct, there should be substantially less decrease in recently changed concern, in earthquake expectation, in awareness of the Uplift, and in earthquake preparedness among respondents who

TABLE 1

CHANGED EARTHQUAKE RESPONSE BY INITIAL FAVORABILITY TOWARD SCIENCE

Response and direction of change	February to August 1977		February 1977 to January 1978	
	Favorability toward science		Favorability toward science	
	Low	High	Low	High
Changed concern:				
Increased	7.5	7.9	7.6	11.2
Unchanged	64.6	65.5	60.5	55.9
Decreased	27.9	26.6	31.9	32.9
Total	100.0	100.0	100.0	100.0
Total number	147	267	157	286
Earthquake expectation:				
Increased	19.7	21.5	22.1	19.4
Unchanged	51.4	52.5	46.1	54.1
Decreased	28.9	26.0	31.8	26.5
Total	100.0	100.0	100.0	100.0
Total number	142	265	154	283
Awareness of the Uplift:				
Increased	29.7	27.0	38.0	28.0
Unchanged	42.6	46.4	44.3	49.8
Decreased	27.7	26.6	17.7	22.2
Total	100.0	100.0	100.0	100.0
Total number	148	267	158	289
Earthquake preparedness:				
Increased	36.5	41.6	50.0	39.8
Unchanged	50.0	47.9	37.3	43.9
Decreased	13.5	10.5	12.7	16.3
Total	100.0	100.0	100.0	100.0
Total number	148	267	158	289

were initially "high" in favorability toward science than among respondents who were "low." The observed differences are trivial, far short of statistical significance, and inconsistent in direction. The null hypothesis cannot be rejected and the relevant false-alarm hypothesis is not supported.

Findings for five of the remaining six independent variables are similar to those in Table 1, so we will not take up space in this report by reproducing all of the tables. None of the false-alarm hypotheses that we were able to test was confirmed by the data. The second procedure was also applied to the seven variables, and again produced no consistent or statistically significant confirmation for the hypotheses.

The only significant relationships yielded by this entire set of tabulations relate the earthquake fear index as an independent variable to change in the perception of personally changed concern over the prospect of an earthquake (Table 2). The relationships for both intervals of time are highly significant (Chi-square = 15.715, 2 d.f., $p < .001$, February to August, 1977; Chi-square = 34.005, 2 d.f., $p < .001$, February, 1977, to January, 1978). But the relationships are not in the predicted direction. They support, rather, a hypothesis that a high fear condition is less attainable than a low fear condition, more subject to both perceived increase and perceived decrease during an interval of five to eleven months. There is no comparable evidence of instability with respect to earthquake expectation, awareness of the Uplift, or earthquake preparedness. So the finding has rather limited relevance for the broader assessment of a false-alarm effect.

One explanation for the negative findings could be that the indicators are inappropriate or insufficient. This seems unlikely, however, since all the items and indexes have been used with meaningful results in other analyses. A second explanation could be that the indicators, while generally valid, are

TABLE 2

CHANGED PERCEPTIONS OF CHANGED EARTHQUAKE CONCERN BY INITIAL LEVEL OF EARTHQUAKE FEAR

Perception of changed earthquake concern	February to August 1977		February 1977 to January 1978	
	Earthquake fear		Earthquake fear	
	Low	High	Low	High
Increased	5.1	10.6	7.4	12.9
Unchanged	72.9	55.0	70.0	41.9
Decreased	22.0	34.4	22.6	45.2
Total	100.0	100.0	100.0	100.0
Total number	236	189	270	186

not the appropriate operationalizations for the variables in the hypotheses. For example, if people believe that information should be withheld from the public for their own good, believing that information is being withheld would not necessarily indicate distrust. But most of the indicators appear to be plausible expressions of the variables in question. A third explanation could be that the reasoning behind the hypotheses is faulty. This is likely to be so in specific instances, such as the possibility that high fear is conducive to instability of perceived affect and possibly to anxious denial, rather than the hypothesis originally proposed. However, it also seems unlikely that the reasoning has been so consistently erroneous as to account for the complete range of negative findings. Finally, the negative findings might be explained on the basis that no false-alarm effect has actually taken place here, so the changes in expectation and perceived concern reflect other processes. In light of the massive disconfirmation of all hypotheses, and the serious questions already raised about a false alarm effect, this explanation is tentatively accepted as the most credible.

Causally effective aspects of experience. Hypotheses in the second set depend on correlative changes during the interval under investigation rather than attitudes and characteristics at the start of the interval. In the final survey respondents were asked the following set of questions:

> During the past year or two, do you happen to remember hearing about an earthquake prediction for the Los Angeles area which was later withdrawn?
>
> During the past year or two, do you happen to remember hearing about an earthquake prediction in the Los Angeles area that didn't happen?
>
> Now, a question about television, radio, and newspaper coverage. Compared to a year or two ago, do you think there has been more, less or about the same amount of coverage on the possibility of a damaging earthquake striking southern California?

> Now, let me ask you a question about topics of conversation among you, your family, friends, or co-workers. Compared to a year or two ago, had there been more, less, or about the same amount of discussion (among you, your family, friends, or co-workers) concerning the possibility of a damaging earthquake striking southern California?

The general response to these four questions was reviewed in Chapter Two. Answers to the first two questions referred to scattered and vague announcements, so it was decided to combine responses to the two questions. Thus we compared respondents who remembered either a disconfirmed or withdrawn prediction with respondents who did not remember either. Because the majority thought media coverage had declined and informal discussion had declined, in each instance we compared respondents who reported a decline with all others. The procedure followed in testing hypotheses is similar to that employed in Table 1.

Seven response variables have been included in the accompanying tables. The fear index and the view of scientists and officials as withholding or releasing all information did not vary between the first and last survey within the respective independent variable categories, so no further analysis of these as response variables was carried out. The hypothesis is tested in each instance by comparing the last two columns of Table 3. For convenience in reading the tables, categories have been arranged so that the hypothesis is confirmed if the percentages at the top of the distribution are larger (more positive, less negative) in the right-hand column and percentages at the bottom of the distribution are larger in the left-hand column. Each hypothesis will be stated in words, and the findings discussed, based on comparison between the February, 1977, and November/December, 1978, surveys. We have not subjected the differences to test of statistical significance, and it will soon be obvious that few would qualify as significant. The strategy is rather to look for consistent differences in hypothesized directions.

TABLE 3

CHANGED RESPONSE BY PERCEIVED CHANGE IN MEDIA COVERAGE OF EARTHQUAKE TOPICS: FEBRUARY, 1977, TO NOVEMBER/DECEMBER, 1978

Type of response	Media coverage is: less or dk		Media coverage is: same or more		Change when media cov. is:	
	Feb. 1977	N/D 1978	Feb. 1977	N/D 1978	Less, dk	Same, more
Changed concern:						
Increased	33.6	13.8	29.3	19.5	-19.8	- 9.8
Same, don't know	62.6	76.3	67.0	76.3	+13.7	+ 9.3
Decreased	3.8	9.9	3.7	4.2	+ 6.1	+ .5
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	131	131	215	215		
Earthquake expectation:						
Will be	45.8	37.2	39.5	36.3	- 8.6	- 3.2
Don't know	5.4	10.1	5.6	6.5	+ 4.7	+ .9
Will not be	48.8	52.7	54.9	57.2	+ 3.9	+ 2.3
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	129	129	215	215		
Awareness of Uplift:						
Relevant	29.8	33.6	29.0	36.9	+ 3.8	+ 7.9
Understood	20.6	24.4	17.5	18.9	+ 3.8	+ 1.4
Heard	18.3	20.6	18.9	24.9	+ 2.3	+ 6.0
Not heard	31.3	21.4	34.6	19.3	- 9.9	-15.3
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	131	131	217	217		
Scientists predict now:						
Q. and S. accurately	41.2	59.5	47.9	57.6	+18.3	+ 9.7
Other answers	58.8	40.5	52.1	42.4	-18.3	- 9.7
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	131	131	217	217		
Scientists predict future:						
Q. and S. accurately	82.4	88.2	86.3	87.4	+ 5.8	+ 1.1
Other answers	17.6	11.8	13.7	12.6	- 5.8	- 1.1
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number*	119	119	182	182		
How certain to release predictions:						
Other answers	30.5	27.5	36.9	29.5	- 3.0	- 7.4
Quite sure	37.4	31.3	36.4	30.4	- 6.1	- 6.0
Definitely sure and shouldn't release	32.1	41.2	26.7	40.1	+ 9.1	+13.4
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	131	131	217	217		
Earthquake preparedness:						
High	58.0	72.5	50.3	72.4	+14.5	+22.1
Low	42.0	27.5	49.7	27.6	-14.5	-22.1
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	131	131	217	217		

*Respondents who said scientists can now predict earthquakes quite accurately are ommitted to avoid redundancy.

People who perceived a decrease in media coverage of earthquake topics are more likely to have experienced decreased concern over the earthquake prospect and less likely to have experienced increased concern than people who perceived that media coverage was unchanged or increased. This relationship is confirmed. In both groups, fewer people at the second time period said their concern over the earthquake prospect had recently increased, but the decline was greater among people who thought media coverage had declined.

People who perceived a decrease in media coverage of earthquake topics are more likely to have experienced decreased conviction that a damaging earthquake is imminent, and less likely to have experienced increased conviction, than people who perceived that media coverage was unchanged or increased. This relationship is also confirmed, though the differences in rates of change between the two groups are smaller.

People who perceived a decrease in media coverage of earthquake topics are more likely to have become less cognizant of the Uplift and its relevance, and less likely to have become more cognizant, than people who perceived that media coverage was unchanged or increased. This hypothesis is confirmed, but by only small differences. More people in both samples had heard of the Uplift at the second time period, but the increase was less for respondents who thought media coverage had declined.

People who perceived a decrease in media coverage of earthquake topics are more likely to have lost confidence in the accuracy with which scientists can predict earthquakes, and less likely to have gained confidence, than people who perceived that media coverage was unchanged or increased. We assumed that this same effect should apply to both present prediction capability and future prediction capability, although prior analysis has led us to understand these as often rather different variables. In both instances the data contra-

dict the hypothesis. In the case of current capability, confidence increased in both groups, but noticeably more among people who thought media coverage had declined. Faith in future prediction capability did not change much in either group, and the difference in amount of change was small.

People who perceived a decrease in media coverage of earthquake topics are more likely to have become less favorable toward the public release of uncertain earthquake predictions than people who perceived that media coverage was unchanged or increased. Again the data contradict the hypothesis, but the difference between the two groups is small. Since these three disconfirmations all apply to perceptions of scientific earthquake prediction we shall return to them later as a set.

People who perceived a decrease in media coverage of earthquake topics are more likely to have allowed their levels of personal and household earthquake preparedness to decline, and less likely to have raised their levels of preparedness, than people who perceived that media coverage was unchanged or increased. The level of preparedness increased fairly substantially in both groups, but the increase was greater among those who perceived that media coverage was unchanged or increased. Thus the hypothesis is confirmed.

The most reasonable way to look at a table like this is usually to observe that the hypothesis was confirmed in four tests and disconfirmed in three, suggesting that chance factors may be at work and that the null hypothesis cannot be rejected. This would surely be the most scientifically respectable conclusion. However, it is reasonable, after acknowledging that the hypothesis has not yet passed the empirical test, to look for patterns in the results.

We have transferred the logic of the false alarm rather directly to this analysis, assuming that perceived reduction in media attention should have the same effects as more direct disconfirmation of the alarm. If the

observed relationships were not discounted as random fluctuations, we should conclude that this line of reasoning is most justified when applied to the sense of recently intensified concern and the level of personal earthquake preparedness, and may be justified as a weak effect in case of the conviction that an earthquake is imminent and remembering about the Uplift. But the reverse effect applies to faith in current prediction capability and possibly a weak reverse effect to faith in future capability and willingness to release uncertain predictions. We may be dealing here with a realism rather than false alarm effect. The generalized faith in science may be such as to create a predisposition toward believing in whatever scientists seem to claim they can do and accepting the appropriateness of disseminating scientific information. In the face of such a predisposition, the effect of attending to media treatment may be to alert people more realistically to the unresolved problems in earthquake prediction and the possible unsettling effects of publicizing predictions that may not come true. Following this reasoning, we can speculate that maintaining a steady level of media attention to earthquake topics contributes to a stable level of concern, awareness, expectation, preparedness, and realism, while declining media attention detracts from all of these effects.

The foregoing speculation cannot be viewed as a finding, but as a revised hypothesis that may warrant testing in future research.

The four items that provided confirmation for the hypothesis were included in the January, 1978, survey, as well as in the initial survey of February, 1977. Hence, we can repeat the analysis of differential change rates for the shorter interval from January to November/December, 1978. The new set of comparisons does not supply a fully independent retest of the hypothesis, since the data for "time two" are the same as before. Nevertheless,

if the findings are the same, we can have greater confidence in the stability of the effects.

The findings in Table 4 do not reveal the same confirmatory findings as in Table 3 for the longer interval of time. The hypothesis is again confirmed in all four instances. The three questions concerning scientific prediction were included in interviews with new respondents so that trends could be established, but not in the interviews with reinterviewed respondents.

The same seven dependent variables were tested in relation to the perception that informal discussion of earthquake topics had changed. The hypothosized relationships are in the same directions as before. For example, the perception of decreased informal discussion is associated with less frequently heightened concern and less frequent expectation of a damaging earthquake within a year. The results are displayed in Tables 5 and 6.

The results for perceived change in amount of informal discussion of earthquake topics over the longer interval are similar to those for perceived change in media coverage except that the reverse association appears for personal preparedness as well as for the three scientific prediction variables. Over the briefer interval of time the magnitudes of the changes are generally smaller, and differences divide equally into those that support and those that contradict the hypotheses.

Remembering a disconfirmed or withdrawn prediction is not related in the hypothesized direction to either awareness of the Uplift or earthquake preparedness, though it is related in the expected direction to faith in current scientific earthquake prediction capability, over the longer interval of time. Again, changes are minimal over the shorter interval and differences do not support the hypotheses (Table 7 and 8).

TABLE 4

CHANGED RESPONSE BY PERCEIVED CHANGE IN MEDIA COVERAGE OF EARTHQUAKE TOPICS: JANUARY, 1978, TO NOVEMBER/DECEMBER, 1978

Type of response	Media coverage is: less or dk		Media coverage is: same or more		Change when media cov. is:	
	Jan. 1978	N/D 1978	Jan. 1978	N/D 1978	Less, dk	Same, more
Changed concern:						
Increased	13.7	13.8	13.4	19.4	+ 0.1	+ 6.0
Same, don't know	77.9	76.3	77.9	76.5	- 1.6	- 1.4
Decreased	8.4	9.9	8.7	4.1	+ 1.5	- 4.6
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	131	131	217	217		
Earthquake expectation:						
Will be	41.4	36.7	32.7	36.0	- 4.7	+ 3.3
Don't know	5.5	10.2	5.1	6.9	+ 4.7	+ 1.8
Will not be	53.1	53.1	62.2	57.1	.0	- 5.1
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	128	128	217	217		
Awareness of Uplift:						
Relevant	38.9	33.6	30.9	36.9	- 5.3	+ 6.0
Understood	24.4	24.4	17.0	18.9	.0	+ 1.9
Heard	19.9	20.6	24.9	24.9	+ .7	.0
Not heard	16.8	21.4	27.2	19.3	+ 4.6	- 7.9
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	131	131	217	217		
Scientists predict now:	Not included in January, 1978, survey of reinterviewed respondents.					
Scientists predict future:	Not included in January, 1978, survey of reinterviewed respondents.					
How certain to release predictions:	Not included in January, 1978, survey of reinterviewed respondents.					
Earthquake preparedness:						
High	45.8	38.2	72.4	72.4	- 7.6	.0
Low	54.2	61.8	27.6	27.6	+ 7.6	.0
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	131	131	217	217		

TABLE 5

CHANGED RESPONSE BY PERCEIVED CHANGE IN INFORMAL DISCUSSION OF EARTHQUAKE TOPICS: FEBRUARY, 1977, TO NOVEMBER/DECEMBER, 1978

Type of response	Informal discussion is: less or dk		Informal discussion is: same or more		Change when informal discussion is:	
	Feb. 1977	N/D 1978	Feb. 1977	N/D 1978	Less, dk	Same, more
Changed concern:						
Increased	28.4	11.8	32.4	20.6	-16.6	-11.8
Same, don't know	66.9	75.6	64.4	76.7	+ 8.7	+12.3
Decreased	4.7	12.6	3.2	2.7	+ 7.9	- .5
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	127	127	219	219		
Earthquake expectation:						
Will be	42.1	34.9	41.7	37.6	- 7.2	- 4.1
Don't know	6.3	7.9	5.1	7.8	+ 1.6	+ 2.7
Will not be	51.6	57.2	53.2	54.6	+ 5.6	+ 1.4
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	126	126	218	218		
Awareness of Uplift:						
Relevant	26.8	29.1	30.8	39.4	+ 2.3	+ 8.6
Understood	19.7	23.6	18.1	19.4	+ 3.9	+ 1.3
Heard	22.0	27.6	16.7	20.8	+ 5.6	+ 4.1
Not heard	31.5	19.7	34.4	20.4	-11.8	-14.0
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	127	127	221	221		
Scientists predict now:						
Q. and S. accurately	40.9	59.1	48.0	57.9	+18.2	+ 9.9
Other answers	59.1	40.9	52.0	42.1	-18.2	- 9.9
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	127	127	221	221		
Scientists predict future:						
Q. and S. accurately	85.2	92.2	84.4	84.9	+ 7.0	+ .5
Other answers	14.8	7.8	15.6	15.1	- 7.0	- .5
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number*	115	115	186	186		
How certain to release predictions:						
Other answers	26.0	29.1	39.4	28.5	+ 3.1	-10.9
Quite sure	37.8	31.5	36.2	30.3	- 6.3	- 5.9
Definitely sure and shouldn't release	36.2	39.4	24.4	41.2	+ 3.2	+16.8
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	127	127	221	221		
Earthquake preparedness:						
High	45.6	67.7	57.5	75.1	+22.1	+17.6
Low	54.4	32.3	42.5	24.9	-22.1	-17.6
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	127	127	221	221		

*Respondents who said scientists can now predict earthquakes quite accurately are ommitted to avoid redundancy.

TABLE 6

CHANGED RESPONSE BY PERCEIVED CHANGE IN INFORMAL DISCUSSION OF EARTHQUAKE TOPICS: JANUARY, 1978, TO NOVEMBER/DECEMBER, 1978

Type of response	Informal discussion is: less or dk		Informal discussion is: same or more		Change when informal discussion is:	
	Jan. 1978	N/D 1978	Jan. 1978	N/D 1978	Less, dk	Same, more
Changed concern:						
Increased	14.2	11.8	13.1	20.4	- 2.4	+ 7.3
Same, don't know	72.4	75.6	81.0	76.9	+ 3.2	- 4.1
Decreased	13.4	12.6	5.9	2.7	- .8	- 3.2
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	127	127	221	221		
Earthquake expectation:						
Will be	34.4	35.2	36.8	36.8	+ .8	.0
Don't know	4.8	8.0	5.5	8.2	+ 3.2	+ 2.7
Will not be	60.8	56.8	57.7	55.0	- 4.0	- 2.7
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	125	125	220	220		
Awareness of Uplift:						
Relevant	34.6	29.1	33.5	39.4	- 5.5	+ 5.9
Understood	21.3	23.6	19.0	19.4	+ 2.3	+ .4
Heard	26.8	27.6	20.8	20.8	+ .8	.0
Not heard	17.3	19.7	26.7	20.4	+ 2.4	- 6.3
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	127	127	221	221		
Scientists predict now:	Not included in January, 1978, survey of reinterviewed respondents.					
Scientists predict future:	Not included in January, 1978, survey of reinterviewed respondents.					
How certain to release predictions:	Not included in January, 1978, survey of reinterviewed respondents.					
Earthquake preparedness:						
High	74.0	67.7	71.5	75.1	- 6.3	+ 3.6
Low	26.0	32.3	28.5	24.9	+ 6.3	- 3.6
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	127	127	221	221		

TABLE 7

CHANGED RESPONSE BY MEMORY OF DISCONFIRMED OR WITHDRAWN PREDICTION: FEBRUARY, 1977, TO NOVEMBER/DECEMBER, 1978

Type of response	Remember disc. or with. prediction				Change when remember	
	Yes		No			
	Feb. 1977	N/D 1978	Feb. 1977	N/D 1978	Yes	No
Changed concern:						
Increased	33.8	17.4	26.9	17.2	-16.4	- 9.7
Same, don't know	62.2	73.1	69.7	80.7	+10.9	+11.0
Decreased	4.0	9.5	3.4	2.1	+ 5.5	- 1.3
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	201	201	145	145		
Earthquake expectation:						
Will be	46.5	38.1	35.2	34.5	- 8.4	- .7
Don't know	4.5	6.4	7.0	9.9	+ 1.9	+ 2.9
Will not be	49.0	55.5	57.8	55.6	+ 6.5	- 2.2
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	202	202	142	142		
Awareness of Uplift:						
Relevant	33.7	40.6	23.3	28.8	+ 6.9	+ 5.5
Understood	17.8	20.3	19.9	21.9	+ 2.5	+ 2.0
Heard	17.3	19.3	20.5	28.8	+ 2.0	+ 8.3
Not heard	31.2	19.8	36.3	20.5	-11.4	-15.8
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	202	202	146	146		
Scientists predict now:						
Q. and S. accurately	46.0	56.9	44.5	60.3	+10.9	+15.8
Other answers	54.0	43.1	55.5	39.7	-10.9	-15.8
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	202	202	146	146		
Scientists predict future:						
Q. and S. accurately	86.1	88.4	82.8	86.7	+ 2.3	+ 3.9
Other answers	13.9	11.6	17.2	13.3	- 2.3	- 3.9
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number*	173	173	128	128		
How certain to release predictions:						
Other answers	32.7	27.7	37.0	30.1	- 5.0	- 6.9
Quite sure	37.6	33.7	35.6	26.7	- 3.9	- 8.9
Definitely sure and shouldn't release	29.7	38.6	27.4	43.2	+ 8.9	+15.8
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	202	202	146	146		
Earthquake preparedness:						
High	54.5	76.3	51.4	67.1	+21.8	+15.7
Low	45.5	23.7	48.6	32.9	-21.8	-15.7
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	202	202	146	146		

*Respondents who said scientists can now predict earthquakes quite accurately are ommitted to avoid redundancy.

TABLE 8

CHANGED RESPONSE BY MEMORY OF DISCONFIRMED OR WITHDRAWN PREDICTION: JANUARY, 1978, TO NOVEMBER/DECEMBER, 1978

Type of response	Remember disc. or with. prediction: Yes		Remember disc. or with. prediction: No		Change when remember	
	Jan. 1978	N/D 1978	Jan. 1978	N/D 1978	Yes	No
Changed concern:						
Increased	12.9	17.3	14.4	17.1	+ 4.4	+ 2.7
Same, don't know	77.7	73.3	78.1	80.8	- 4.0	+ 2.7
Decreased	9.4	9.4	7.5	2.1	.0	- 5.4
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	202	202	146	146		
Earthquake expectation:						
Will be	39.5	38.0	31.0	33.8	- 1.5	+ 2.8
Don't know	4.5	6.5	6.2	10.3	+ 2.0	+ 4.1
Will not be	56.0	55.5	62.8	55.9	- .5	- 6.9
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	200	200	145	145		
Awareness of Uplift:						
Relevant	35.6	40.6	31.5	28.8	+ 5.0	- 2.7
Understood	17.3	20.3	23.3	21.9	+ 3.0	- 1.4
Heard	24.8	19.3	20.5	28.8	- 5.5	+ 8.3
Not heard	22.3	19.8	24.7	20.5	- 2.5	- 4.2
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	202	202	146	146		
Scientists predict now:	Not included in January, 1978, survey of reinterviewed respondents.					
Scientists predict future:	Not included in January, 1978, survey of reinterviewed respondents.					
How certain to release predictions:	Not included in January, 1978, survey of reinterviewed respondents.					
Earthquake preparedness:						
High	75.3	76.3	68.5	67.1	+ 1.0	- 1.4
Low	24.7	23.7	31.5	32.9	+ 1.0	+ 1.4
Total	100.0	100.0	100.0	100.0	0.0	0.0
Total number	202	202	146	146		

The relatively random distribution of confirmations and disconfirmations precludes our drawing conclusions. But "hunches" that might contribute to the formulation of hypotheses for future research can be stated. First, the two variables that depend on the least tortured reasoning for incorporation in the hypotheses and which also exhibit the predicted decline in the aggregate data fare best. Changed concern over the prospect of a damaging earthquake and imminent expectation of a damaging earthquake exhibit the hypothesized differences in amount of change in five of six tests each, and in all three tests using the longer interval. Because the total magnitude of changes during the shorter interval is small, findings should be less reliable than for the longer time interval.

Changes between early 1977 and late 1978 are most substantial for earthquake preparedness, changed concern, and faith in current scientific earthquake prediction capability. Hence, the patterns of differential change for these three variables should be taken most seriously. We noted earlier that increased levels of earthquake preparedness may have been the byproduct of enhanced preparedness of other kinds and have little to do with earthquake concern. It is consistent with this view that differential rates of change are small relative to the magnitude of change, and that only one of three tests for the longer interval and two of three for the shorter interval support the hypothesis.

Since the reported level of faith in current earthquake prediction capability was plainly unrealistic at the start of the longer interval and became more so over the 21 months, we suggested that the reasoning underlying false alarm hypotheses was less appropriate than reasoning concerning determinants of realism and unrealism. From the latter perspective a reasonable level of media coverage and informal discussion help to preserve realism and

counteract tendencies toward magical and other exaggerated assumptions about scientific capability. For perceived levels of media coverage and informal discussion, the false alarm reasoning and the realism reasoning produce opposite predictions, and differential rates of change accord with the latter rather than the former. But when the independent variable is remembering a disconfirmed or withdrawn prediction, the two assumptions produce the same hypothesis, that people who remember what has happened in the past are less likely to form unrealistic conceptions of the current state of the art than people who do not remember past experience.

Conclusions. Although a plausible case can be made that the people of southern California have been subjected to a slowly developing false alarm, the evidence makes it appear doubtful that most people experienced events in this way. Tests of seven hypotheses concerning differential susceptibility to false-alarm effects, each with four different dependent variables, were consistently negative. Individual and aggregate changes in earthquake response must be explained by other mechanisms than a false-alarm effect.

A second approach to explaining individual and aggregate change is more promising, though we cannot claim to have confirmed the hypotheses put forward. Two principles have been educed to explain the second set of findings. First, extent of media attention and extent of informal discussion serve as surrogates for actual events in assessing the credibility of an uncertain threat to the community. The more the threat is talked about, the more credible it seems, so that lessened media attention and its corollary in less frequent informal discussion reduces the credibility of the threat to the community. Second, when prevalent tendencies toward magical thinking and other causes are at work to foster unrealistic thinking, a steady level of media attention and informal discussion helps to moderate this unrealism.

Consequently, reduced media attention and correlative declines in informal discussion contribute to less realistic conceptions of the threat facing the community and the problems of dealing with it.

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CHAPTER SIX

PATTERNS OF CHANGE

The objectives of Part Nine have been to ascertain the extent and describe the nature of change and stability in response to a sustained near prediction of an earthquake, and to explain change and stability on the basis of either specific events and their treatment by the media or the unfolding effects of waiting for disaster. In this chapter we shall review and round out the analysis in answer to these questions.

Extent and Nature of Stability and Change

Stability. In general, stability is more characteristic of the responses we have measured than change. Several crucial types of response have remained without significant change throughout the nearly two years covered by our surveys. For responses that have changed, the change has often not been dramatic. When the evidence of change is unambiguous, the change most often occurred between early and mid-1977, with chiefly random fluctuations thereafter. On the other hand, some of the responses that exhibited greatest stability for twenty-one months suddenly changed in the unsettling aftermath of the moderate and unpredicted earthquake of New Year's Day, 1979.

The relative credibility given scientific and nonscientific forecasts and warnings and, after adjustment for the one-time Minturn forecast, relative awareness of scientific and nonscientific forecasts and near predictions, were fairly constant throughout the study period. The level of fatalism about

earthquake damage was quite stable. High levels of confidence in the eventual achievement of accurate scientific earthquake prediction and endorsement of government spending to mitigate earthquake hazard changed little during the study period, though both declined under the unsettling impact of the New Year's Day earthquake. The suspicion that scientists and public officials were withholding information concerning predicitons from the public likewise remained at a steady level over the twenty one months, but shifted surprisingly toward lessened suspicion after the New Year's Day tremor. Although our information is less complete for these variables, desire for news about earthquake topics remained at a high level and the tendency to interpret smaller earthquakes and other events as clues to the imminence of the anticipated destructive earthquake was recurrent. Salience of earthquake concern was always low, and after an initial drop, general fear and concern over future earthquakes was relatively unchanged, even after the New Year's Day quake.

There are several reasons why such relative stability of response might have been observed. First, it is possible that some of the variables such as earthquake fatalism, scientific versus nonscientific orientation, support for government spending, and the suspicion that important information was being withheld from the public are surface expressions of underlying attitudes of greater generality. If fatalism, for example, is a general orientation toward risks of all sorts, fatalism about earthquakes may reflect that general orientation more than it reflects any experience that is restricted to the earthquake risk. This highly plausible interpretation is weakened, however, by the fact that such stable responses as support for government spending, confidence in the eventual achievement of accurate scientific earthquake prediction, and suspicion that information is being withheld changed significantly after the New Year's Day quake. Either the events during the twenty one months

were too mild by comparison with the New Year's tremor to have an effect on these responses, or they were the wrong kinds of stimuli. But in any case, it is difficult to believe that attitudes changed by so mild a stimulus as the New Year's quake are primarily expressions of relatively impervious fundamental attitudes. Unfortunately, the most plausible candidate for interpretation as expressing a fundamental orientation, earthquake fatalism, was not included in the New Year's Day tremor survey.

A second reason for the observed stability might be that significant changes took place during the interval before our first survey, and our monitoring of individual response began after most responses had already stabilized. This interpretation gains in plausibility from the observation that most of the observed changes took place between our first and second surveys. These changes may have been just the final stages of a much more dramatic and comprehensive set of changes during the initial year of the Uplift. The fact that some apparently stable responses were significantly modified by the objectively rather inconsequential earthquake of New Year's Day, 1979, lends further plausibility to the speculation that a great deal of change might have taken place before our first survey.

On the other hand, examination of the absolute levels for many of the variables impels us to think twice about placing too much weight on this kind of speculation. Support for government spending, faith in the ultimate achievement of scientific earthquake prediction, the desire to hear more about earthquakes, and belief in anomalous animal behavior as an earthquake sign could hardly have been higher. Perhaps salience of earthquake concern could have been higher. Variables that changed during the first interval such as imminent expectation of an earthquake and expressed fear of earthquakes were at fairly high levels at the time of the first survey. How plausible is it that

even more than 43 percent at one time expected a damaging earthquake within a year, or that even more people admitted being frightened at the prospect of an earthquake?

It is perhaps easiest to believe that there were gradually developing awareness and response during the months after the announcement of the Uplift, but little turnabout in general awareness and response by the time of our first survey.

If we accept the evidence of stability at face value, two further explanations can be offered. The fact that most people took moderate, qualified, or tentative stances on most questions may have reduced dissonance when the anticipated earthquake failed to materialize. The logic here is opposite to that in one of our false-alarm hypotheses, but assumes that adoption of a qualified position reflects realistic recognition of the uncertainty of present knowledge. The Chinese have repeatedly insisted that false alarms did not undermine public cooperation in their earthquake prediction program because the people were taught to understand prediction as a science that was still being perfected.

Most of our respondents do not believe that scientists can predict earthquakes quite accurately yet. Nevertheless the level of faith in current earthquake prediction capability is unrealistically high. Hence it is not altogether clear that realistic appreciation of the tentative nature of earthquake prediction is sufficiently widespread to insulate a wide range of earthquake responses from the effects of events like the report of an earthquake swarm near Palmdale or the unpredicted Santa Barbara earthquake.

Finally, stability of response may be explained on the basis of the normal anticipation of earthquakes in southern California. If the effect of announcement of the Uplift, Whitcomb's near prediction, and Minturn's forecast has merely been to add a sense of imminence to the standing anticipation

of an earthquake, we would expect some types of response to be unaffected and others to change only moderately. Since the scientific announcements have been vague and qualified and the Minturn forecast was enveloped in controversy, this may be the most generally applicable explanation for response stability. In varying degrees the other three interpretations may help selectively to explain the stability of specific responses.

Change. In spite of the relative stability of response, several significant changes did occur during the study period. People remembered fewer announcements and engaged in less discussion and the sense of imminence declined. The admission of uncertainty about the likelihood of an early earthquake grew steadily. More people doubted the wisdom of releasing uncertain predictions and reconsidered the attitude of treating a severe earthquake as a normal event. The unrealistic assessment of present earthquake prediction capability became more general, and people looked more strongly to government to deal with the problems of especially endangered groups. The earthquake threat may have been assimilated to political issues of more wiedespread concern such as the plight of the poor. And the New Year's Day earthquake induced a distinctive pattern of changes that were in some instances the extrapolation of earlier changes and in other instances a reversal.

Events as Causes of Change

Some changes we recorded were expressions of changing circumstances. People remembered fewer near predictions, forecasts, and cautions because fewer new announcements were made after 1976. In particular, the prominence of pseudoscientific announcements was shown to have been greatly inflated because of concentrated attention to the Minturn forecast. The popular credibility of the pseudoscientific was probably unaffected, as indicated by the

by the stable rate with which the prophecy that much of California would break off and fall into the Pacific Ocean in a great earthquake was mentioned, and by the fact that nineteen months after Minturn's forecast was disconfirmed half our respondents said they would take seriously a prediction issued by a self-educated amateur. So the simple absence of a widely publicized new forecast by an amateur accounts for the declining mention of this kind of announcement.

Obversely, periodic reports of developments related to the southern California Uplift in the absence of other new developments gave the Uplift an increasingly focal place in the public awareness of the earthquake prospect.

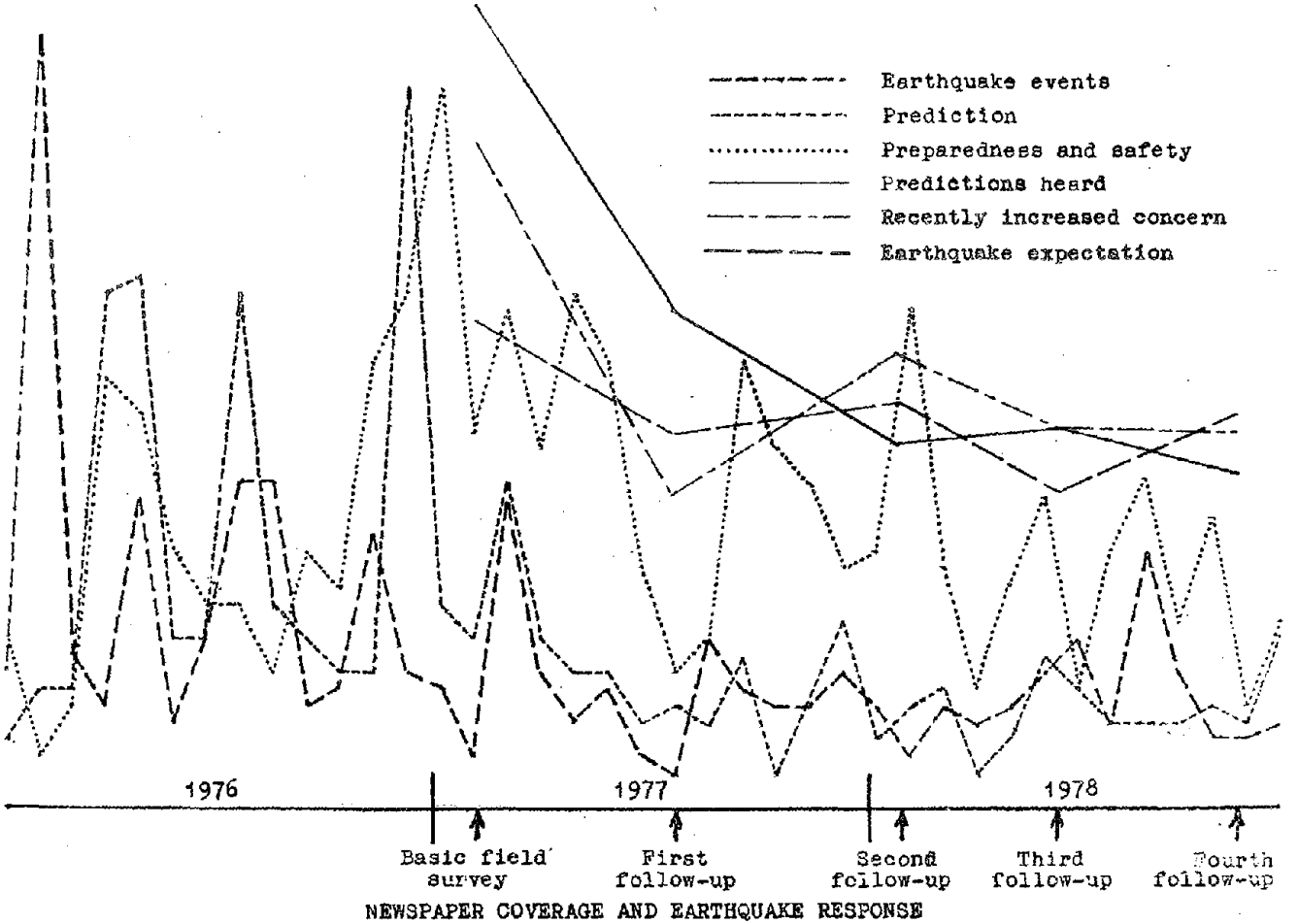
We are tempted to explain the reduced faith in the ultimate accuracy of scientific earthquake prediction following the New Year's Day tremor as just such a simple response to the fact that the quake was not predicted. But this interpretation is difficult to sustain when we remember that faith in current prediction capability, which ought realistically to be more responsive than faith in eventual capability to the occurrence of an unpredicted earthquake. The fact that a more severe earthquake accompanied by both destruction and casualties in nearby Santa Barbara had no such apparent effect also calls into question the simple correspondence interpretation. Efforts to explain other changes in this simple fashion meet a similar fate. Only changes in levels and kinds of awareness appear to be susceptible to such explanations.

Media coverage and earthquake response. A stronger case can be made, however, for the effects of changing levels of media coverage and informal community discussion of earthquake topics on expectation, concern, and realism. Not only did earthquake expectation, recently aroused concern, and realism about earthquake prediction change consistently with a general change in levels

of media coverage and reported discussion: the changes were more pronounced among respondents who perceived declines in media coverage and informal discussion. The findings here are by no means definitive, and we have resorted to post hoc reinterpretations. But they are sufficiently suggestive to warrant further investigation in later research.

In Figure 1 we have graphed the trends in three key variables against the changing newspaper coverage of earthquake events, prediction, and preparedness and safety. The newspaper frequencies have been plotted by four-week periods, including all items in the six monitored papers. The three types of newspaper coverage have been plotted on the same scale so that heights of the three lines indicate the comparative attention given to the three topics at any period of time. Each of the response variables has been plotted using a different scale, so trends but not absolute levels can be compared.

Both earthquake events and prediction exhibited several peaks in 1976 before our first survey. Both remained relatively low throughout 1977 and 1978 except for correlated peaks just after our first survey, associated with earthquakes in Romania and Iran, and a peak in event coverage without a corresponding peak in attention to prediction a little before our final survey, associated with earthquakes in Santa Barbara and again in Iran. While preparedness and safety peaked during the period of concentrated attention to prediction brought on by Whitcomb's near prediction and belated consideration of the Uplift, and again just before our first survey with a few weeks lag behind the Minturn peak, it generally received less attention in 1976 than in 1977 and 1978. Unlike the other two topics, preparedness and safety remained high for several months after the first survey, and continued to peak throughout the remainder of the study period.



NEWSPAPER COVERAGE AND EARTHQUAKE RESPONSE

FIGURE 1

It is quite plausible to understand declines in predictions heard, recently increased concern, and earthquake expectation as responses to the drop in attention to earthquake prediction from just before the first survey until the time of the first follow-up wave. Unless we assume that these three response variables would have been astronomical in an earlier survey, we must assume that there is a lag of a few months before the impact of declining media coverage is plainly reflected in public response. This seems a thoroughly reasonable assumption. Two smaller peaks in coverage of prediction in the latter half of 1977 might then have accounted for the rebounding level of recently increased earthquake concern and perhaps of earthquake expectation registered in early 1978. But the failure of a number of predictive announcements remembered to exhibit a similar rebound would require special explanation.

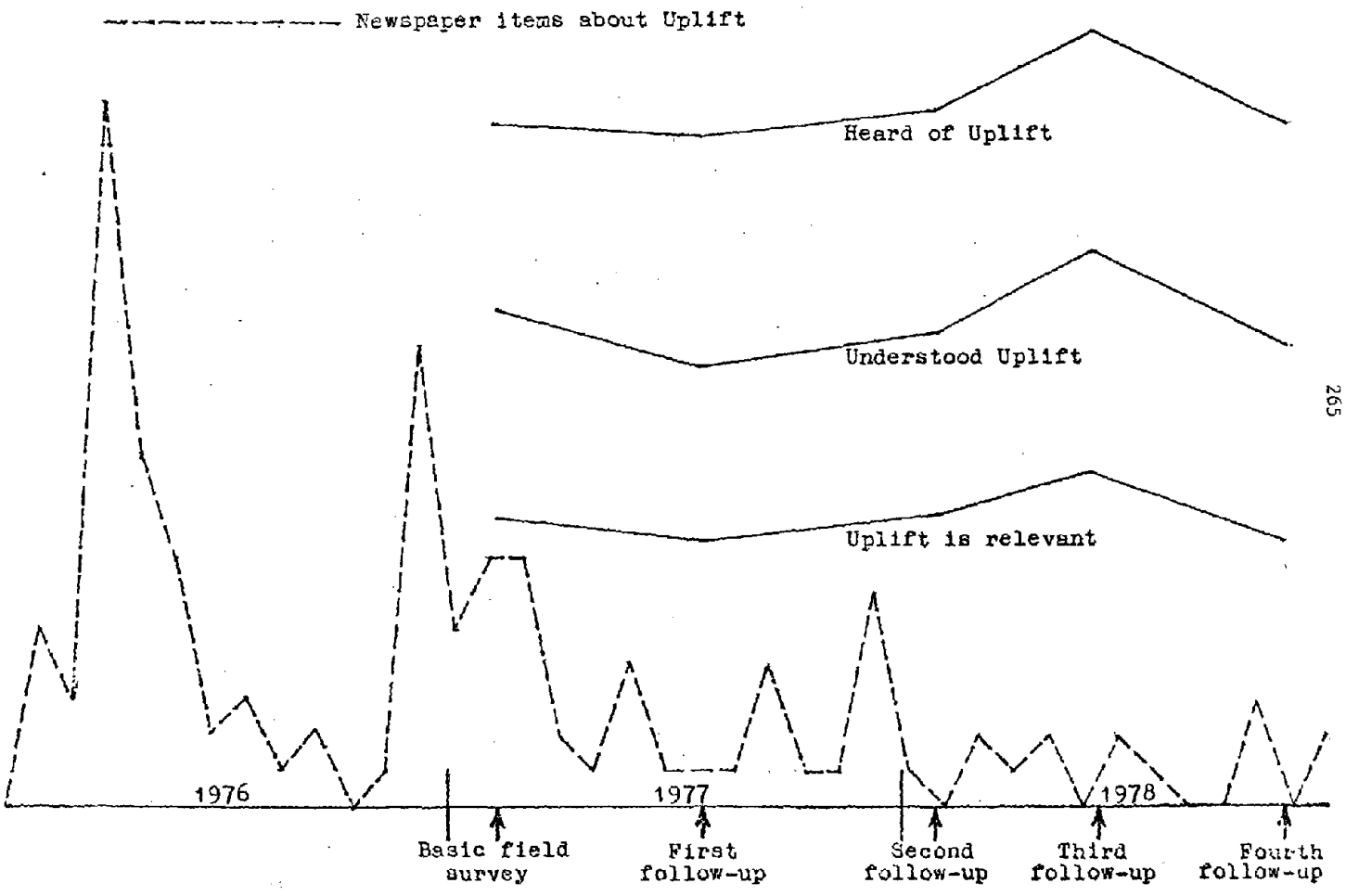
We recall from Part Four and earlier chapters in Part Nine the tendency toward vagueness of recollection and the persistence of expectation in the absence of any specifically remembered announcement. The declining exponential curve of announcements remembered suggests the failure to recognize as new and assimilate as distinct announcements the continuing flow of information bearing on the earthquake prospect, none of which has the pointedness and weight of the 1976 pronouncements. If the new announcements are insufficiently distinct to be assimilated cognitively, they may nevertheless stimulate affect. It is not surprising that the sense of recently intensified concern is more sensitive to short-term changes in media coverage than either cognition or conviction (expectation). We are not assuming that people develop a belief or conviction about impending disaster and then experience aroused concern because they anticipate disaster. We assume that belief or conviction is slower to respond than aroused concern. If we could extend our observations beyond the five data points we could test the hypothesis that cognition is most responsive to

longer-term trends, leveling out short-term fluctuations; that the sense of momentarily aroused concern is most responsive to short-term changes; and that conviction or expectation is intermediate, responding to short-term fluctuations more than cognition but less than aroused affect, and reflecting the longer trend more faithfully than affect but less than cognition.

If our speculations have any merit, discussions related to prediction are critical and discussions of preparedness and safety are of little or no relevance to the sense of earthquake imminence and aroused concern. It is more difficult to judge the significance of reports of earthquake events because of the correlation with attention to prediction.

The number of predictive announcements remembered is a measure of salience and of cognitive discrimination rather than simple awareness. It measures recall rather than recognition memory. By contrast, the typology we use to assess awareness of the Uplift measures recognition. In Figure 2 we have plotted newspaper items mentioning the Uplift by four-week frequencies with awareness of the Uplift among our respondents. There does not appear to be any relationship in this graph. Although media attention to the Uplift declines over the total period, awareness of the Uplift remains stable and possibly even increases from mid-1977 and mid-1978. Three more specific observations seem justified.

First, once the awareness of the Uplift had been fairly widely diffused through periods of more intensive coverage, a continuing lower level of media attention was sufficient to maintain the level of awareness. The pattern of attention to the Uplift is not greatly unlike the more inclusive pattern of attention to predictive matters. But while the reduced level of newspaper coverage can be plausibly viewed as a prime cause of a lessened recall of recent specific announcements and a declining sense of imminence concerning



NEWSPAPER ATTENTION TO UPLIFT AND AWARENESS OF UPLIFT
FIGURE 2

the earthquake threat, it is not accompanied by lessened recognition awareness of the Uplift. Thus after an extended period of occasional reminders, the underlying awareness remains steady although the salience and sense of imminence drops.

Second, this persistence is particularly impressive because it applies to recognition of the Uplift as personally relevant as well as to simple recognition that it exists. It would not have been surprising to find that people continued to recall the existence of the "bulge" while increasingly coming to feel that it had no significance for them. Instead, having once gotten the message, people retain the awareness of what it could mean to them with the help of a low-keyed series of media reminders.

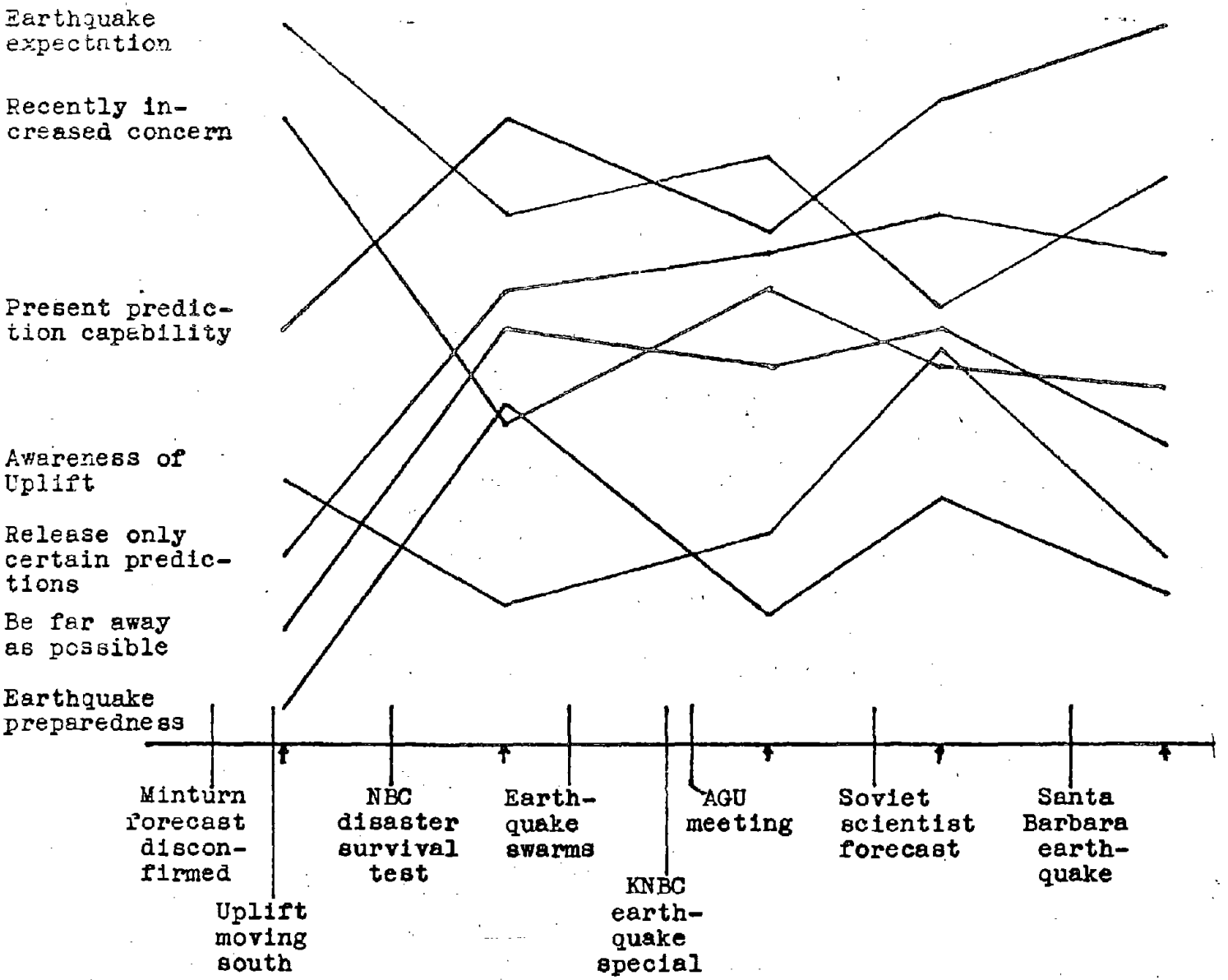
Third, awareness of the Uplift had apparently reached or come close to a ceiling by the time of our first survey. Further communication about the Uplift, at least at the modest levels of 1977 and 1978, does not appear to have reached new people. During our study period and beyond the modest rise from mid-1977 to mid-1978 there is no net increase in the number of people who are aware. The new communications seem to be reaching only those who have already heard, keeping their awareness alive without augmenting the aware population. There is a substantial hard corps of unaware who are simply not to be reached in this way. Because of the separation between cognition and conviction and between awareness and action, there may be better ways to work with these people than by promoting awareness of the Uplift. But it does seem clear that they do constitute an awareness hard corps so far as the conventional diffusion of information through the media is concerned.

In Figure 1 we plotted preparedness and safety topics together. These include items as diverse as a check list to be used by individual households in preparing for an earthquake and discussions of the highly politicized issues of building a nuclear power plant, a liquid natural gas terminal, or the

we should reexamine our data in such a way as to see whether plausible connections between changing earthquake response and critical events are suggested.

In Chapter Two we specifically explore awareness of a few of what we thought might have been critical events. The persistent swarm of small tremors in the uplifted zone, reported in September, 1977, and the Santa Barbara earthquake of August, 1978, were the two events that attracted considerable attention. Only the former, however, seemed to be widely interpreted as having significance for the earthquake future of Los Angeles County residents. By the end of 1978, in spite of the highly publicized political controversy provoked by Whitcomb's near prediction and the widespread awareness of Minturn's forecast at the time of our first survey, we were surprised at how few respondents remembered a withdrawn or disconfirmed prediction, and how few of those referred in any credible way to the Whitcomb or Minturn announcements. Nevertheless, the response of significant minorities of our respondents to critical events could have measurably influenced the trends we have observed.

In Figure 4 we have selected eight events that might plausibily have influenced the earthquake responses of substantial numbers of people and used the dates of their occurrence to subdivide the horizontal axis of the graph. Thus, as one moves from left to right on the graph, one can identify the time when each of the eight events occurred. The date for the median interview in each of the five surveys has also been marked along the horizontal axis for easy comparison. Seven response variables that exhibited change during the study period have been plotted on the graph so that their trends can be related to the eight events. As before, each is plotted using a different scale so that only trends and not absolute levels can be compared. In addition, and in contrast to the earlier graphs, zero levels for the seven response variables do not correspond with the base of the graph and would all fall at



SELECTED EVENTS AND EARTHQUAKE RESPONSE

FIGURE 4

different locations if projected.

The interval from early to mid-1977 was characterized by the greatest range and amount of change. Fewer people expected an earthquake within a year, fewer said that their concern about the earthquake prospect had recently increased, and fewer remembered hearing of the Uplift and associating it with earthquake danger. Belief in current scientific earthquake prediction capability increased, but so did reluctance to release uncertain predictions. More people said they would try to get as far away as possible if they had advance warning of an earthquake, and the level of individual and household preparedness rose. Except for the modest decline in awareness of the Uplift, the changes might constitute a pattern in which the earthquake danger is no longer felt to be so imminent as before, but the prospect is being viewed more realistically rather than being treated as a normal event.

The NBC National Disaster Survival Test, aired to a large nationwide television audience on May 1, 1977, might have contributed to the rise in earthquake preparedness, especially since preparedness declined in the next interval and never reached the same level again, and preparedness ascribed specifically to the earthquake prospect did not increase to the same extent. But it is difficult to relate the disaster test to the other changes.

In the absence of any striking event to explain these changes during the recorded interval, we are led to consider whether they might be either the continuation of a trend begun before our first survey or the delayed effect of earlier events. Either interpretation would be plausible in light of the December disconfirmation of the much publicized Minturn forecast and the less publicized withdrawal of Whitcomb's "hypothesis test." If preoccupation with a highly publicized and immediate danger is sometimes handled by denial, the breathing spell that comes when the sense of imminence passes enables people

to acknowledge and begin to deal with the real nature of the threatening event.

A month or more had already passed since Minturn's forecast was disconfirmed and the media clamor died down when our first round of interviews was conducted. Hence we must assume that the sense of imminent danger is not instantly dispelled but persists for weeks or even months. Whether there is also a group of people who respond more quickly is something we cannot tell in the absence of an earlier survey.

The next interval, from mid-1977 to early 1978, sees every variable but one reversing direction. Except for the decline in personal and household preparedness the lines of ascent and descent are not steep and may be better described as a leveling off than as a reversal of direction. Awareness of the Uplift and the sense of imminent danger are partially restored, faith in current scientific earthquake prediction capability is moderated and preparedness deteriorates, and attitudes toward releasing uncertain predictions and toward getting away from the site of an earthquake are little changed. Discovery and frequent discussion of the earthquake swarm, as well as earthquake specials on KNBC and other television networks and concentrated reporting on the San Francisco meeting of the American Geophysical Union may have restored some of the lost sense of immediacy, and contributed to a more realistic assessment of scientific earthquake prediction capability. But other changes suggest rather the absence of significant events than positive influences.

During the third interval the sense of imminence once again declines. As awareness of the Uplift increases a little, unrealistic faith in current prediction capability decreases, and preparedness rises a little, realism may be increasing. No event stands out during this interval except the Soviet scientist's forecast, which, however, very few people remembered seven to eight months later. This was an interval marked by continuing but

unspectacular and infrequent discussion with greatest attention to the often highly politicized earthquake safety issues. We see no obvious coherent pattern here.

The fourth interval is similarly made up of changes that are not obviously interconnected. Most trends are weak, and random variation may account for most of what we see. The Santa Barbara earthquake could have had a significant effect during this interval. But it would be difficult to make a plausible case relating decreased preparedness, awareness of the Uplift, and disposition to be as far away from an expected earthquake as possible, combined with greater earthquake expectation and faith in scientific prediction capability, to the Santa Barbara earthquake.

In general, a plausible but not necessarily convincing case can be made linking changes during the first two intervals to events during and preceding those intervals. But efforts to find plausible explanations for changes during the second two intervals seem to tax reasonable credulity.

The New Year's Day Earthquake. By launching a survey directly after the small New Year's Day earthquake and designing it comprehensively to explore perception, interpretation, and response, we have been able to gain a clearer picture of the quake's short-run effects, though we have no way to know how lasting they were.

The New Year's Day earthquake was taken in stride by most respondents. It was not experienced as a very frightening event, though it did raise the level of fear concerning a future earthquake. Although a few people claimed personally to have had the idea that an earthquake was about to happen, very few thought the quake had been predicted. Either people had not heard of a prediction, or they had assumed that the relatively vague near predictions in effect would be followed by more specific warning announcements as the time

of a predicted quake approached.

Although the quake was not disruptive of normal routines, neither did it, as a near-miss, lull people into a false sense of security. The quake stimulated considerable interest. In the absence of answers to their most pressing questions from the authorities and the media, people sought the meaning of the quake for the future through informal discussion and rumor.

The most general characterization of the earthquake's effects on earthquake attitudes and responses is to say that it was unsettling. The established trend toward seeing a destructive earthquake as a crisis event rather than a normal occurrence was intensified. Confidence in the significance of the Uplift as an earthquake precursor, faith in the eventual accuracy of scientific earthquake prediction, and support for the most popular government hazard mitigation measures were shaken. There may have been some stock-taking concerning household preparedness, but there was no general increase in the level of preparedness.

Complementing the unsettling effect was the striking drop in what had been a stable variable, the level of suspicion that scientists and public officials were withholding information concerning earthquake predictions. It is a plausible interpretation that this change signalled a modest disposition toward shoring up community solidarity in a situation of potential community crisis.

The special examination of response to the New Year's Day earthquake warrants two further observations. First, in spite of the nonlethal nature of the physical event, the moderate earthquake precipitated clearer and more widely ranging changes in relatively stable response patterns than did other specific events during the study period. The changes were not so great as those that followed more gradually the end of the Uplift-Whitcomb-Minturn year of prediction preoccupation. And our research was unfortunately not

underway early enough to assess changes brought about by the combined Whitcomb and delayed Uplift preoccupation of April, 1976, or the Minturn phenomenon of November and December, 1976. But compared to a destructive earthquake nearby and such developments on the prediction scene as the mini-quake swarm and the Soviet scientist's prediction, occurrence at home of a nonlethal earthquake of near-miss magnitude had more effect in shaking established assumptions and stimulating reflection--though not action.

Second, the changes triggered by the quake are not understandable except in the context of the prior years' experience with earthquake forecasts, near predictions, and cautions. The stage had been set by the end of 1978 when 36 percent said there would probably or definitely be a damaging earthquake within a year and 71 percent said within five years. A nonlethal quake occurring against a different background might have had quite different and possibly less significant effects. But the quake took its principal meaning as a reality-reminding step on the inexorable path toward the "big one" that was not far away.

Waiting as the Cause of Change

We described the near prediction conveyed by announcement of the Uplift as having zero lead time and an open-ended time window. We hypothesized that people would attempt to give closure to the window, and would often translate time window into lead time. The high percentage initially expecting a damaging earthquake within a year suggests that the closure tendency was at work, and the subsequent reduction suggests a reopening of the time window in the popular view.

Six alternative but not mutually exclusive hypotheses concerning the effect of waiting for disaster were outlined. First, there should be an initial sense of urgency, perhaps translated into action, followed by a period of

lessened urgency as people live through the ever-extending time window. If there is a strong sense of closure, the sense of urgency should be restored as the assumed end of the time window approaches. If the former pattern applies, such variables as imminent expectation of an earthquake and recently intensified concern should decline, either linearly or following a declining exponential curve and approaching a horizontal asymptote. If the later applies, the trend might be described by a concave parabola. Although five moments is too few for fitting a curve confidently, the exponential curve provides the nearest fit to the largest number of variables, and the parabola fits the fewest. In one instance, individual and household preparedness, the spurt of preparedness comes at the second rather than the first moment, which seemed best explained as a response to the disaster survival test on NBC television. But the subsequent decline fits the model of lessened urgency, though we cannot specify a curve to fit the foreshortened data.

The second hypothesis is that waiting translates the earthquake warning into a slowly developing false alarm, inclining people toward skepticism and disillusionment about scientific prediction. Since the changes are actually in the opposite direction, we have rejected the false alarm or "cry wolf" hypothesis after careful study.

The third hypothesis is that waiting is a period of accumulating anxiety, leading to defensive denial of danger and other pathological responses. Our data provide no evidence to support this hypothesis.

The fourth hypothesis is that accumulating personal tension is translated into active and aggressive responses, expressed as suspicion, resentment, and scapegoating. Again, there is no increased suspicion that information is being withheld, there is continued support for government spending, and more people have confidence in government preparedness than in their own or the general public's preparedness. We do not find evidence to support this hypothesis.

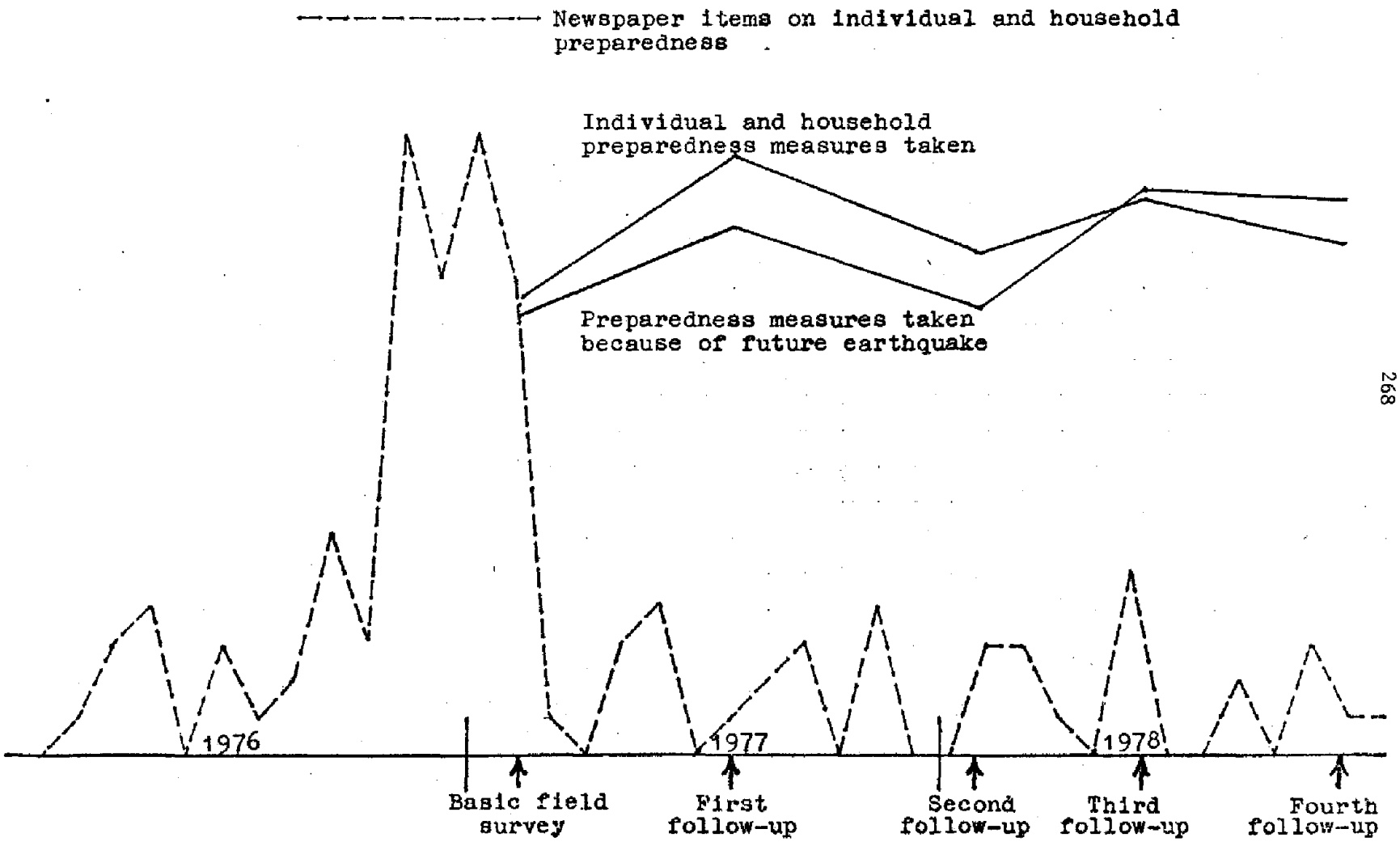
The fifth hypothesis assumes that the period of waiting is not one of passivity, but one of repeated reminder, clarification, informal discussion and information seeking. As a result the period of waiting increases familiarity with the threatening situation and its many aspects and increases sensitization to the cues that may be relevant at the time of crisis. The most striking evidence bearing on this hypothesis is the increased confidence in current earthquake prediction capability, with the trend beginning and ending at levels that are unrealistic in relation to actual scientific capability. There is no cumulative growth in awareness of predictive announcements or of the Uplift, but there is some change in the quality of announcements remembered, with more focus on the Uplift and scientific announcements. Thus, there is suggestive support for this hypothesis.

The final hypothesis assumes an even stronger positive effect, with waiting and periodic reminders leading to rehearsals and the selection of more effective responses through trial and error. We have noted that many people have assumed that the crisis event will be preceded by a short-term warning. A relaxed sense of urgency may save people from destructive anxiety, and if coupled with learning for more effective response during the waiting interval, may mean a population that could be transformed from apparent apathy rather quickly. We have no real test for this hypothesis, though we observe that such survival lessons as standing under an inside doorframe during an earthquake and not immediately rushing outdoors have been widely learned. And without expressing greater fear, fewer people say they would go on with life as usual if they knew that an earthquake was imminent.

It is quite clear that while there has been a declining sense of urgency, there has been no general disillusionment or scapegoating during the waiting period. There has, on the other hand, been increased acceptance of

scientific earthquake prediction, and some indication that the prospect of a damaging quake is being faced more realistically, as the normalcy bias is eroded.

The analytic separation between the effects of waiting and the effects of passing events is artificial. It is undoubtedly important that the period of waiting has not been without a series of unfolding developments, and that the media have managed to keep a three-year-old announcement newsworthy. Each of our six hypotheses is more or less likely, depending upon the nature of the events and media treatment. The unsettling effect of the New Year's Day earthquake underlines the contingent effects of events on the longer term waiting effects. No doubt a more combative press and television could have stirred up some of the effects described in hypotheses two, three, and four. On the other hand, active political leadership to develop a comprehensive community-based program for earthquake preparedness and prediction awareness could undoubtedly have strengthened the effects anticipated under hypotheses five and six.



NEWSPAPER ATTENTION TO PREPAREDNESS AND LEVEL OF PREPAREDNESS
FIGURE 3

Auburn Dam in a location where earthquake faults may still be active. In Figure 3 we have separated out the former type of article and plotted with it the levels of individual and household preparedness based on the standard checklist included in all our surveys. Again, unless we assume some complicated lag effect, it is difficult to see a meaningful relationship in Figure 3. The basic field survey came just at the completion of four months of unparalled attention to personal preparedness, associated especially with the reprinting of the Drucky series in several newspapers. The remainder of the study period was characterized by a fairly regular series of quite small peaks. Yet household preparedness was still at its lowest level when the first survey was conducted and rose to its highest level during the next five months. Preparedness may be like awareness of the Uplift: once a level of preparedness is initially established, a fairly steady stream of occasional reminders may be sufficient to maintain it. But we shall still need further explanation for the rise from early to mid-1977. It could plausibly constitute a lag of one or two months in people getting around to taking measures suggested over the previous four months.

Events and earthquake response. The foregoing analysis dealt with levels of media attention to broad topics. This type of analysis could only be effective if people respond less to the discrete events as they occur than to the aggregate rates with which events occur or are given public attention through the media. The poor quality of discrimination between specific near predictions, forecasts, and cautions, and the number of people who expect an earthquake within a year without being able to name a single announcement presaging a destructive earthquake that they take seriously provides justification for such an assumption. Yet at the time of our first survey a large proportion of respondents had differentiated the Minturn forecast out of the background of vague awareness, and the Uplift survived as a discrete phenomenon. Hence,