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COMMUNITY RESPONSE TO EARTHQUAKE THREAT IN SOUTHERN CALIFORNIA

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PART FOUR
AWARENESS AND CONCERN IN THE PUBLIC

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16. Abstract (Limit: 200 words)

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. Presented are conclusions about public awareness and concerns about earthquake threat. Findings are based chiefly on data gathered in a field survey of 1,450 Los Angeles County residents from January to March of 1977. Sampling procedures through which the respondents were selected and the strategy used in analyzing the data are described. Disaster experience, earthquake vulnerability, and understanding and respect for the sciences are discussed. In addition, the following questions are addressed: (1) Where do people hear about earthquake danger and earthquake safety? (2) Are southern Californians aware of the Uplift? (3) What earthquake predictions, forecasts, and cautions do people remember? (4) How seriously are earthquake announcements taken? (5) Will there be an earthquake soon? (6) How fearful and concerned are people over the earthquake threat? and (7) Do southern Californians want to hear about earthquakes?

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Part Four was written primarily by Denise Paz, with contributions by Joanne Nigg, Barbara Young, and Ralph Turner. Gerald Goetsch and Jill Kiecolt contributed extensively in the statistical analysis.

PART FOUR

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CHAPTER ONE

THE BASIC FIELD SURVEY AND THE APPROACH TO DATA ANALYSIS

Parts Four and Five of this report present the main findings concerning public awareness, communication, and action about the earthquake threat. The findings are based chiefly on data gathered in the basic field survey of 1450 Los Angeles County residents, from January to March, 1977. As a prelude to reporting the main findings we shall describe the basic survey and the strategy employed in analyzing data from the survey.

We begin the chapter by providing a brief overview of the kinds of information solicited from respondents in the basic field survey. Each set of interview questions will be specified more fully as the findings are reported. But the overview should provide the reader with a preliminary idea of the range of information available for analysis. Next we shall describe the sampling procedures through which the respondents for the basic field survey were selected. And finally we shall outline the strategy employed in analyzing the data.

The Interview Schedule

The interview schedule employed mostly closed-ended items, but also included a substantial number of open-ended questions. The information secured through the interview will be reviewed roughly in the following order: dependent variables, intervening variables, and independent variables. The grouping is only approximate since the same item can be classified differently in separate analyses. The order of discussion bears no relationship to the order of presentation in the interview.

The dependent variables concern action in preparation for earthquakes. (1) Personal preparation for an earthquake was assessed with a battery of items including a check list of steps such as storing a supply of water, and a question on thoughts about leaving the area. (2) Attitudes toward public preparation included questions about what government agencies should be doing and a judgment concerning the adequacy of steps that government officials have taken in preparation. (3) Social awareness and responsibility were assessed by questions to determine awareness of the special needs of unusually vulnerable groups and placement of responsibility for dealing with these needs. Of especial concern here is whether earthquake hazard requires community-wide action or is a matter of every family for themselves.

Intervening variables include feelings and attitudes toward the earthquake threat, understandings and beliefs about the earthquake threat, patterns of communication through which individual decisions are being reached, and attitudes toward the public release and communication of earthquake predictions and warnings. Each of the four topics involves several clusters of items.

Four clusters of feelings and attitudes were examined. (4) The schedule opened with three items to measure salience of concern with earthquakes. (5) Subsequently three questions were asked to measure fear and concern over earthquakes. It is of interest to note that although few people spontaneously mentioned earthquakes when asked the opening questions about problems of life in southern California (very low saliency), the same respondents indicated a high degree of fear of earthquakes when the subject was directly broached to them. (6) A single item assessed fear change, the extent to which concern over earthquake danger had increased or decreased during the preceding year.

(7) A six-item inventory, reworded to apply specifically to earthquake danger, was used to measure attitudes along an earthquake fatalism-mastery dimension.

The longest portion of the interview was devoted to what people had heard and understood about earthquake predictions and near-predictions, and about the causes of earthquakes. This phase of the schedule received the most attention because of the practical importance of letting scientists, public officials, and media personnel know more about how their communications are being heard, understood, and remembered. (8) A branching series of questions was used to determine the predictions heard. Initially respondents were asked if they had heard any predictions, statements, or warnings, about earthquakes in southern California during the past year or so. Interviewers probed for as many answers as possible up to a limit of five. After the initial listing and probing, interviewers took up each announcement separately and asked a series of questions concerning the source, nature, and significance of the announcement and how seriously respondents took it. This series of questions tells us a great many things in addition to how widespread the awareness of the various predictions is. For example, we shall look for confusion between different predictive announcements, as with respondents who attributed the December 20 prediction (Minturn) to a Caltech scientist (Whitcomb). It will also enable us to tell whether announcements from scientific sources receive more credence than announcements from nonscientific sources. In all instances when respondents did not mention the southern California Uplift, the interviewer specifically asked whether they have heard of the Uplift, and followed up a positive response with a similar sequence of questions about their understanding of and attitude toward the uplift.

(9) A single question was addressed to personal belief in the probability of an earthquake in the next year.

Patterns of communication include four kinds of information. (10) Questions about sources of information appeared in several parts of the questionnaire, in connection with various topics. (11) Participation in group meetings on the subject of earthquake danger was covered in a short series of items. (12) Subjects were asked with whom they discussed earthquake matters. (13) A question was included to identify opinion leaders on earthquake matters.

Three aspects of the attitude toward public release and communication of earthquake predictions were explored. (14) First was a set of questions on whether and when predictions should be released, according to the respondents' own views. (15) Who should notify the public was another question. (16) And another pair of questions asked whether scientists and/or public officials are holding back information from the public, and why.

The independent variables for the investigation are of four different kinds, namely underlying scientific and nonscientific frames of reference, prior disaster experience, vulnerability of the individual's current situation, and the place of the individual in the social structure. With the emphasis we are placing on public understanding of earthquake predictions and warnings as affecting the actions people take or advocate, underlying scientific and anti-scientific thought frameworks and attitudes take on considerable importance. (17) Following the question on belief in the probability of an earthquake in the next year, we asked the open-ended question why people believe an earthquake may occur. Answers to this question give us initial clues to respondents' thought frameworks. The most important exploration of thought frameworks follows. (18) Two open-ended questions were devised to enable us to identify the frames of reference in which earthquakes are understood. Subjects were first asked why we have earthquakes. This query was intended principally to show whether respondents thought in terms of physical causality or whether they answered with prophetic or mystical answers. In addition it gave us an opportunity to see whether respondents emphasized external forces or human intervention in nature. A second question asked directly for things that people do that increase the likelihood of earthquakes. This question dealt more directly with the second issue, but supplied further material for determining whether physical causation is assumed.

(19) A six-item inventory of forced-choice items measured general attitude toward science. (20) Interviewees were asked whether they believed scientists can predict or will be able to predict earthquakes. (21) In a companion question they were asked to identify types of nonscientists who can predict earthquakes, thus enabling us to judge whether they credit seers, prophets, and other wise persons with predictive ability as well as scientists. Of great importance for public policy in dealing with predictions is the hypothesis that people who believe that scientists can predict earthquakes also believe that nonscientists can do so, suggesting that scientific frameworks do not replace nonscientific frameworks in popular thinking but supplement them. (22) Respondents are also asked about their belief in such items of earthquake folklore as earthquake weather and animal behavior.

Prior disaster experience was covered by a battery of questions. (23) Respondents were asked about their own personal earthquake experience, including a follow-up series of items to identify the seriousness of the experience and the extent of personal involvement and loss. (24) A brief check list with follow-up items provided skeletal information about personal experience with natural disasters other than earthquakes.

(25) Vulnerability of the individual's current situation was noted through questions dealing with building construction of the residence and place of work or other building in which much time is spent. Interviewers also answered questions about the construction of the residence based on their

personal inspection.

The individual's place in the social structure involves two kinds of variables. (26) A short battery of items was used to assess personal commitment to the community. Questions dealt with length of stable residence, future plans, relatives in the area, and involvement in community activities. (27) Standard demographic and socioeconomic variables such as employment, occupation, education, age, sex, racial or ethnic identity, and religious preference completed the set.

Selection of the Sample

Two alternate sample designs were initially considered. The first was a representative sample of County residents according to the established sampling frame employed by the Survey Research Center in its biennial Los Angeles Metropolitan Area Survey (LAMAS). The design would pose the fewest problems in sample selection and would permit generalization concerning popular response in the metropolitan area. The second design would depend on selecting several specialized samples of 200 persons each with crucial independent variables in mind. The advantage of this procedure would be to insure sufficiently large numbers of cases having requisite characteristics for testing certain key hypotheses. Such a design, however, would have precluded generalization about the population of the County or testing relationships other than those explicitly incorporated into the sampling design.

We concluded that the representative sample of County residents would serve most of our purposes better. Not only does the representative sample enable us to provide a descriptive account of response throughout the County: it also permits a more flexible approach to data analysis in which we could often explore hypotheses and interpretations that were not thought of when the investigation was planned.

Use of the representative sample creates the risk, however, that certain analyses cannot be conducted because too few respondents fall into the sample from critical categories. Preliminary estimates indicated that too few Blacks might fall into the sample for us to make an adequate set of ethnic and racial comparisons. It also seemed unlikely that we would secure enough respondents from the damage area of the 1971 San Fernando-Sylmar earthquake to explore the effect of living in that area of the city. Hence we oversampled for Blacks and residents of the damage area. The oversampled respondents were not included in the 1450 basic survey respondents, but were reserved for special analysis. They are not included in any of the analyses reported in Parts Four and Five. The oversampling procedure is described in connection with the report of findings from these special analyses in Parts Six and Eight. The following description of the sampling procedure applies only to the County-wide representative sample of 1450 adults.

The Los Angeles Metropolitan Area sampling frame contains approximately 20,000 computer-readable addresses sampled from the county on a probability selection basis. Samples from the frame may be characterized as probabilities-proportional-to-size three-stage samples. The first step in constructing the 1976 frame was to obtain recent estimates of numbers of housing units in each census tract to serve as sampling measures-of-size. This was accomplished by making adjustments to the 1970 Census counts using County Regional Planning data derived from building starts and demolitions. In the first-stage, 108 primary sampling units or census tracts were selected and stratified by geographical area, racial and ethnic mix, and lifestyle characteristics. Two second-stage units, typically census blocks, were sampled from each primary sampling unit. The third-stage units are housing units, which are sampled from blocks independently for each survey that utilized the frame. This sampling procedure assures each housing unit in the county an equal probability of being selected.

One adult member of each selected houshold was interviewed. In order to insure that selection of the respondent was random, a procedure developed by Leslie Kish (1965, pp. 398-401) was followed. On first face-to-face contact with the household the interviewer prepares a complete listing of all permanent adult household members, including their age and sex. The interviewer then assigns numbers to the members, assigning the number "one" to the oldest male, "two" to the second oldest male, and so on until all males have been numbered; then assigning the next consecutive number to the oldest female and continuing until all have been numbered. A unique computer-generated label provided for each interview schedule indicates to the interviewer, depending upon the number of eligible adults in the household, which one is to be interviewed. At that point the interviewer either commences the interview with the selected respondent or makes arrangements to return when the respondent is available. In this way, although the selection is biased toward members of smaller households, the final sample is a random sample of adult residents from a random sample of households in Los Angeles County.

The Strategy for Data Analysis

The reader is reminded that the investigation was guided by the assumption that public announcement and discussion of the southern California Uplift, as a scientific earthquake near prediction, created a situation that was novel in American experience, but likely to be repeated in the future. Consequently there was a great deal to be learned simply about how people were responding to the situation. A sophisticated theory-testing research design would have been premature until the general response was characterized descriptively.

Consequently, although most of the detailed steps in data analysis were informed by hypotheses from the wide range of literature reviewed in Part One of the report, the general strategy was inductive. A carefully executed case study seemed the most useful product the investigators could supply to potential users of the research findings.

The inductive strategy was executed through data analyses at four levels of complexity. The first level was simple description. How frightened and concerned were people over the earthquake threat? How much of an impression have announcements of the southern California Uplift made on the public? In how many households have children been instructed on what to do in case of an earthquake? This kind of descriptive analysis, usually downplayed or skipped entirely when theory testing is the prime objective, is of paramount importance when the situation under investigation is without a close parallel in prior documented experience. We shall not slight the descriptive level in the analysis to follow.

The second level for data analysis consisted of identifying simple relationships. Are older or younger people more aware of the earthquake threat, or does age make any difference at all? Is greater personal preparedness for an earthquake associated with greater awareness of the Uplift, or are they unrelated? Does prior experience with destructive earthquakes signify greater awareness of the current threat?

The third level of data analysis was a search for simple integrative models of relationships. At this level the data analyst set out to identify the set of variables that would best explain or predict a key dependent variable. For example, we looked for a simple model to explain or predict variations in awareness of the Uplift. This involves, first, locating all of the simple relationships (level two) in which one of the variables was awareness of the Uplift. After assembling the simple relationships, we know that many of them are redundant. For example, both age of respondent and the presence or absence of children in the household are associated with awareness of the Uplift. Because age of respondent and the presence or absence of children in the household are also associated, we know that these two relationships are at least partially giving us the same information twice. The objective at this level of data analysis is therefore to locate the smallest number of independent variables that will provide us with the maximum prediction or explanation of awareness of the Uplift, or whatever dependent variable we are studying.

The fourth level of data analysis is an elaboration of the third level in which we introduce intervening variables between independent and dependent variables. For example, if young respondents with children are less aware of the Uplift than older respondents without children in the household, it may be because the latter have more time to listen to televison reports, read newspapers, and discuss current events with neighbors and friends. The assumption here is that parental responsibilities affect exposure to information and exposure to information in turn affects awareness. The goal of the fourth level of analysis is to develop a model that supplies a comprehensive explanation for variations in awareness of the Uplift, incorporating both direct and indirect relationships.

The descriptive level. The first task in our data analysis was to determine the basic distribution for each of the variables. This was accomplished by examining simple frequencies and percentage distributions and by obtaining descriptive statistics (mean, range, and standard deviation) for the total sample and for important subgroups.

Certain items were then grouped to form a number of indices. In certain cases the internal structure of the variables justified use of a Gutman scale format. For example, twelve variables were originally selected for possible inclusion in a community attachment index. A correlation matrix was constructed. Variables with negative or non-significant correlations were eliminated, resulting in a six-item index which included questions on length of residence in the local community, thinking ofthe local community as one's home, having relatives and friends in the immediate area, participating in local groups and organizations, and considering it unlikely that one will move from the immediate area in the next five years. A Guttman scale analysis was computed to determine the index's internal consistency. The coefficient of reproducibility was sufficiently high to indicate the clustering of items into a single universe of content. In addition, a factor analysis was run on the six items using a minimum residual factor program. This computation resulted in an unrotated, single factor solution, indicating that the six items were homogeneous and reflected a single dimension of community attachment.

In other cases simple summated indices were constructed. For example, in our basic inquiry on earthquake predictions and cautions heard during 1976, respondents were given the opportunity to mention up to five predictions, forecasts, or other announcements. Individuals who did not remember hearing any announcements were given a score of zero on the index, while a value of one was given for each prediction mentioned, resulting in an index which ranged from zero to five.

In some instances we were interested in identifying types of responses. An example is provided by the prediction belief typology. Responses to a battery of questions dealing with the ability of scientists and nonscientists to predict earthquakes accurately and personal reliance on folk signs to foretell the occurrence of earthquakes were used as the basis for this classification. Four types were created. People who believe that scientists will be able to predict earthquakes somewhat or quite accurately in the future or can do so quite accurately now, but reject all other predictors and folk signs except animal behavior, are called the strictly scientific. People who express faith in scientific prediction but also believe in one or more other ways of predicting have been called believers. These are people who combine faith in science with faith in nonscience in their view of earthquake prediction. The anti-scientific are those who do not believe in the future of scientific prediction, but accept some other kind of predictor. And the skeptics are those who reject both scientific and nonscientific prediction capabilities.

Identifying simple relationships. After completing these preliminary steps in the analysis we began to test for relationships and differences among variables with simple cross tabulations, inspection of resulting percentage distributions, Chi-squares, and gamma coefficients of relationship. Where relationships were substantial enough to warrant more sophisticated analysis, Pearson coefficients of linear correlation were used and, when curvilinearity was marked, correlation ratios.

Identifying simple and complex models. For more complex analysis, we employed multiple regression. Multiple regression allows the researcher to study the linear relationship between one or more independent variables and a dependent variable while taking into account the interrelationship among the independent variables. The basic goal of multiple regression is to produce a linear combination (a weighted sum) of independent variables that will correlate as highly as possible with the dependent variable (Nie, et. al., 1975:8). Regression analysis supplies two important kinds of information. First, the regression coefficients can be used to assess the importance of each independent variable in predicting the dependent variable. Second, the multiple R^2 can be used to indicate the proportion of the variance in the dependent variable accounted for by the linear combination of the independent variable (Winkler and Hays, 1975:643-699).

For each dependent variable the regression model relied upon was recursive and additive--the casual ordering proceeded from background to intervening to dependent variables and consideration was only given to main (additive) effects of each independent variable, rather than also considering effects given by certain (multiplicative) combinations of the independent variables.

Our choice of which variables to enter into a particular regression model was aided by the following procedures: (a) defining sets of predetermined variables that are thought to relate theoretically to the dependent variable of interest (e.g., a demographic set, an earthquake awareness set, etc.); (b) determining an hypothesized causal ordering of each set, i.e., which sets are considered as either background or intervening in affecting the dependent variable; (c) regressing the intervening variables on the dependent variable to isolate those variables which had effects of appreciable magnitude (of, say, .10 or better), and which fell within the boundaries of chance. The same treatment was given to the retained variables and the background variables, in which case the intervening variables were taken as dependent variables.

It is often the case in regression analyses that only a small number of variables account for a majority of the variance in the dependent variable. However, it is often possible to increase the amount of explained variance substantially by entering into the regression model a large number of variances which each effect the dependent variable to only a small degree (e.g., less than .10), but which also reach an acceptable level of significance. Our strategy was to isolate the smallest set of variables which accounted for the largest amount of explained variance.

With procedures a through c, the larger sets of predetermined variables were trimmed to include only those which made appreciable contributions in explaining the variance of the dependent variables. But, the only effects considered thus far were direct effects, and the possibility that one or the other background variable might have an indirect effect via some intervening variable had been neglected. This possibility was handled by: (d) regressing the smaller sets of variables on both the intervening and background variables, including first the intervening variables and then the background variables together with the intervening variables. At this final step in the procedure, direct effects of both background and intervening variables on the dependent variable were determined, as well as whatever indirect effect a particular background variable had on the dependent variable considered.

Outline of Part Four

We began Part Four of the report by providing the reader with a brief overview of the basic field survey and the strategy employed in analyzing the data. Chapter Two provides a description of the characteristics of the respondents who fell into the sample, including demographic characteristics and prior orientations.

Prior disaster experience and the vulnerability of the individual's current situation are likely to have an impact on present awareness and concern over the earthquake prospect. Chapter Three examines the respondents' past earthquake experience and their current vulnerability to earthquake hazards.

The remainder of Part Four deals with substantive issues regarding awareness and communication about the earthquake threat. Chapters Four and Five deal with two special aspects of the response to earthquake hazards.

In Chapter Four we ask what confidence people place in scientific earthquake prediction and in less scientific forms of earthquake forecasting, and what are their more general attitudes toward science. In Chapter Five we ask where people look for information about the earthquake threat, and how they make up their minds about the danger and about actions to be taken. We assume that orientations toward science and communication patterns will help to determine awareness and action in response to the current earthquake threat.

Chapters Six and Seven begin by asking the simple question, to what extent are people aware of the southern California Uplift and of the various predictions, near predictions, forecasts, and cautions concerning possible earthquakes in the near future? But awareness of predictions does not insure that the earthquake threat will have personal meaning for the individual. In Chapter Eight we examine how seriously earthquake announcements are taken by various segments of the public.

Regardless of what specific announcements people remember or take seriously, are most people convinced that a serious earthquake is on its way? In Chapter Nine we examine public expectations and attempt to see whether they are related to events of 1976.

An appreciation of the public state of mind requires that we also know how people feel about earthquake hazard. To what extent are people preoccupied with the earthquake prospect and to what extent are they concerned and fearful of earthquakes? These questions are explored in Chapter Ten. An important indicator of the public state of mind, and of great practical importance to those who communicate with the public, is public receptiveness toward information about the earthquake hazard. Do people want to be kept informed, or would they prefer to be sheltered from anxiety-provoking communications? Chapter Eleven is devoted to these questions.

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CHAPTER TWO

CHARACTERISTICS OF THE SAMPLE POPULATION AND BACKGROUND INDICES

Before we begin to explore differences in public perception and response to the earthquake threat we will provide the reader with a brief description of the characteristics of the sample population. We shall begin with demographic characteristics and conclude with values and patterns in the social life of the community that seem relevant to earthquake response.

Personal Characteristics and Values

Age, ethnicity, and household composition. There are more women than men in the sample, though the 58 to 42 percent division is not so imbalanced as to leave male attitudes unexpressed.

People over thirty-three years of age comprise over half of the sample population (Table 1). Over a quarter of the respondents are in the 34 to 50 year category and almost a third of the respondents are over fifty years of age. A total of ten percent of the people interviewed are over the age of sixty-five. Younger respondents may be underrepresented in the sample. Twenty-two percent of the sample are between the ages of 26 and 33, and only 18.6 percent are under twenty-six years of age.

Ethnic differences are substantial and may be important as we interpret later findings (Table 2). White Anglos comprise 66 percent of the sample population. Blacks and Mexican Americans have about equal representation in the sample, comprising 12.5 percent and 13 percent of the sample, respectively.

Household composition may be particularly relevant in explaining response to earthquake threat. The sample produced almost equal proportions

TABLE 1

AGE DISTRIBUTION OF RESPONDENTS

Age of Respondent	Frequency	Percent
17-25 years	269	18.6
17-20	93	6.4
21-23	96	6.6
24-25	80	5.6
26-33	321	22.1
26-28	135	9.3
29-30	89	6.2
31-33	97	6.6
34-50	380	26.2
34-37	121	8.3
38-44	135	9.3
45-50	124	8.6
51-90	475	32.8
51-57	157	10.8
58-65	173	12.0
66-90	145	10.0
No answer	5	.3
Total	1450	100.0

TABLE 2

ETHNICITY OF RESPONDENTS

Ethnicity	Frequency	Percent
White Anglo	959	66.1
Mexican American	188	13.0
Black	181	12.5
Other	122	8.4
Total	1450	100.0

TABLE 3

MARITAL STATUS AND HOUSEHOLD COMPOSITION OF RESPONDENTS

Personal or Household Characteristic	Frequency	Percent
Marital status		
Married	744	51.3
Single	706	48.7
Total	1450	100.0
Adults in household		
One	506	34.9
Two	759	52.4
Three	128	8.8
Four or more	57	3.9
Total	1450	100.0
Children in household		
None	850	58.6
One	216	14.9
Two	211	14.6
Three	99	6.8
Four or more	74	5.1
Total	1450	100.0
School children in household		
None	955	65.9
One or more	495	34.1
Total	1450	100.0

of married (51.3 percent) and single (48.7 percent) respondents (Table 3).

Whether the respondent is married or not tells us little about the nature of the household. The number of adults in the household and the number of children in the household will tell us more about the household composition. The majority of people in the sample (52.4 percent) live in households with two adults. A third of the respondents live in single adult households. Relatively fewer people (12.7 percent) in the sample live in households with an extended family consisting of more than two adults.

The majority of households sampled have no children. Among households with children, one or two children appears to be the norm. Relatively few people (11.9 percent) have more than two children living in the household. The presence of school children in the household is often thought to increase linkages to the neighborhood and community as well as to increase one's access to interpersonal communication networks. Only 34 percent of the respondents live in households with school children, leaving the majority of people in the sample without this potential linkage.

The question "Who is considered head of this household?" was included in the interview as an aid to establishing the socioeconomic standing of the household. The majority of people in the sample (62.4 percent) maintain a traditional orientation toward the family and identify a male as head of the household (Table 4). Over a quarter of the respondents identify a female as head, while the remainder (8.7 percent) choose not to identify anyone as the head.

In order to provide a more comprehensive characterization of the household, we grouped households into types according to the number of adults, presence or absence of children, and sex of head. In households with more than one adult we have combined instances in which the head is explicitly

TABLE 4

HOUSEHOLD COMPOSITION

Household composition	Frequency	Percent
Head of household		
Male head	905	62.4
Female head	419	28.9
Head not designated	126	8.7
Total	1450	100.0
Adult-only household		
One person, male	162	11.2
One person, female	249	17.2
Two persons, head not explicitly female	316	21.8
Two persons, head explicitly female	40	2.8
Three or more persons, head not explicitly female	71	4.9
Three or more persons, head explicitly female	12	.8
Adult and child(ren) household		
One adult, male	4	.3
One adult, female	91	6.3
Two adults, head not explicitly female	376	25.9
Two adults, head explicitly female	27	1.9
Three or more adults, head not explicitly female	95	6.6
Three or more adults, head explicitly female	7	.5
Total	1450	100.0

male and instances in which no one is designated as head. The category "Female head" includes only those households in which the respondent explicitly designated a female as head.

Among adult-only households, there is a greater proportion of females who live alone than males. However, males are more commonly the head of the household among adult-only households with two or more adults. This pattern characterizes one in five households in the sample. Likewise, male-headed households are the preponderant pattern among households with children. One One in four households consists of children, a male head and one other adult. When there are children, the household is rarely female-headed, except when the female is the only adult. Few households consist of two or more adults with children. This living arrangement is even less prominent with a female as head.

Social Class and Economic Status

Differences in educational attainment may be crucial in understanding reports of near predictions and the significance of the earthquake threat. The majority of respondents have no formal education beyond high school. One in three is a high school graduate and one in four has less than a high school education (Table 5). Twenty-six percent of the people in the sample have completed some college work, while only eighteen percent have actually completed a college education.

The distribution of household income indicates that the median income for respondents in the sample is between \$12,000 and \$19,000 per year (Table 6). Over half of the households sampled earn less than \$19,000 per year. Twenty-three percent of the households sampled earn less than \$6,000 a year. A quarter of the respondents are concentrated in the middle (\$6,000-\$11,999) and high income brackets.

TABLE 5

LEVEL OF EDUCATIONAL ATTAINMENT

Educational attainment	Frequency	Percent
Less than high school	373	25.8
High school graduate	437	30.1
Some college	376	25.9
College graduate	261	18.0
No answer	3	.2
Total	1450	100.0

TABLE 6

HOUSEHOLD INCOME OF RESPONDENTS

Household income	Frequency		Percent	
Broad Categories				
Less than $6,000	300		20.7	
$6,000-11,999	331		22.8	
$12,000-19,999	349		24.0	
$20,000 and over	314		21.7	
No answer	156		10.8	
Total	1450		100.0	
Detailed Categories				
Less than $6,000	300		23.2	
Under $3,000		79		6.1
$3,000-5,999		221		17.1
$6,000-11,999	331		25.6	
$6,000-7,999		145		11.2
$8,000-11,999		186		14.4
$12,000-19,999	349		27.0	
$12,000-13,999		114		8.8
$14,000-16,999		137		10.6
$17,000-19,999		98		7.6
$20,000 and over	314		24.2	
$20,000-24,999		107		8.3
$25,000-29,999		84		6.5
$30,000-39,999		73		5.6
$40,000 or more		50		3.8
Total	1294	1294	100.0	100.0

Household income alone may be a poor indicator of economic sufficiency, therefore we computed separate tabulations, taking into account size and composition of the household. First, we will look at the number of people contributing to the household income (Table 7). The largest proportion of households in the sample have only one wage earner (45 percent). Nearly a third of the households have two or more wage earners and twenty-three percent of the households have no one contributing earned income. Another indicator of socioeconomic status is work status and level of income. Half the respondents in the sample work full time.

Respondents were also asked how many adults and children, including themselves, are dependent on the family income. Over half the households sampled divide the income among one or two people. From 15 to 16 percent of the households divide the income among three, four, or five or more household members (Table 7).

A modified version of the estimates of income required for an adequate standard of living in 1976, devised by the Bureau of Labor Statistics of the US Department of Labor, was used in preparing an adjusted income figure for each household, based on need. We first translated the income standard for each combination of children under six years of age and adults plus children six years old and over into a proportion of the median income standard for all types of households. This proportion ranged from .326 for the single adult living alone, indicating that the single adult needed only one third the income of the median household, to 1.348 for the six-or-more person household in which three or fewer of the members were children under six years of age. We then simply divided the reported household income by the appropriate income standard decimal, dropping the last two digits. The resulting <u>income adequacy</u> index is simply household income inflated or deflated according to an estimate of need.

TABLE 7

SOCIAL AND ECONOMIC STATUS

Status variable	Frequency	Percent
Work status		
Working full time	752	51.9
Not working full time	698	48.1
Total	1450	100.0
Number earning income		
None	336	23.2
One	653	45.0
Two or more	461	31.8
Total	1450	100.0
Adults and children dependent on household income		
One	431	28.5
Two	357	24.6
Three	217	15.0
Four	214	14.8
Five or more	236	16.2
No answer	13	.9
Total	1450	100.0

Employing this procedure, we converted a reported household income of $15,000 a year for a household consisting of two adults and two children over five years old into an income adequacy index of 158 by dividing the reported income by .948 and dropping two digits. The index places them in the low medium income adequacy bracket (Table 8). The same $15,000 income for a family consisting of two adults and two children under six years of age would be divided by .727, producing an index value of 206. This household would then fall into the high medium income adequacy bracket. A single adult earning $40,000 would receive an index of 1227, and two adults without children earning the same income would receive an index of 726, placing both households in the high income adequacy bracket. As adjusted income values, the index scores for small households are probably unduly inflated, but the rank ordering is probably reasonably fair. Consequently, we shall employ the collapsed ordinal categories rather than the absolute index values when relating other variables to income adequacy. These categories should provide a more sensitive indicator of disposable family income than either gross household income or simple per capita income.

Perhaps the best general indicator of social and economic status is the socioeconomic rating of one's occupation. The occupation of the head of the household was used to determine the socioeconomic status of the household. The occupation of the household head was classified according the Featherman revision of the Duncan scale to fit 1970 Census occupational categories. The occupational rankings range from a low of 1 to a high of 96. Over half the respondents have occupational rankings ranging from 5 to 44 (Table 9). Nearly twelve percent of the respondents received scores equal to 44. Eleven percent received scores equal to 62. Only sixteen percent of the people surveyed have occupational rankings ranging from 63 to 96.

TABLE 8

HOUSEHOLD INCOME ADEQUACY

Income adequacy	Frequency		Percent	
Low (1-100)	324		22.3	
1-37		109		7.5
38-68		104		7.2
69-100		111		7.6
Low medium (101-197)	333		23.0	
101-126		113		7.8
137-167		105		7.2
168-197		115		8.0
High medium (198-336)	327		22.5	
198-236		99		6.8
237-278		102		7.0
279-336		126		8.7
High (337-1840)	310		21.4	
337-408		115		8.0
409-556		93		6.4
557-1840		102		7.0
No answer	156		10.8	
Total	1450		100.0	

TABLE 9

OCCUPATIONAL STATUS

Duncan Scale scores	Frequency		Percent	
Range 05-19	398		27.4	
05-14		113		7.8
15-17		146		10.0
18-19		139		9.6
20-44	395		27.3	
20-32		123		8.5
33-43		104		7.2
44		168		11.6
45-62	380		26.2	
45-51		116		8.0
52-61		106		7.3
62		158		10.9
63-96	241		16.6	
63-68		67		4.6
69-76		91		6.2
77-96		83		5.8
No answer	36		2.5	
Total	1450		100.0	

TABLE 10

LENGTH OF RESIDENCE IN SOUTHERN CALIFORNIA

Length of residence	Frequency		Percent	
Years 11 or less	349		24.0	
Less than a year		27		1.8
1-5 years		157		10.8
6-11 years		165		11.4
12-23	462		31.9	
12-17 years		205		14.1
18-23 years		257		17.8
24-33	324		22.3	
24-28		180		12.4
29-33		144		9.9
34 or more	313		21.6	
34-39		103		7.1
40-50		113		7.8
51 or more		97		6.7
No answer	2		.2	
Total	1450		100.0	

TABLE 11

LENGTH OF RESIDENCE IN THE LOCAL COMMUNITY

Length of residence	Frequency	Percent
In local community		
2 years or less	391	27.0
3-7 years	374	25.8
8-17 years	352	24.2
18 years or more	332	22.9
No answer	1	.1
	1450	100.0

Length of residence. A final set of demographic variables was used to assess the length of residence in southern California and the local community. Relatively few people have lived in southern California for less than a year (Table 10). If we use 1971, the year of the San Fernando quake, as the cut-off point we find that eighty-seven percent of the respondents were living in southern California at the time of the quake. On the whole the vast majority of people in our sample are long-time residents of southern California.

However, when we examine length of residence in the local community a different pattern emerges (Table 11). Twenty-seven percent of the people in the sample have lived in their local community less than two years. Another 26 percent have lived in the community from 3 to 7 years. While most people are long-time residents of southern California, they are relatively mobile with respect to residence in communities within the southern California area.

Attachment to the Local Community

In addition to length of residence in the community, we were interested in determining how strongly people are attached to the local community. We constructed an index of community attachment which includes the feeling that the local community is one's real home, personal and family involvement in the social life of the community, and length of residence in the community. An index ranging from 2, for people with no formal or informal attachments and less than twenty-one months in the community, to 21, for people with membership in several groups plus thirty-one years residence in the community was used to assess community attachment.

The majority of respondents received scores ranging from 7 to 12 on the index. Nearly twenty-four percent of the respondents received scores of less than 7. Only twenty percent of the sample received scores ranging from

13 to 21, indicating that a small proportion of respondents have a high attachment to the community. By examining each of the questions which are included in the index, we can get a clearer picture of the subjective and objective measures of community attachment. Since we already discussed length of residence in the local community we need not review it here.

A second component of the index assesses subjective feelings about one's community. Respondents were asked the name of the community where they lived, and then asked:

> Do you think of (. . .) NAME OF COMMUNITY as your real home, the community that is important to you, or is it just a place you happen to be living in now?

Seventy percent of the respondents identified their community as their real home (Table 12).

Next we examined several measures of group participation. One question assesses informal group involvement in the community. Respondents were asked the proportion of their friends who lived within a three-mile radius of their home. The majority of respondents (54.7 percent) have none or a few friends who live within a three mile-radius. We also asked respondents to indicate the number of formal organizations--social, religious, and political groups--they are involved in within a three-mile radius of their home. Nearly half the respondents do not belong to any local organizations. Among people who belong to formal groups, most belong to only one group. More people are linked to the local community through friendships than through organizations and groups and only one quarter of the respondents are linked by more than one group involvement (Table 12).

Attachment to the local community was also examined in terms of long-term housing arrangements. Respondents were asked whether they or another family member owned their home. The distribution of homeowners and non-owners is almost equal. The 47.5 and 52.5 split indicates a slightly greater propor-

TABLE 12

COMMUNITY ATTACHMENT

Form of community attachment	Frequency	Percent
Index of community attachment		
Low (2-6)	341	23.5
Low medium (7-9)	410	28.3
High medium (10-12)	403	27.8
High (13-21)	283	19.5
No answer	13	.9
Total	1450	100.0
Group involvements		
None	686	47.3
One	382	26.4
Two	173	11.9
Three or more	209	14.4
Total	1450	100.0
How likely to move within 5 years		
Definitely move	274	18.9
Probably move	376	25.9
Don't know	73	5.1
Probably not move	427	29.4
Definitely not move	300	20.7
Total	1450	100.0
Home ownership		
Owner-occupied	689	47.5
Not owner-occupied	761	52.5
Total	1450	100.0
Friends in a 3 mile radius		
None	225	15.5
A few of them	569	39.2
Some of them	293	20.2
Most or almost all of them	358	24.7
No answer	5	.4
Total	1450	100.0
Community as a:		
Real home	1011	69.7
Just a place	432	29.8
No answer	7	.5
Total	1450	100.0

TABLE 13

RELIGION

Religion	Frequency	Percent
Importance of religion		
Very important	641	44.2
Important	417	28.8
Fairly unimportant	133	9.2
Not important at all	47	3.2
No preference and no answer	212	14.6
Total	1450	100.0
Religious preference		
Protestant	698	48.1
Catholic	448	30.9
Jewish	78	5.4
Other	29	2.0
None	198	13.6
Total	1450	100.0
Protestant denomination		
Congregational, Disciples of Christ, Episcopalian, Lutheran, Methodist, Presbyterian	292	41.9
Baptist	187	26.8
Pentecostal	60	8.6
Latter Day Saints	21	3.0
Christian Science, Science of Mind, Religious Science	23	3.3
Nondenominational, Unspecified, Other	114	16.4
Total	1450	100.0

tion of people do not own their homes. Finally, we asked people how likely it is they will move from their community within the next five years. The majority of respondents indicate they will probably not or definitely not move within the next five years. One in five respondents indicates he or she will definitely move and one in four says he or she will probably move.

Group values. The overwhelming majority of respondents say that religion is "very important" in their lives (Table 13). The respondents are more heterogeneous with respect to religious preference. The majority give Protestant as their preference, one in three is Roman Catholic, one in eight claims no religious preference and one in twenty is Jewish.

The majority of protestants belong to the most conventional denominations. A large proportion of protestants belong to the Baptist Church or do not specify a denomination.

Summary

The sample is composed of almost equal proportions of females and males. Over half of the people in the sample are over thirty-eight years of age. There are more White Anglos than either Mexican Americans or Blacks in the sample. Married and single respondents are also equally represented. The majority of people in the sample live in households with two adults without children. Males are named head of the household by a majority of respondents.

In terms of socioeconomic status, the majority of people in the sample have no formal education beyond high school. The median income is between \$12,000 and \$19,999. Nearly half of the households have only one wage-earner. Typically there are one or two people dependent on the family income. On the average people in the sample are long-term residents of southern California but have lived in their local community for less than seven years.

Most people describe their community as their real home and few people expect to move within the next five years. While the respondents are characterized by religious hetereogeneity, most agree that religion is important in their daily lives.

CHAPTER THREE

DISASTER EXPERIENCE AND EARTHQUAKE VULNERABILITY

The most directly relevant independent variables in conceptualizing the problem of response to earthquake near predictions are measures of past experience with earthquakes and present vulnerability to earthquake damage. While the exact relationship between prior experience and response to future threat is not a simple one, there seems little doubt that past experience shapes the image people have of the disaster agent and its effect. It may be, as Kunreuther suggests (1978, p. 112) that prior experience contributes to vigilance only if the damage was relatively high, and may even foster complacency if the damage was slight. Likewise the relationship between personal vulnerability and response to threat may be complex. People may or may not recognize that theirs is a vulnerable situation. They may or may not feel that they have realistic alternatives to their vulnerable situations and they may or may not be aware of ways to protect themselves in the situation. In this chapter we shall review the various measures of prior experience and present vulnerability used in the investigation and characterize the sample in these terms.

Prior Disaster Experience

Measures of prior disaster experience used in the investigation dealt with (1) prior earthquake experience, (2) personal and property damage during these earthquake experiences, and (3) experience with other natural disaster agents.

Whether respondents have ever experienced natural disasters, and the extent of that experience, may have an important effect on their perception of future disasters and, in turn, on the precautions they take to prepare for such disasters. One might expect that personal experience would result in a heightened awareness and expectation of future disasters and preparedness for these events. However, the link between awareness of past events and future expectations appears to be more complex. For example, in studying storm hazard, Kates (1967) found that although 90 percent of his respondents had experienced prior storm disaster, with 50 percent experiencing water and wind damage, only 66 percent expected storms in the future, and only 33 percent expected future damage. He also found that only a few coastal dwellers had taken even minimal steps to reduce the hazard. He suggested that the relationship between past experience and future expectations of hazard may be strengthened or weakened by the interpretive scheme in which the hazard is placed (i.e., if the disaster event is seen as cyclical or unique; if respondents escaped serious damage in the past, they may feel the disaster agent cannot hurt them, etc.). Similarly, Burton and Kates (1964) have suggested that newcomers to a hazard-prone area often take on the shared or dominant perception of the community toward the disaster agent. Thus, it may not be the individual's actual disaster experience but that of others close to him or her that determines the effect of past experience on future expectations of disaster and on preparedness measures.

A number of different hypotheses can be suggested regarding the effect of past earthquake experience on subsequent attitudes and behavior. For instance, prior experience with earthquakes may heighten respondents' awareness of the threat of future earthquake disasters, increase their fear and, in turn, increase the possibility of taking preparedness measures. On the other hand, extensive experience may cause respondents to feel that because they have weathered earthquakes before, they can again, and that they really do not have to worry about them or prepare for them. Still another hypothesis is that those who have experienced only small, non-damaging quakes will tend to deny or disregard the real threat of earthquakes because it is foreign to their own experience. Thus, they may not be fearful, take predictions seriously, or prepare for future quakes.

Prior earthquake experience. Before we can analyze these hypotheses, we need to get a general view of the extent of prior earthquake experience of respondents. To assess this, respondents were asked a series of questions regarding their prior earthquake experience. As expected, given the history of earthquakes in southern California, the majority indicated fairly extensive experience with quakes. When asked,

> Now we would like to ask if you have ever personally experienced certain natural disasters. Have you ever been through . . . (an) earthquake?

the vast majority of respondents (92.0 percent) stated they had. These experienced respondents (n = 1333) were then handed a card with the responses "once," "2-4 times," "5 or more times" written on it. They were asked,

> Please look at this card and tell me which category best describes the number of times you have experienced an earthquake.

The largest category of respondents (45.4 percent) indicated they had experienced two to four earthquakes, with 26.2 percent stating they had experienced five or more. The large majority (71.6 percent) of respondents indicating any earthquake experience had had multiple experiences; only 27.4 percent indicated they had experienced an earthquake only once (Table 1).

These same respondents (n = 1333) were then asked,

> Thinking back to your experience(s), which of the following best describe(s) your overall feelings during the earthquake(s)? 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?

The majority of respondents (58.8 percent) stated they were either very

TABLE 1

NUMBER OF EARTHQUAKES RESPONDENT HAD EXPERIENCED

Number of earthquakes	Frequency	Absolute Percent	Adjusted Percent*
None	117	8.1	-----
One	366	25.2	27.4
2-4	605	41.7	45.4
5 or more	349	24.1	26.2
No answer	13	.9	1.0
Total	1450	100.0	100.0

* Base of 1333 used to compute adjusted percentage, those who had experienced at least one earthquake

TABLE 2

RESPONDENTS' OVERALL FEELINGS DURING EARTHQUAKE EXPERIENCES

Feelings	Frequency	Percentage
Very frightened	427	32.0
Somewhat frightened	357	26.8
Not very frightened	264	19.8
Not frightened at all	239	17.9
Enjoyed the experience	36	2.7
Don't know	1	.1
No answer	9	.7
Total	1333	100.0

* Based on 1333, the number stating they had experienced an earthquake.

TABLE 3

NUMBER OF DAMAGING EARTHQUAKES RESPONDENTS HAD EXPERIENCED

Number of quakes	Frequency	Percentage
1	748	65.4
2	271	23.7
3	77	6.7
4 or more	33	3.0
No answer	14	1.2
Total	1143	100.0

* Based on 1143, those stating they had experienced a damaging earthquake.

frightened or somewhat frightened and upset during their earthquake experience; 40.4 percent stated they were not very frightened or not at all frightened and upset, with only 2.7 percent stating they actually enjoyed the experience (Table 2).

The data indicate that the overwhelming majority of respondents had had prior earthquake experience (92.0 percent); of these, most had had multiple experiences (71.6 percent) and, again, the majority were at least somewhat frightened and upset by their experience. This information, however, only gives us a general idea of respondents' earthquake experience, without distinguishing between those who had only experienced non-damaging earthquakes and those who had personally experienced more severe quakes. To assess this, we asked the same 1333 respondents,

> Thinking about the earthquake(s) you experienced, was it/were any of these earthquakes strong enough to damage buildings and cost lives?

Of the respondents who indicated they had experienced an earthquake, 1143 or 85.7 percent stated that they had experienced such a strong quake (this comprises 78.8 percent of the total sample of 1450). To determine the extensiveness of these experiences we asked,

> How many earthquakes of this strength have you experienced in all?

Of the 1143 respondents, the majority (65.4 percent) had experienced only one. Almost one-fourth (23.7 percent) stated they had experienced two damaging earthquakes, 6.7 percent had experienced three, and 3.0 percent had experienced four or more such quakes (Table 3).

After distinguishing between general earthquake experience and experience with damaging quakes, we can look at the relationship between the number of earthquakes experienced and respondents' feelings during those experiences. Two relationships were thought to be possible. (1) Since the majority of respondents who had experienced earthquakes felt at least somewhat frightened by

TABLE 4

OVERALL FEELINGS DURING EARTHQUAKE BY NUMBER OF QUAKES EXPERIENCED

Feelings during earthquake	Number of quakes experienced		
	One	Two-four	Five or more
Very frightened	35.0	33.7	27.9
Somewhat frightened	24.2	28.3	27.9
Not very frightened	18.7	19.6	21.8
Not frightened	19.3	15.9	19.2
Enjoyed experience	2.8	2.5	3.2
Total	100.0	100.0	100.0
Total number*	363	603	348

*Table total equals 1314.

TABLE 5

OVERALL FEELINGS DURING EARTHQUAKES BY NUMBER OF DAMAGING EARTHQUAKES EXPERIENCED

Feelings during earthquake	Number of damaging quakes experienced			
	One	Two	Three	Four or more
Very frightened	35.6	31.9	35.0	37.5
Somewhat frightened	27.0	29.0	20.8	12.5
Not very frightened	20.4	18.6	20.8	25.0
Not frightened	14.7	17.5	18.2	25.0
Enjoyed experience	2.3	3.0	5.2	0.0
Total	100.0	100.0	100.0	100.0
Total number*	745	269	77	32

*Table total equals 1123 since ten respondents failed to give answers to both questions.

TABLE 6

MOST RECENT DAMAGING QUAKE EXPERIENCED

Earthquake	Frequency	Percentage
1975: Imperial Valley quake swarm	12	1.0
1971: San Fernando/Sylmar	1035	90.6
1964: Alaska	1	.1
1952: Tehachepi/Bakersfield/ Kern County	12	1.0
1940: El Centro/Imperial Valley	1	.1
1933: Long Beach/Compton	19	1.7
Other United States	31	2.7
Other foreign	29	2.5
Don't know	2	.2
No answer	1	.1
Total	1143	100.0

these experiences, we thought the more earthquakes respondents had experienced, the more likely they would be to be frightened by the experience. Here we thought that prior experience, especially with damaging earthquakes would increase respondents' anxiety and fear. (2) We also felt that a negative relationship between the number of quakes experienced and feelings during those experiences might exist. It is possible that the more earthquakes one experiences, the more routinized the experience becomes and thus the less frightened one is during the next experience. However, in analyzing the data we found that there was no relationship between the number of quakes experienced and overall feelings during those experiences. The lack of a relationship persisted regardless of whether we looked at the relationship between the number of all quakes experienced and feelings (Table 4) or the number of damaging quakes and feelings during those experiences (Table 5).

To add to the profile on respondents' experience with damaging quakes, we asked them the open-ended pre-coded question,

> Which was <u>your</u> last experience of a damaging earthquake? Can you tell me when and where it happened?

As expected, almost all of the respondents (90.6 percent) who had experienced a damaging quake (n = 1143) stated that the 1971 San Fernando quake was their most recent experience (Table 6). Next, respondents were asked,

> Can you tell me the magnitude of that last quake, that is, the Richter Scale rating?

Interviewers were instructed to ask for the respondent's best guess if he or she stated he or she didn't know or didn't remember. The largest proportion of respondents (48.1 percent) stated that the last damaging earthquake they had experienced was a magnitude 6-plus. Considering the fact that 90.6 percent of the respondents (n = 1143) had experienced the San Fernando quake, this large proportion of respondents seems to indicate the correct magnitude. The

TABLE 7

MAGNITUDE OF MOST RECENT DAMAGING QUAKE EXPERIENCED

Magnitude	Frequency	Percentage
2	5	.4
3	17	1.5
4	42	3.7
5	169	14.8
6	550	48.1
7	249	21.8
8	45	4.0
9	2	.2
10	4	.3
Don't know	54	4.7
No answer	6	.5
Total	1143	100.0

next two largest categories were 7-plus (21.8 percent) and 5-plus (14.8 percent). Although these are inaccurate answers if they refer to the San Fernando quake, they seem to suggest a general awareness of the magnitude necessary to cause damage (Table 7).

Personal and property damage in prior earthquake experiences. Two sets of questions were used to determine a respondent's experience with personal and property damage from prior earthquakes. The first set consisted of three forced-choice questions which measured respondents' own experience. The second consisted of two forced-choice questions assessing the experience of individuals close to the respondent.

First, all respondents who stated they had experienced an earthquake (n = 1333) were asked,

> Thinking again of all the earthquakes you have experienced, during any of these earthquake(s), was the home you were living in then damaged enough to need repairs?

A little fewer than one-fourth of the respondents (22.6 percent) stated their homes had sustained such damage. Next, the same respondents were asked,

> Did you have any other personal property damage during those earthquakes?

Again, only a fourth (26.0 percent) of the respondents stated that they had received other personal property damage. Finally, the respondents were asked,

> Have you ever been personally injured in an earthquake?

Here only 23 or 1.7 percent of the respondents stated they had been injured (Table 8).

In order to make a more generalized assessment of the extent of damage respondents had experienced, an index was constructed consisting of a respondent's answers to the above three questions. Each "yes" answer was given a value of one; the scores were then summed. As Table 9 indicates, a third

TABLE 8

PERSONAL AND PROPERTY DAMAGE SUFFERED BY RESPONDENT

Extent of damage	Yes	No	Not Answered	Total	Total Number
Home ever damaged requiring repairs	22.6	77.2	.2	100.0	1333
Ever received personal property damage	26.0	73.7	.3	100.0	1333
Ever been injured in a quake	1.7	97.9	.4	100.0	1333

*Base used is 1333, those who stated they had experienced an earthquake.

TABLE 9

INDEX OF RESPONDENTS' PERSONAL AND PROPERTY DAMAGE DUE TO EARTHQUAKES

	Score	Frequency	Percentage	Cumulative Percentage
No damage	0	950*	65.5	--
	1	338	23.3	34.5
	2	153	10.6	11.2
Extensive damage	3	9	.6	.6
Total		1450	100.0	

* Includes 117 respondents who had never experienced an earthquake.

TABLE 10

RESPONDENTS WHO HAD CLOSE FRIENDS OR RELATIVES
SUFFER PERSONAL OR PROPERTY DAMAGE

	Friend or relative ever injured in a quake	Friend or relative ever suffered any property damage in a quake
Yes	7.1	35.1
No	92.6	64.6
No answer	.3	.3
Total	100.0	100.0
Total number	1450	1450

(34.5 percent) of the total number of respondents had experienced at least one kind of personal or property damage. More specifically, 23.3 percent had experienced only one kind of damage, 10.6 percent had experienced two kinds, and only .6 percent experienced all three.

Next, to assess whether respondents were close to individuals who had suffered personal or property damage from an earthquake, all respondents were asked,

> Have you ever had a relative, family member, or close friend injured in an earthquake?

The overwhelming majority of respondents (92.6 percent) did not have anyone close to them who had had such an experience. However, in answer to the question,

> Has any relative, family member, or close friend ever suffered any property damage in an earthquake?

35.1 percent responded that they knew such a person (Table 10).

To summarize the responses to these last questions, an index was constructed by assigning a value of one to each "yes" answer. As Table 11 indicates, 36.2 percent of the respondents had someone close to them who had been injured in a quake and/or had suffered property damage.

Because of the widespread nature of earthquake damage, we hypothesized that respondents who had suffered personal and/or property damage would most likely have family members or close friends who had also suffered such damage. To investigate this relationship, a Pearson's correlation coefficient was computed between these two variables. The relationship was found to be highly significant (Pearson's $r = .36$, $p < .001$; see Table 12). Pursuing further the question raised initially of whether experience with earthquakes intensifies fear or fosters a blasé attitude, we looked at relationships between intimate personal or vicarious experience of earthquake loss and an index measuring fear and concern about future earthquakes. The index is based on

TABLE 11

INDEX OF OTHERS' PERSONAL AND PROPERTY DAMAGE DUE TO EARTHQUAKES

	Score	Frequency	Percentage	Cumulative Percentage
No damage	0	926	63.8	----
	1	436	30.1	36.2
Extensive damage	2	88	6.1	6.1
Total		1450	100.0	

TABLE 12

OTHERS' PERSONAL AND PROPERTY DAMAGE
BY RESPONDENTS' PERSONAL AND PROPERTY DAMAGE

Others damage index	Respondent's damage index			
	0	1	2	3
0	75.8	48.5	26.2	22.2
1	20.5	43.5	58.8	44.5
2	3.7	8.0	15.0	33.3
Total	100.0	100.0	100.0	100.0
Total number	950	338	153	9

r = .36, $p < .001$

TABLE 13

EARTHQUAKE FEAR AND CONCERN BY PERSONAL LOSS

Variables correlated	Correlation		Significance	
	r or R	r or R^2	F	P <
Fear, Self loss	.053	.0028	4.13	.05
Fear, Loss by close other	.066	.0044	6.47	.05
Self loss, Loss by close other	.355	.1264	209.43	.01
Fear: Self loss <u>and</u> Loss by close other	.073	.005	3.96	.05

three items and is explained fully in Chapter Ten. In connection with the findings already reported, the two hypothesized effects of earthquake experience may have cancelled each other out, resulting in the absence of any observable relationship. The personal consequences of an earthquake for most people do not match the first anticipations. But if we look only at the extent to which respondents have intimately experienced loss in an earthquake we should expect the intensification effect to override the blasé effect and produce a positive correlation between personal experience of loss and fear of future earthquakes. As reported in Table 13, correlations of personal loss and loss by a family member or close friend with fear of a future earthquake, measured separately or jointly, are of borderline significance and quite weak. Whether personal experience or vicarious experience is entered first, the other does not add significantly to the explained variance. The fact that there apparently is a relationship here lends modest support to the argument. The weakness of the relationship might be explained by the fact that the amount of loss for most of the positively scored respondents was still minor relative to the conception of a destructive earthquake as a major disaster.

Experience with other natural disasters. Finally, it is important to assess respondents' experience with other natural disasters in order to understand the effects these experiences may have on their awareness, fear, and sense of vulnerability to such natural events--in our case, to earthquakes. It may be, for instance, that extensive experience helps contribute to a heightened awareness of natural disasters and their potential danger. On the other hand, extensive experience may help to generate an attitude of invulnerability--an attitude that one has weathered many disasters and that earthquakes pose no special threat.

In order to assess the diversity of other natural disasters respondents had personally experienced, we asked,

> Now we would like to ask if you have ever personally experienced certain natural disasters. Have you ever been through any of the following: hurricane or typhoon, tornado or cyclone, flood, tsunami or tidal wave, or any other natural disasters?

TABLE 14

OTHER NATURAL DISASTERS RESPONDENTS HAVE EXPERIENCED

Disaster agent	Frequency	Percentage*
Hurricane/Typhoon	303	20.9
Tornado/Cyclone	313	21.6
Flood	246	17.0
Tsunami/Tidal wave	26	1.8
Other Natural Disaster		
Snow storm	27	1.9
Landslides	1	.1
Volcanic eruptions	5	.3
Fires	27	1.9
Electrical storms	3	.2
Other (unspecified)	16	1.1
Total	967**	

* Base used is the total sample of 1450

** Reflects multiple answers

TABLE 15

NUMBER OF TIMES RESPONDENT HAD EXPERIENCED EACH DISASTER AGENT

Number of times experienced	Disaster agent				
	Hurricane/ Typhoon	Tornado/ Cyclone	Flood	Tsunami/ Tidal Wave	Other
Once	46.5	46.0	53.7	80.8	48.1
2-4 times	32.7	36.4	31.7	11.6	26.6
5 or more times	16.8	15.4	13.8	3.8	21.5
No answer	4.0	2.2	.8	3.8	3.8
Total	100.0	100.0	100.0	100.0	100.0
Total number	303	313	246	26	79

TABLE 16

RESPONDENTS' OVERALL FEELINGS DURING NATURAL DISASTER EXPERIENCES

Category label	Disaster agent				
	Hurricane/ Typhoon	Tornado/ Cyclone	Flood	Tsunami/ Tidal Wave	Other
Very frightened	26.4	33.5	23.2	38.5	31.7
Somewhat frightened	22.1	28.8	21.5	7.7	15.2
Not very frightened	18.5	16.3	21.5	15.4	25.3
Not frightened	18.8	11.5	24.8	26.9	17.7
Enjoyed experience	10.3	5.8	6.1	7.7	6.3
Don't know	.3	.3	.8	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0
Total number	303	313	246	26	79

As Table 14 indicates, the respondents had experienced a variety of disasters. The largest category were those who had experienced a tornado or cyclone, (21.6 percent). This category was followed by those stating they had experienced a hurricane or typhoon (20.9 percent), and those who had experienced a flood (17.0 percent).

Next, respondents were handed a card with the following responses: "once," "2-4 times," "5 or more times," and asked to indicate the number of times they had experienced each disaster they had mentioned in the previous question. Looking at Table 15, we can see that the largest number of respondents who had experienced a particular type of disaster indicated that they had only experienced it once. Approximately one-third of all respondents who had experienced a hurricane, tornado, or flood indicated that they had experienced the disaster agent two to four times.

Finally, we wanted to assess respondents' general feelings during each type of disaster they experienced. We asked,

> Thinking back to your experience(s), which of the following best describe(s) your overall feelings during the (. . . hurricane, etc.)? 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?

Generally, for each disaster agent except tornadoes and cyclones respondents were almost evenly divided between those who were very or somewhat frightened and those who were not very or not at all frightened (hurricanes, 48.5 percent to 37.3 percent; tornadoes, 62.3 percent to 27.8 percent; floods, 44.7 percent to 46.3 percent; tsunamis, 46.2 percent to 42.3 percent; and other disasters, 46.9 percent to 43.0 percent). Looking at those who stated they actually enjoyed the experience, the largest group were those who enjoyed experiencing a hurricane (10.3 percent), followed by tsunamis (7.7 percent), other disasters (6.3 percent), floods (6.1 percent), and tornadoes (5.8 percent, Table 16)

TABLE 17

NUMBER OF DIFFERENT TYPES OF NATURAL DISASTERS RESPONDENTS EXPERIENCED

Number		Frequency	Percentage
0		836	57.7
1		346	23.9
2		192	13.2
3		67	4.6
4		9	.6
	Total	1450	100.0

In order to summarize the data on respondents' experience with other natural disasters, an index was constructed combining the number of different types of natural disasters (excluding earthquakes) respondents had experienced (Table 17) and the number of times they had experienced each. As indicated in Table 18, 58.3 percent had never experienced a natural disaster (excluding earthquakes); 14.0 percent had had only a single experience. The group with moderate experience (17.7 percent) included those who had experienced two or three types of disasters one time each, those who had experienced one disaster two or more times, and those who had experienced one disaster agent two to four times and another disaster agent only once. Finally, 10.0 percent of the sample had considerable experience. This included respondents who had experienced more than one disaster agent two or more times each.

General Purpose Indexes of Earthquake Experience

Answers to several questions were combined to create an index that we call extent of earthquake experience. We have used this index wherever a general measure of earthquake experience was needed throughout the investigation. The component items are not treated summatively, as in most indexes. Instead, they are used to supply information necessary to classify each case into an ordered typology. A score of zero is assigned to all respondents who have not experienced an earthquake. A score of one is assigned when respondents have experienced one or more earthquakes, but none of the quakes was "strong enough to damage buildings and cost lives." A score of two is assigned to respondents who have experienced one or more damaging quakes, but have not personally suffered property damage or injury in an earthquake. And the highest score of three is assigned if respondents have personally suffered either property damage or injury in an earthquake. Thus the index

TABLE 18

INDEX OF RESPONDENTS' EXPERIENCE WITH NATURAL DISASTERS OTHER THAN EARTHQUAKES

Extent of experience	Frequency	Percentage	Cumulative Percentage
None	836	58.3	----
Single	201	14.0	41.7
Moderate	254	17.7	27.7
Considerable	142	10.0	10.0
Total	1433*	100.0	

* Seventeen cases were not included because of missing values.

measures the quality or intensity rather than simply the amount of experience with earthquakes. All but five of the 1450 respondents in the basic field survey sample supplied enough information for us to classify them. The distribution of cases was as follows: zero, 8.1 percent; one, 12.9 percent; two, 45.5 percent; three, 33.5 percent. In retrospect there were undoubtedly too many people in the third category who had suffered fairly trivial damage, and the index might have been more discriminating had we included a further distinction between minor and major damage.

A second general purpose index was developed that was often a more powerful predictor of various responses than the extent of earthquake experience index. The earthquake damage index is a measure of damage or injury from an earthquake experienced either personally or by a "relative, family member, or close friend." This index is summative. Five items calling for simple "yes" and "no" answers, as summarized in Tables 8 and 10, are combined to produce a score that can range from zero for no intimate experience with earthquake damage to five for intense intimate experience with earthquake damage. In effect this index combines the two indexes already summarized in Tables 9 and 11, on the assumption that damage or injury experienced vicariously within one's primary groups is often equivalent to damage or injury experienced personally. The distribution of all 1450 cases by index values is as follows: zero, 49.7 percent; one, 24.7 percent; two, 15.3 percent; three, 8.25 percent; four, 1.9 percent; five, 0.2 percent. Since the frequencies for index values three, four, and five are small, they were usually collapsed into one category for tabulation and computational purposes.

TABLE 19

TYPES OF HOUSING STRUCTURES

Type	Frequency	Percentage
Single story detached building, similar to a home	797	54.9
One or two story building	453	31.2
Three to ten story building	95	6.6
A high-rise, eleven or more stories	19	1.3
Other types	43	3.0
No answer	43	3.0
Total	1450	100.0

Present Earthquake Vulnerability

To assess an individual's vulnerability to the effects of an earthquake, we asked several groups of questions concerned with the location and construction type of his or her residence and place of work. These included (1) the building construction of the residence; (2) the building construction of the workplace; (3) the ecological location of the residence; and (4) the ecological location of the workplace. These questions are important in measuring vulnerability in an objective sense--that is, whether respondents spend a good deal of time in vulnerable buildings--rather than in a subjective sense--whether they are aware of such vulnerability. Unfortunately, the interview schedule did not include questions specifically designed to measure respondents' awareness of earthquake vulnerability. Therefore, the above questions will be used to investigate the relationship between vulnerability and salience, fear, fatalism, favorability to public release of predictions, extent of earthquake discussion, and public and personal preparedness measures. If a relationship is found between objective vulnerability and these other variables, it can be assumed that respondents are aware of their objective vulnerability, and that they react accordingly.

Building construction of residence. To determine the type of structure the respondent lived in, the interviewer was asked to record data about the residence immediately after leaving it. First interviewers were asked to record the type of house the respondent lived in. The majority of respondents (54.9 percent) lived in single-story detached buildings with 31.2 percent living in one or two-story buildings. Only 6.6 percent lived in three to ten-story buildings, and 1.3 percent lived in high-rise buildings of eleven or more stories (Table 19). Most of the respondents (86.1 percent), then, lived in

TABLE 20

TYPE OF STRUCTURES SURROUNDING RESPONDENT'S RESIDENCE

Type	Frequency	Percentage*
One or two story buildings	1332	91.9
Three to ten story buildings	106	7.3
Eleven or more story buildings	6	.4
A mixture--three to ten stories and eleven or more stories	18	1.2
Other types	39	2.7
No other buildings	2	.1
Total	1503**	

* Base used is 1450

** Multiple answers possible.

one of the two safest categories of buildings in the event of an earthquake--single story detached and one or two story buildings.

Next, interviewers were asked to record all the different types of structures which surrounded the respondent's residence. As indicated in Table 20, the majority of respondents lived in relatively low density neighborhoods. Most lived in homes surrounded by one or two story structures. Only 8.9 percent lived in residences surrounded by three to ten story buildings, eleven or more stories, or a combination of the two.

To obtain information about the actual construction of the respondent's residence, each respondent was asked,

> What is the construction of the home/building you live in? Is it primarily: wood frame or frame and stucco, brick or stone, concrete block, or concrete and steel?

The majority (80.6 percent) of respondents stated they lived in a wood frame or frame and stucco structure. The next largest group (9.2 percent) stated they lived in structures of concrete and steel. These two types of construction are the most sturdy in case of an earthquake. Thus, 89.9 percent of the respondents lived in buildings made of fairly sturdy construction. Those that indicated they lived in buildings constructed of materials considered relatively unsafe by accepted earthquake safety standards comprise 7.9 percent of the sample. These include people living in structures of brick or stone (3.5 percent) and concrete block (1.6 percent). This group also includes those who indicated some other type of construction; 2.4 percent indicated wood and aluminum construction (presumably that of a mobile home), with 0.4 percent indicating another unspecified type of construction (Table 21).

Next, respondents were asked a forced-choice question about the year in which their residence was built. They were asked,

TABLE 21

TYPE OF CONSTRUCTION OF RESIDENCE

Type	Frequency	Percentage
Wood frame or frame and stucco	1168	80.6
Concrete and steel	133	9.2
Brick or Stone	51	3.6
Concrete Block	23	1.6
Other	6	.4
Wood and Aluminum	35	2.4
Don't Know	30	2.1
Total	1450	100.0

TABLE 22

WHEN RESIDENCE WAS BUILT

Date	Frequency	Percentage
Before 1933	180	12.4
Between 1933 and 1971	1017	70.1
After 1971	117	8.1
Before 1933 and After 1933	6	.4
Don't Know	127	8.8
No Answer	3	.2
Total	1450	100.0

TABLE 23

RESPONDENT'S KNOWLEDGE OF AN EARTHQUAKE FAULT WITHIN A MILE OF RESIDENCE

Response	Frequency	Percentage
Definitely is	99	6.8
Probably is	169	11.7
Probably is not	319	22.0
Definitely is not	231	15.9
Don't know	626	43.2
No answer	6	.4
Total	1450	100.0

> Could you tell me approximately when this home/building was built? Would you say: before 1933, between 1933 and 1971, or after 1971?

Residences built before 1933 are the most damage-prone buildings because they were built before stringent earthquake codes were passed (resulting from the Long Beach 1933 earthquake). Respondents who stated their residences were built before this date comprised 12.4 percent of the total sample. The majority (70.1 percent), however, indicated their residences were built between 1933 and 1971; 8.1 percent indicated structures built after 1971 and 0.4 percent stated that part of their residence was built before 1933 and part after. A sizeable number (8.8 percent) stated they did not know when their residence was built (Table 22).

To provide a general purpose index of residential vulnerability, we took note of whether each respondent's place of residence was characterized by none of these various hazardous indications, one of them, or more than one. The resulting very skewed index distributed the 1450 respondents in the basic field survey sample as follows: zero, 84.3 percent; one, 14.4 percent; two, 1.3 percent. Although the index did correlate with some response variables, such as awareness of the Uplift, it was not on the whole a very satisfactory index.

Finally respondents were asked,

> Do you happen to know if there is an earthquake fault within one mile of this property? Would you say: there definitely is, there probably is, there probably is not, or there definitely is not?

The largest group of respondents (43.2 percent) stated that they did not know if their property was within a mile of a fault; 37.9 percent said that a fault was probably or definitely not within a mile, whereas 18.5 percent said that one probably or definitely was within a mile (Table 23).

Building construction of place of work. Because many people spend

TABLE 24

RESPONDENTS WHO SPEND A LARGE PART OF THE DAY IN A BUILDING OTHER THAN HOME

Response	Frequency	Percent
Yes	789	54.4
No	643	44.3
Location varies	16	1.1
No answer	2	.1
Total	1450	100.0

a large part of the day outside their residence, we wanted to determine how vulnerable their place of work was. Respondents were asked,

> Generally speaking, do you spend a large part of your day in a building other than your home?

A slight majority of respondents (54.4 percent) answered that they did spend a large part of their day in a building other than their home (Table 24). These respondents were then asked a series of questions concerning the building construction of their workplace.

First, the 789 respondents were asked the forced-choice questions,

> As I read the following, please tell me which one best describes the structure of that building (the one other than your home). Would you say: a single story detached building similar to a home, a one or two story building, a three to ten story building, or a high-rise of eleven or more stories?

The largest category of respondents (42.4 percent) indicated that this building was a one or two story building; 25.6 percent indicated it was a one story detached building, and 22.4 percent indicated a three to ten story building. Only 8.2 percent indicated that they spent a large portion of the day in a high-rise of eleven or more stories (Table 25).

Next, these respondents were asked,

> Please tell me which of the following best describes the structures which surround that building. Is it surrounded by: one or two story buildings, three to ten story buildings, eleven or more story buildings, or a mixture of buildings of three to ten stories and eleven or more stories?

The majority of respondents (66.9 percent) stated that the surrounding buildings were one or two stories. Those indicating the surrounding buildings were three to ten stories comprised 16.0 percent of this part of the sample, and 11.2 percent indicated buildings of eleven or more stories or a mixture (Table 26). Respondents were then asked,

> Is the construction of that building primarily: wood frame or frame and stucco, brick or stone, concrete block, or concrete and steel?

TABLE 25

TYPE OF BUILDING STRUCTURE OF RESPONDENT'S WORKPLACE

Type	Frequency	Percent
Single story detached building, similar to a home	202	25.6
One or two story building	335	42.4
Three to ten story building	176	22.4
A high-rise, eleven or more stories	65	8.2
Other types	5	.6
Location varies	2	.3
No answer	4	.5
Total	789*	100.0

* 789 is the number of respondents who answered yes to the question: "Do you spend a large part of the day in a building other than your home?"

TABLE 26

TYPE OF BUILDINGS SURROUNDING RESPONDENT'S WORKPLACE

Type	Frequency	Percent
One or two story buildings	528	66.9
Three to ten story buildings	126	16.0
Eleven or more story buildings	26	3.2
A mixture--three to ten stories and eleven or more stories	63	8.0
Other types	12	1.5
No other buildings	22	2.8
Location varies	5	.7
No answer	7	.9
Total	789*	100.0

*789 is the number of respondents who answered yes to the question: "Do you spend a large part of the day in a building other than your home?"

TABLE 27

TYPE OF BUILDING CONSTRUCTION OF RESPONDENT'S WORKPLACE

Type	Frequency	Percent
Wood frame or frame and stucco	177	22.4
Concrete and steel	361	45.9
Brick or Stone	94	11.9
Concrete Block	86	10.8
Other	20	2.5
Wood and Aluminum	6	.8
Don't Know	37	4.7
No Answer	8	1.0
Total	789*	100.0

*789 is the number of respondents who answered yes to the question "Do you spend a large part of the day in a building other than your home?"

The largest category of respondents (45.9 percent) stated that the construction was concrete and steel followed by wood frame or frame and stucco (22.4 percent), brick or stone (11.9 percent), and concrete block (10.8 percent) (Table 27). The last two categories represent buildings constructed of materials least resistant to a damaging earthquake. Thus, 22.7 percent of the respondents who spend a large portion of the day in a building other than their home do so in a potentially earthquake-vulnerable building.

Finally, to determine if the building was built before the 1934 earthquake standards for building construction were passed, we asked the 789 respondents,

> Can you tell me approximately when that building was built? Would you say: before 1933, between 1933 and 1971, or after 1971?

The majority of respondents (64.4 percent) stated that the building they spent time in was built between 1933 and 1971; 15.6 percent indicated a 1971 or later construction date. These two groups, comprising 80.0 percent of those spending a large portion of time in a building other than their home, do so in a relatively earthquake-safe building. Those who spent much of the day in a building built before the 1934 earthquake safety standards were passed included 9.6 percent spending time in a building built before 1933 and 0.9 percent in a building partially built before that date (Table 28).

Ecological location of residence. The ecological location of the respondent's residence is comprised of two components. The first is the location of the residence according to census tract data. In drawing the sample for this study, several areas considered more hazardous than the general Los Angeles County area were oversampled to complete enough interviews for special analyses. These areas included the San Fernando 1971 earthquake damage area, inundation areas, and areas with high concentrations of pre-1934 buildings.

TABLE 28

YEAR RESPONDENT'S WORKPLACE WAS BUILT

Time period	Frequency	Percent
Before 1933	76	9.6
Between 1933 and 1971	508	64.4
After 1971	123	15.6
Before 1933 and After 1933	7	.9
Don't Know	68	8.6
No Answer	7	.9
Total	789*	100.0

*789 is the number of respondents who answered yes to the question: "Do you spend a large part of the day in a building other than your home?"

TABLE 29

ECOLOGICAL LOCATION OF RESPONDENT'S RESIDENCE

Location	Frequency	Percentage
In a residential area	1185	81.7
On a steep incline	30	2.1
Downtown area	26	1.8
Within three blocks of a beach or marina	6	.4
In a canyon	5	.3
Surrounded by open fields	2	.1
Within fifteen feet of a freeway overpass or bridge	1	.1
Other (unspecified)	4	.3
Residential and open fields	35	2.4
Residential and beach or marina	30	2.1
Residential and business	27	1.9
Residential and steep incline	17	1.2
Residential, steep incline, and beach	12	.8
Residential, beach, and school	7	.5
Mobile home	6	.4
Business and commercial	5	.3
Other combinations	23	1.6
No answer	29	2.0
Total	1450	100.0

TABLE 30

ECOLOGICAL LOCATION OF BUILDING OTHER THAN HOME

Location	Frequency	Percentage
Residential area	344	43.6
Downtown area	254	32.2
Surrounded by open fields	139	17.6
Business and commercial	133	16.9
Within fifteen feet of a freeway overpass or bridge	39	4.9
Within three blocks of a beach or marina	19	2.4
On a steep incline	17	2.2
Near an airport	14	1.8
In a canyon	7	.9
Other	26	3.3
No answer	1	.1
Total	993	100.0

The special sample groups will be used in later analyses to determine what effects living in a very hazardous area have on the major variables of the study. Respondents living in these areas will be compared with a group living in census tracts chosen as control tracts--that is, tracts thought not to be exposed to the ecological hazards listed above.

The second component of this variable is supplied by the interviewers. Interviewers were asked to record the type of location of the respondent's residence upon leaving it. Table 29 provides a list of these types of locations. As expected, the majority of respondents (90.6 percent) live in residential areas, including those coded as only residential and those coded as also including a steep incline, open fields, beach or marina, business, or a combination of these. Looking at those living in areas considered to be hazardous, 4.1 percent live on a steep incline (including steep incline and residential (1.2 percent) and steep incline, residential, and beach, .8 percent); 1.8 percent live in downtown areas, 0.3 percent live in a canyon, and 0.1 percent live within fifteen feet of a freeway overpass or bridge. Thus, of the total sample only 6.7 percent live in one of these hazardous areas.

Ecological location of place of work. To determine the ecological location of the respondent's workplace, those respondents who indicated that they spent a large amount of time in a building other than their home (n = 789) were handed a card and asked,

> What type of area is it in? Please look at all the descriptions on this card and tell me the ones that describe the location of this building.

Choices listed were: in a canyon, on a steep incline, in a residential area, downtown area, surrounded by open fields, within fifteen feet of a freeway overpass or bridge, within three blocks of a beach or marina, or other. In Table 30, the largest group (43.6 percent) stated the building was in a residential area, 32.2 percent stated it was in a downtown area, 17.6 percent in an open field, 16.9 percent in an industrial or commercial area, 4.9 percent near an overpass or bridge, 2.2 percent on a steep incline, 1.8 percent near an airport, 0.9 percent in a canyon, and 3.3 percent mentioned some other unspecified location.

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CHAPTER FOUR

UNDERSTANDING AND RESPECT FOR SCIENCE

A constructive response to an earthquake warning depends crucially on public appreciation of science. When meteorologists issue tornado or hurricane forecasts, people often decide whether to take the forecasts seriously or not by looking for telltale cloud formations and wind changes or "feeling" for sudden temperature drops. But there are no generally accepted signs by which people can confirm an earthquake forecast through the testimony of their own senses. The scientific conclusion will probably be the only information people have in deciding whether to take protective action or go on with life as usual. Public appreciation of science and trust in scientists is therefore likely to be more important in determining how people respond to warning of an impending earthquake than it is for other kinds of natural disaster.

Respect for Science

A series of questions was included in the survey in order to shed light on the public appreciation of science. The first question is whether people believe that scientists can predict earthquakes. Respondents were asked:

> How accurately do you believe scientists can predict earthquakes at the present time? Would you say: Quite accurately, Somewhat accurately, Not too accurately, or Not at all?

As indicated in Table 1, only one in twenty believes that scientists can now predict earthquakes quite accurately. But a striking 42 percent believe that scientists can predict earthquakes "somewhat accurately" or better.

TABLE 1

HOW ACCURATELY SCIENTISTS CAN PREDICT EARTHQUAKES NOW

Degree of accuracy	Percent
Quite accurately	5.4
Somewhat accurately	36.4
Not too accurately	38.3
Not at all accurately	18.1
Don't know	1.7
Total	100.0
Total number	1450

Since relatively few earthquake scientists would have claimed the ability to predict fairly accurately at the present time, these replies express a striking vote of confidence--or overconfidence--in science. The majority are more skeptical. But the large minority who credit scientists with more than they can do constitutes an important segment of the public. Either these people have not read and listened carefully for the many reminders of fallibility that are part of the typical scientific announcement, or they think of science as a sophisticated form of magic.

A more adequate indication of faith in science can be gained from belief in the future capability to predict earthquakes. All the respondents who did not say that scientists can now predict earthquakes quite accurately were next asked:

> In the future, how accurately do you think scientists will be able to predict earthquakes? Would you say: Quite accurately, Somewhat accurately, Not too accurately, or Not at all?

Here we find that a striking 83.6 percent believe that scientists either can or will be able to predict earthquakes fairly accurately (Table 2). About half of these people believe that quite accurate prediction is either here or in the future. Only one person in fourteen is either completely skeptical or unwilling to make a judgment. Certainly the level of confidence in science is high. Problems with the public are more likely to revolve about overconfidence and excessive expectations than about skepticism of scientific claims.

The confidence that most of our respondents place in the prospects for scientific earthquake prediction does not preclude some ambivalence toward science and scientists. Nor does it preclude the existence of an actively antiscientific attitude in a significant minority of the population. A series of six questions about science and scientists in general was used to look for possible ambivalence. A card was prepared with the four desired

TABLE 2

HOW ACCURATELY SCIENTISTS WILL BE ABLE TO PREDICT EARTHQUAKES IN THE FUTURE

Degree of accuracy	Percent
Now: Quite accurately	5.4
In the future:	
Quite accurately	36.7
Somewhat accurately	41.5
Not too accurately	9.1
Not at all accurately	4.2
Don't know, depends, or no answer	3.1
Total	100.0
Total number	1450

answers on it. The interviewer announced the series of questions as follows:

> In this part of the questionnaire we will be asking your opinions about science and scientists in general.
> (Hand card to respondent) As I read each of the following, please tell me whether you strongly agree, agree, disagree, or strongly disagree with each of these statements.

The wording of the six statements is reproduced in Figure 1.

In order to interpret the graph it is important to recognize that three of the statements were worded so that agreement expressed a positive attitude toward science and scientists, and three of the statements were worded so that disagreement expressed a positive attitude. Positive and negative statements must be balanced in this way to counteract a tendency for some people to agree with almost any statement. For ease of interpretation, we have arranged the answers on a graph so that replies favorable toward science always appear to the left. As a result, half of the answers on the extreme left are "strongly agree" and half are "strongly disagree," depending upon the specific statement.

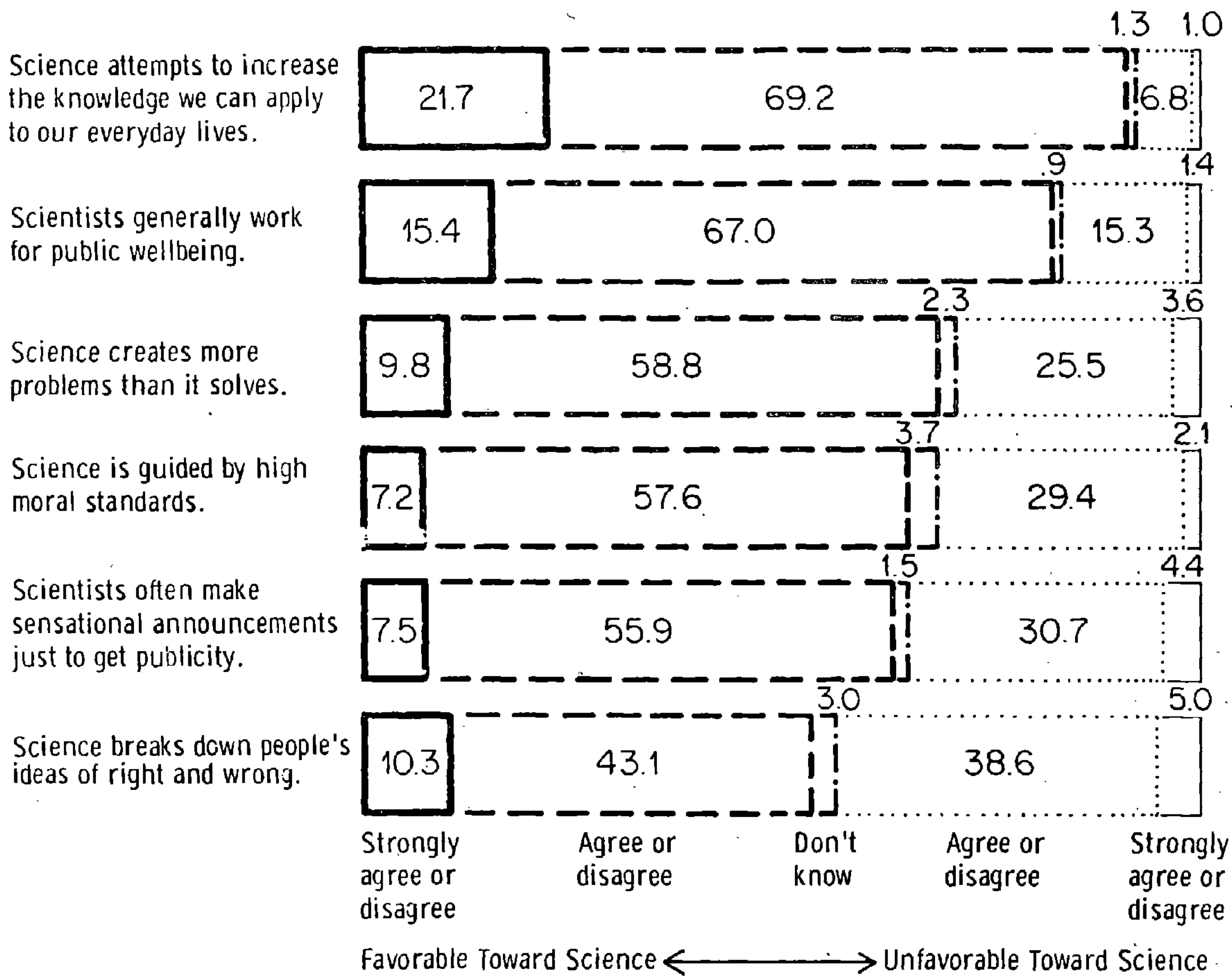
The responses are overwhelmingly favorable toward science. None of the six items draws less than 53.4 percent favorable responses, and one item draws 90.0 percent favorable responses. Nevertheless the range of responses is interesting and reveals something about where the ambivalence toward science is felt. Less than nine percent dissent from the view that science attempts to increase the knowledge we can apply to our daily lives, and less than one person in five questions that scientists generally work for the public well-being. There is very little ambivalence revealed by these two items. Only a very small minority deny that science is constructively oriented toward human use.

At the other extreme, 43.6 percent agree that science breaks down people's ideas of right and wrong. More than a third agree that scientists often make sensational announcements just to get publicity and about a third question whether science is guided by high moral standards. Thus the more widely shared reservations about science relate to the moral dimensions of science and the scientific enterprise. Although nearly everyone recognizes that science is useful and that scientists try to serve the public wellbeing, many suspect that scientists are not immune from less admirable motivations. Furthermore the cost paid for the benefits of science can include weakening the moral fabric of the community. Nevertheless, a majority of the respondents do not indicate that they share even these reservations about science.

Midway between the items that reveal the most and the least ambivalence is the statement that two-thirds of the respondents reject, that science creates more problems than it solves. The 29.1 percent who agree with this statement are again expressing awareness of an uncertain ratio of benefits to costs in the scientific enterprise. But fewer people will go so far as to say that science creates more problems than it solves than will acknowledge that undermining moral beliefs can be a cost of scientific accomplishment. There is considerable ambivalence about the costs of science, but relatively few will say that the costs outweigh the benefits.

Unlike splitting the atom or learning how to fertilize the human ovum in a test tube, earthquake prediction probably evokes relatively little moral concern. If earthquake prediction is morally rather neutral, it may not be viewed with the ambivalence that is expressed toward many scientific enterprises. Positive attitudes based on its potential human usefulness may be paramount.

However, a large enough block of people harbor doubts about the balance of costs to benefits that focusing public attention on possible economic and social problems induced by earthquake predictions could stimulate unfavorable attitudes toward scientific work in this field.



ATTITUDES TOWARD SCIENCE

FIGURE 1

TABLE 3

ARE SCIENTISTS AND PUBLIC OFFICIALS WITHHOLDING INFORMATION?

Action and reason	Scientists		Public officials	
Giving all information	45.2		42.6	
Holding back information	46.1		48.6	
For people's welfare		21.5		22.4
For their own interests		11.2		12.5
For both people's welfare and their own interests		8.7		9.0
Other and don't know		4.7		4.7
Don't know or not answered	8.7		8.8	
Total	100.0		100.0	
Total number	1450		1450	

The view of more than a third of the people that scientists sometimes make sensational announcements for the sake of publicity may have implications for the release of earthquake predictions. When doubts about releasing predictions and the suspicion that scientists are often publicity seekers are held by the same people, the responsible issuance of a scientific prediction is very likely to be viewed as an exercise in publicity seeking.

The image of publicity-hungry scientists must be balanced with another view often expressed, that scientists know a great deal more than they are willing to tell the public. After a major disaster we sometimes hear that the scientists knew the disaster was imminent but were afraid to tell the public for fear of creating an even worse disaster. And sometimes there are dark hints that scientists withhold information to serve their own ends. We tapped this sentiment by asking:

> Do you think scientists and public officials are giving us all the information they have on earthquake predictions, or are they holding back information?

Answers to this question were coded according to whether people said that either scientists or public officials or both were holding back information. Respondents who believed information was being withheld were then asked:

> Do you think they are holding information back: Because of their concern for the people's welfare, or To protect their own interests?

Only those who say that scientists are withholding information to serve their own interests can clearly be said to distrust scientists.

In Table 3 we have combined answers to the two questions and also separated the evaluations of scientists and public officials for comparison. People are evenly divided over whether scientists are telling all or holding back information. But more of the people who think scientists are holding back information attribute this to concern for the public interest than to self interest. Nevertheless, nearly one person in five suspects scientists of holding back information about earthquake predictions at least partly out of self interest. The difference in attitude toward scientists and public officials is not striking, though scientists are trusted somewhat more than public officials.

The more general observation that fully half of the people believe they are not being told all there is to know about the prospect of a future earthquake has widely ranging implications. The view of a paternalistic government-and-science establishment protecting the public from potentially unsettling news and the alternative conception of a self-serving government-and-science establishment controlling the flow of information command about equal support. Together they insure a widespread disposition to believe that there is a reservoir of secret information to which the public is not privy. According to generally accepted theories, beliefs of this sort constitute fertile ground for the rapid growth and spread of rumor. They also contribute to credibility problems when scientists and government officials attempt to reassure the public in times of crisis.

Frames of Reference

A more difficult question to explore than whether people believe in science and have favorable attitudes toward scientific enterprise is whether people think about earthquakes in a manner that is compatible with science. We do not expect the public to be masters of scientific thought. Even well trained scientists often lapse into unscientific ways of thinking about events outside of their scientific specialties. Nor do we expect the ordinary citizen to have a deep and correct understanding of techtonic plate theory and other advanced earth science theories. But we are concerned over whether people think of earthquakes as physical events, manifesting physical processes, and having physical causes. If people employ a physical frame of reference when they think about earthquakes, communication between scientists and the public should be facilitated. In contrast, people might apply a mystical or magical frame of reference, with earthquakes occurring because of the ideas in someone's head or because of the work of a sorcerer. Or they might apply a teleological or religious frame of reference, with earthquakes being part of some grand design for the world, a punishment for the sins of mankind, or harbingers of the millenium. People who think of earthquakes in these terms will have great difficulty interpreting a scientifically based earthquake warning as it is intended to be understood.

The causes of earthquakes. As a basis for deciding whether people employed frames of reference that were compatible or incompatible with science, we asked the following question and completely open-ended probe:

> People have various ideas about why there are earthquakes. Do you have any ideas why earthquakes occur? Yes or No.

If the answer was "Yes,"

> What are they? (Probe fully; record verbatim)

Spaces were provided for as many as five separate answers.

Of the 1450 respondents, 75.1 percent responded affirmatively. When their replies to the follow-up question were classified, 93.2 percent of the answers refer to physical causes (Table 4). Causes classified as physical are not necessarily scientifically valid. All that is required is that there be a plausible physical connection between the cause and occurrence of an earthquake. For example, "launching satellites that pollute the atmosphere" was classified as magical or mystical because there seemed to be no plausible physical connection between atmospheric pollution and the occurrence of an

TABLE 4

CAUSES FOR EARTHQUAKES

Earthquake cause	Percent	
Physical: Naturally occurring		81.4
Fault movement	23.1	
Earth movement	25.0	
Earth's heat	10.0	
Sea, tidal waves	1.8	
Moon, planets	3.2	
Other	18.3	
Physical: Human action		11.8
Drilling, digging	6.3	
Underground explosions	4.2	
Dam filling	.3	
Scientific research	.2	
Other	.8	
Nonphysical: Naturally occurring	3.8	3.8
Nonphysical: Human action		3.0
Divine retribution, evil forces	.9	
Unreasonable physical link	2.1	
Total	100.0	100.0
Total responses	1816	1816

earthquake. The nonphysical explanations referred principally to Divine Plan, punishment for the sins of mankind, and a secular theme of interfering with nature.

There is a further distinction of importance. Whether causes are physical or nonphysical, they may lie outside of human control or may involve some kind of human action to trigger the physical causes. For example, if an earthquake is precipitated by the weight of the water newly impounded behind a dam, the immediate cause is physical (increased pressure because of the weight of the water), but it was human action that put the water there. Similarly in cases of nonphysical explanations, an earthquake that was foreordained as part of an ancient Divine Plan is different from an earthquake that is visited on the people of a sinful nation.

Some people volunteered references to human action in answer to the leading question on why earthquakes occur. But whether people did so or not, when they finished answering the question they were asked a second leading query, followed again by an open-ended probe:

> Do you think there are things that <u>people do</u> that make earthquakes <u>more</u> likely to occur? Yes or no.

If the answer was "Yes,"

> What are some of these things? (Probe fully; record verbatim)

We were able to use the answers to both open questions in searching for answers that involved human triggering actions.

When the two classifications are combined, as in Table 4, 81.4 percent of the explanations identify naturally occurring physical causes and another 11.8 percent identify physical causes triggered by human action. The small group of nonphysical causes divides fairly equally between naturally occurring causes and causes triggered by human action.

TABLE 5

TYPES OF BELIEF ABOUT CAUSES OF EARTHQUAKES

Types of causes	Percent
Strictly naturally occurring physical causes	33.4
Strictly physical causes, but some triggered by human action	34.8
Some nonphysical causes, but strictly naturally occurring	2.7
Some nonphysical causes, and some triggered by human action	4.1
No idea	25.0
Total	100.0
Total number of respondents	1450

The category of physical causes triggered by human action deserves special attention. Most of the responses do not refer to scientifically accepted mechanisms such as impounding water behind dams. They have rather the flavor of interfering too deeply with nature or doing something that is socially reprehensible. The fear that drilling and digging in the earth is likely to set off an earthquake implies as much of magic as of physical causation. The second most frequent answer in this category, underground bomb testing, undoubtedly reflects some of the abhorrence of atomic warfare. Hence a great many if not all of these answers are a melding of physical frameworks with either a magical or a moralistic framework. This is an important observation. While people understand earthquakes overwhelmingly in physical terms, the physical frameworks they use are sometimes contaminated by other frameworks that are less compatible with science.

Our discussion of physical and nonphysical frames of reference has been presented strictly by the number of answers falling into each category, and not according to how many people employ each of the frames. We are left with the question whether most people employ a strictly physical frame of reference, and whether they understand earthquakes as strictly naturally occurring physical events. Since nearly everyone gives one or more naturally occurring physical causes, we classified anyone who gave as many as one nonphysical answer under the "nonphysical" heading. We followed the same procedure with human causation. The result is that people who use nonphysical frames of reference in understanding earthquakes remain a very small group (Table 5). But half of the people who employ exclusively physical explanations give at least one cause for earthquakes involving a human triggering effect. Not all of these are nonscientific, but many of them do incorporate an element of less scientific thinking.

TABLE 6

WHY A DAMAGING EARTHQUAKE IS EXPECTED WITHIN THE NEXT YEAR

Reasons given	Frequency	Percentage
Media coverage	173	18.6
Vague reference	106	11.4
Quake overdue	94	10.1
Scientific prediction	75	8.1
Individual intuition	75	8.1
Increased frequency	73	7.9
Southern California earthquake history	67	7.2
Fault movements	62	6.7
Climatic changes	45	4.8
Quake cycles	34	3.7
Changes in the earth	29	3.1
Bulge in the earth	27	2.9
Religious prophecies	18	2.0
Secular prophecies	11	1.2
Things people do	9	1.0
Whitcomb	9	.9
Respondent was in earthquake	8	.9
Animal behavior	3	.3
Minturn's prediction	2	.2
California splash	2	.2
Jupiter effect	2	.2
Other	5	.5
Total*	929*	100.0

*Includes multiple answers

Why expect an earthquake. A request to justify respondents' expectations for an earthquake in the near future provided another set of evidence on frames of reference. Because of the nature of the question, responses did not lend themselves to classification into the same categories as the previous answers. However, they enable us to look at some different dimensions, and to employ frames of reference that will be used later in the analysis of predictions and other announcements people have heard. The principal limitation to these data is the fact that the open-ended question could be asked of only 43.5 percent of the entire sample, for reasons that will be evident as we explain the question sequence.

First we asked respondents, "How likely do you think it is that there will be a damaging earthquake in southern California within the next year?" A total of 630 respondents (43.5 percent) thought there would probably or definitely be such an earthquake within the next year. We then asked these 630 respondents the open-ended question, "What makes you believe that a damaging earthquake will probably occur within the next year?" (instructing interviewers to record the first three reasons verbatim. Most of the respondents gave reasons for their belief, some giving more than one, for a total of 929 reasons. Table 6 provides a list of all the reasons respondents gave. The one mentioned most often was a reference to coverage of predictions by the news media (18.6 percent). Next was a general or vague reference to earthquake prediction (11.4 percent), followed by those who mentioned that we are overdue for a quake (10.1 percent), a reference to general scientific predictions (8.1 percent), and individual intuition (e.g., "I feel we are going to have one.") (8.1 percent).

To understand the interpretive schemes respondents used to decide whether a damaging earthquake would probably occur within the next year, we

TABLE 7

WHY AN EARTHQUAKE IS EXPECTED

Reason earthquake is expected	Number		Percent	
Scientific and Physical Cause		470		50.6
Scientific Authority	111		12.0	
Physical Mechanisms & Principles	359		38.6	
General		279		30.0
Vague References	106		11.4	
Media Coverage	173		18.6	
Pseudo-scientific	(54)	54	(5.8)	5.8
Prophetic		112		12.1
Secular and Religious	29		3.1	
Personal	83		9.0	
Other	(14)	14	(1.5)	1.5
Total*	929	929	100.0	100.0

*Includes multiple answers

divided their responses into four major categories or frames of reference (Table 7). The first and most important in relation to respondents' receptivity to scientific earthquake prediction is the scientific or folk-scientific perspective. Because of the diverse ways this question could be answered, the scientific category is separated into references to scientific predictions and references to mechanisms or principles that have some basis in science. A total of 470 (50.6 percent) of the reasons given for expecting a quake fall in the scientific category. The largest number of them (38.6 percent) make reference to mechanisms or principles having some basis in science. These included references to the idea that we are overdue for a quake (10.1 percent), the increased frequency or severity of quakes (7.9 percent), the history of earthquakes in southern California (7.2 percent), the idea that earthquakes occur in cycles or patterns (3.7 percent), and references to changes in the physical character of the earth (3.1 percent). A smaller group of 111 (12.0 percent) of the respondents mentioned a scientific prediction or a scientist making such a prediction. These included references to the southern California Uplift (2.9 percent), to Whitcomb or the Cal Tech announcement (.9 percent), and to general unspecified scientific predictions (8.1 percent). Although few of these respondents can be expected to have a sophisticated scientific understanding of the mechanisms, they appear to be making an effort to assimilate scientific ideas with their own experience. Rather than being satisfied with merely accepting scientific authority, they are attempting to achieve a naturalistic understanding of the earthquake danger. Therefore, this group may be especially receptive to scientific communication.

The next group of reasons given for expecting a quake falls into a general category of vague references. These include both vague or general references to earthquake predictions themselves (11.4 percent) and references to coverage of predictions by the news media (18.6 percent). It appears that although the respondents who gave these reasons do have a general idea about earthquake prediction, they may not have enough information to cite the source of the prediction or the principle behind the media announcement. Thus, they look to the media as justification for their belief. Although the media are thought to exert a great deal of influence on our beliefs and decisions only 27.5 percent of the 630 respondents asked this question cited the media. (This comprises only 11.9 percent of the total sample of 1450).

The third group of reasons given for expecting a damaging earthquake is classified under a pseudo-scientific heading. Although these reasons may on the surface appear to have a basis in scientific fact, they as yet have not been supported by any scientific theory. These include references to climatic changes or earthquake weather (4.8 percent), unusual animal behavior (.3 percent), Minturn's December 20, 1977, prediction (.2 percent), the idea that California will fall into the ocean (.2 percent), and the "Jupiter Effect," or the aligning of planets on the same side of the sun (.2 percent).

Finally, references were given to prophetic justifications for the belief that a damaging earthquake would probably occur within the next year. These included references to secular prophecies issued by such people as psychics, seers, mystics, and astrologers (1.2 percent) and to those issued by religious sources or mentioned in the Bible (2.0 percent). Respondents also cited "personal knowledge" of a coming quake. This included their own past experience in earthquakes (.9 percent) and individual intuition or general feelings that an earthquake was coming (8.1 percent). Interestingly, if people cited prophetic reasons at all (12.1 percent), they were much more likely to refer to their own feelings than to those of a recognized mystic (9.0 percent and 3.1 percent).

Research on public opinion often stresses the public reliance on authorities to justify whatever opinions people hold. Critics from Ralph Waldo Emerson to the present have bemoaned public unwillingness to adopt and assert opinions on their own. There are some signs of an opposite tendency in these data. We have already noted that three-fourths of the respondents claim to have some idea of why earthquakes occur. Most of these people then offered what they understood as a statement of physical processes and causes underlying earthquakes. While a scientist would almost certainly find most of their answers inaccurate, it is striking that people are attempting to go beyond reliance on scientific authority in making earthquake dynamics personally meaningful.

Reexamination of Table 7 adds confirmation to this finding. When asked why they believe that an earthquake would occur, people could spontaneously choose either to cite prestigious authority in support of their views or to attempt to explain the evidence or reasoning underlying their expectation. Nothing in the question suggested which kind of answer was preferred, and the question was deliberately placed early in the interview before the discussion of reasons for earthquakes or predictions that people had heard. Among the answers classified as scientific, more than three quarters offer a statement of mechanisms and principles and less than a quarter cite some scientific authority. Likewise in the prophetic category, the majority refer to their own personal intuition rather than some external authority. Thus whether people give scientific or prophetic answers, the tendency is to personalize understanding.

TABLE 8

WHO BESIDES SCIENTISTS CAN PREDICT EARTHQUAKES

Type of predictor	Percent of total sample*
Psychics, mystics, etc.	20.8
Religious leaders, etc.	3.4
Political leaders	.1
Farmers	1.5
Other	4.4
Don't know, not answered	1.4

*Total sample = 1450 cases

Public Coexistence of Science and Nonscience

The last observations underline a point: scientific and nonscientific ways of viewing the world coexist widely in our society. Accepting an explanation for earthquakes that is compatible with science does not necessarily mean rejecting all explanations that are incompatible with science. Earlier we were impressed with the overwhelming faith in the capacity of science to predict earthquakes. Now we must look back at whether this acceptance of scientific claims means an equal rejection of claims by the competitors of science.

Directly after answering the question on how accurately scientists will be able to predict earthquakes, respondents were asked:

> Are there any other people besides scientists who can sometimes tell when an earthquake is coming? Yes or no.

If the answer was "Yes,"

> Who are these people?

A total of 31.2 percent of our sample answered "Yes," that there were others who can sometimes tell when an earthquake is coming. Most of these people (20.8 percent of the total sample) identified the forecasters as psychics, mystics, occultists, and the like (Table 8). Another 3.4 percent ascribed this capacity to religious figures. A few thought that farmers could tell. Other answers were scattered or too vague to classify.

The question was followed by another, designed to identify belief in a sort of folk wisdom that ordinary people can apply.

> As I read each of the following, please tell me if you think people can use any of the following signs in their daily life to tell when an earthquake might be coming: Unusual animal behavior? Unusual weather? Premonitions, instinct, or ESP? Unusual aches or pains? Any other signs (Specify).

TABLE 9

SIGNS IN DAILY LIFE USED TO PREDICT EARTHQUAKES

Signs in daily life	Percent of total sample*
Unusual animal behavior	67.5
Unusual weather	43.5
Premonition, instinct, ESP	38.5
Unusual aches, pains	7.9
Small tremors	1.0
Water levels	.8
Other	3.3

*Total sample = 1450 cases

Answers were entered as simply "yes" or "no." If a respondent said "sometimes" or "some people," the answer was treated as "yes."

Three of the folk signs are widely accepted (Table 9). Two-thirds of the respondents believe in animal behavior, more than two-fifths in earthquake weather, and more than a third accept premonition. A few people volunteered "small tremors" and "water levels" as signs, probably reflecting popular awareness of the Chinese experience.

Two significant conclusions about the public and science are justified. First, the widespread belief in folk signs suggests that people feel that nature can be apprehended directly and personally, without appeal to authority or to technical knowledge. Even among the believers in mystical forecasting, it is surprising that more people accept the validity of personal premonitions than spontaneously mention mystics and similar people as able to predict earthquakes. This observation can be put together with the finding that most people had some ideas about earthquake causes and are able to state their own understanding of the physical causes. Whether people are scientific or non-scientific in their approaches, the majority seek to understand earthquakes personally and directly rather than leaving such matters to authorities and specialists. If our interpretation of these findings is correct, scientists who take the trouble to explain earthquake announcements in terms that are comprehensible to the public will find a more receptive public than those who rely on the authority of science.

While these findings and interpretations seemed relatively clear, the fact that they are drawn from questions formulated in three different ways renders the evidence inconclusive. For example, the references to seers and psychics are spontaneous answers to an open-ended question, while respondents were asked directly whether people could tell when an earthquake was coming on the basis of unusual animal behavior, earthquake weather, premonitions, and unusual aches and pains. It is plausible that more people would have credited seers and psychics with ability to forecast earthquakes if they had been asked directly in the same way they were asked about their own premonitions.

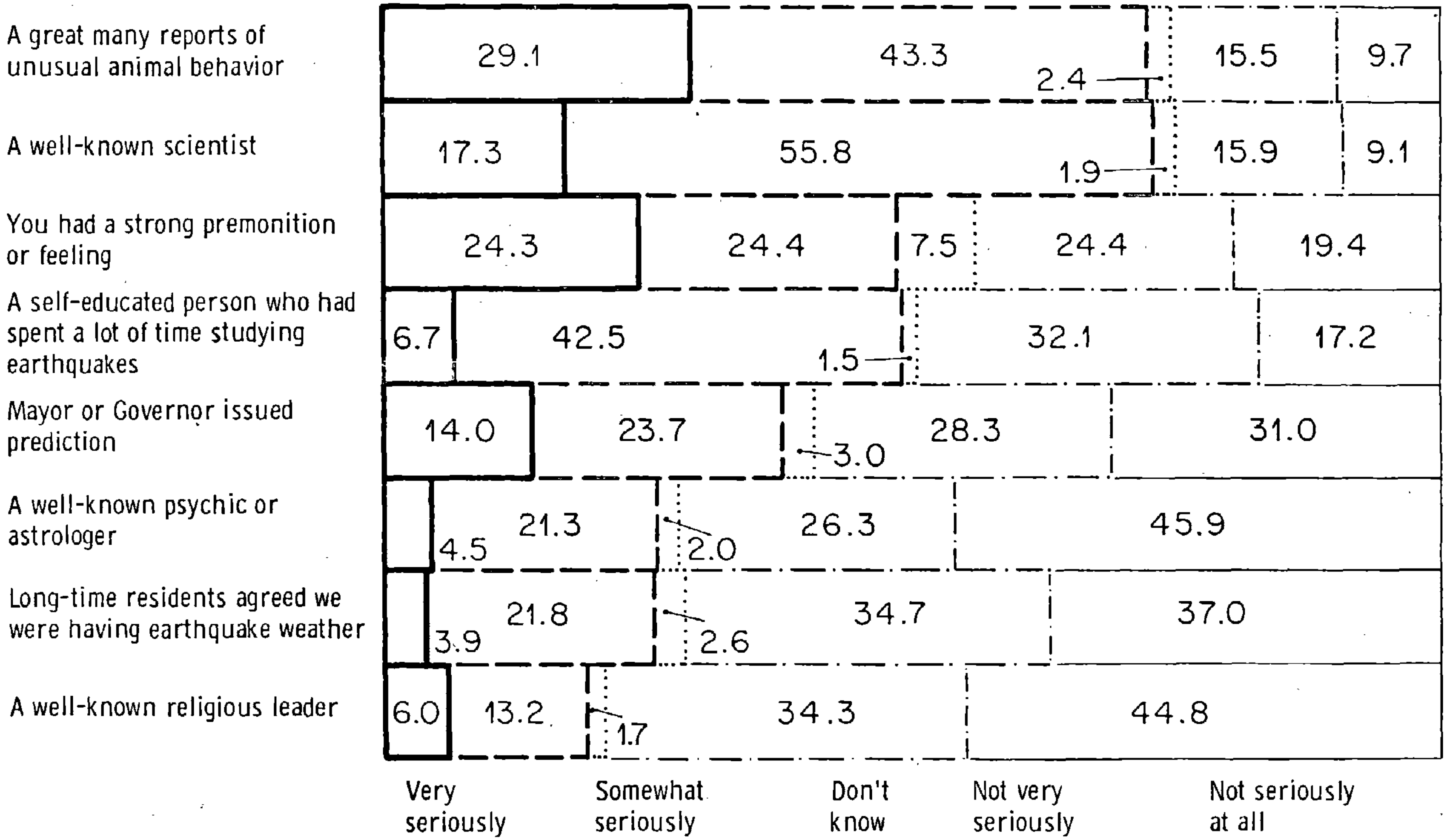
In order to verify or disprove our findings, we devised a battery of comparably worded questions for inclusion in the telephone interview wave conducted in June and July, 1978. The questions were asked of a sample of 536 adult residents of Los Angeles County, chosen from the same sampling frame used in selecting the larger sample for the basic field survey. The battery of questions was worded as follows:

> Now I'd like to ask you a few questions about earthquake predictions. I am going to read a series of statements to you about predictions of a future destructive earthquake. As I read each statement, try to imagine how seriously you would take that prediction, that is, whether you would take it very seriously, somewhat seriously, not very seriously, or not seriously at all. REPEAT RESPONSE CATEGORIES AND STEM AS OFTEN AS NECESSARY. First,
>
> Suppose a well-known religious leader said that a destructive earthquake would strike your community within a week, how seriously would you take this prediction?
>
> If a well-known scientist made such a prediction?
>
> If a self-educated person who had spent a lot of time studying earthquakes made such a prediction?
>
> If a well-known psychic or astrologer made such a prediction?
>
> If the Mayor of your city or the Governor of California issued such a prediction?
>
> Now, suppose you had a strong premonition or feeling that a destructive earthquake would strike your community within a week, how seriously would you take your premonition or feeling?
>
> Suppose there were a great many reports of unusual animal behavior so that people were saying a destructive earthquake would strike within a week?
>
> Suppose many long-time residents of California agreed that we were having earthquake weather, so that people were saying a destructive earthquake would strike within a week?

If we look first at the "very seriously" and "somewhat seriously" responses together as indicating how many people assign credibility to each prediction source, the sources fall into five groups (Figure 2). About three quarters of the respondents would take seriously either a prediction issued by a well-known scientist or a prediction based on a great many reports of unusual animal behavior. The proportions are almost identical, although the core of "true believers" is larger for animal behavior than for the scientist. About half of the respondents would take seriously either their own strong premonition or feeling, or the prediction issued by an informed amateur. Again, a much larger core of respondents would take their own premonitions very seriously, second only to those who would take a prediction based on animal behavior seriously. Just over three fifths would take seriously a prediction issued by the mayor or governor. About one quarter of the respondents would take seriously a forecast by a well-known psychic or astrologer or a forecast based on earthquake weather. And finally, just under one in five would take seriously the forecast issued by a well-known religious leader.

The general pattern of responses to these questions is similar to that secured in the basic field survey using a different question format. The high credibility of both science and animal behavior is confirmed. The more widespread acceptance of personal premonition than of the psychic's or astrologer's forecast is dramatically confirmed by a ratio of 48.7 percent to 25.8 percent. The difference in the proportions who take the two sources very seriously is even more impressive, being more than five to one in favor of personal premonitions.

Respondents were not asked about predictions by amateur scientists in the original survey. The high level of credibility attributed to the self-educated expert in the later survey augments our understanding in at



HOW SERIOUSLY A PREDICTION OF A DESTRUCTIVE EARTHQUAKE WITHIN A WEEK WOULD BE TAKEN ACCORDING TO SOURCE

FIGURE 2

least two important ways. First, the finding provides support for the supposition that the widespread interest in Henry Minturn's earthquake forecast for December 20, 1976, was not an idiosyncratic response, but reflected a deep-seated populist element in American thinking. Since this battery of questions was asked about eighteen months after the Minturn prediction had ceased to be news, when very few people still mentioned his prediction in answer to a question about predictions in general (cf. Part Nine, Chapter Three), it can be interpreted as an independent measure of receptiveness to the announcements of "enlightened" amateurs.

Second, the finding adds support to the evidence already adduced of public belief in the relatively personal understanding of events. The resourceful maverick can achieve the same results as scientists without expensive equipment or elaborate and long-drawn-out procedures, just as the sensitive individual who is "tuned in" to nature can find reliable clues to the future in his own premonitions.

The ratio of numbers who take a prediction very seriously to the number who take it either somewhat or very seriously differs considerably among the sources. We can speculate about the meaning of these differences on the basis of either of two assumptions. First, we might assume that a high ratio of "very seriously" responses to "very" and "somewhat seriously" responses indicates the presence of strong value commitments in contrast to more utilitarian assessments of the situation. The highest ratios apply to a personal premonition (.50), unusual animal behavior (.40), an announcement by the mayor or governor (.37), and a prediction by a religious leader (.31). The first two do correspond to a sort of oneness-with-nature value that has been important in many mid-twentieth-century social movements. The third and fourth correspond with patriotic and religious values. On the other hand, if oneness-with-nature and populist values explain the highest ratios, the self-educated expert should not have ranked last (.14).

The alternative assumption might be that a high ratio indicates the infallibility of the source. For example, about equal numbers of people believe that the methods of science, correctly applied, and the behavior of animals can foretell earthquakes. But animals are naive and simply report what their senses tell them, while scientists carry out complicated analyses that are subject to human error and social and political constraints. Following this reasoning, the sensitive individual knows his own feelings better than he knows anything else, so recognition of a strong premonition is less subject to error than perceptions of the outside world. Similarly, public officials are known to be cautious about releasing potentially disturbing announcements, so the governor's or mayor's stamp of authenticity is not to be taken lightly. While half the people believe that an amateur could actually predict an earthquake accurately, most of them realize that untested amateurs are especially prone to error. And the religious leader, like the political leader, is assumed to be governed by an unusually strong sense of moral responsibility.

Although we have engaged in strict speculation, the second assumption produces a reasonably plausible and consistent set of interpretations of the evidence, and is worthy of further investigation.

Scientific and Nonscientific Beliefs and the Individual

It is clear that science commands no monoply of public faith in the realm of earthquake prediction and forecasting. Nonscientific ideas such as the belief in premonitions, and ideas that float in an ill-defined realm between science and nonscience such as faith in animal behavior and in the self-educated amateur, are prevalent in American culture. But we have still not addressed the question of whether people are polorized in their beliefs between the supporters of science and the supporters of nonscience, or whether most people mix the two sets of ideas. With 73.1 percent willing to take a scientific prediction seriously and 48.7 percent willing to take their own premonitions seriously there must be at least 21.8 percent and probably more, who accept both.

One model of the relationship among the various beliefs is supplied by the well-known Guttman scale. Conceivably there may be a single underlying dimension of belief in the predictability of earthquakes. Which kinds of prediction people accept and which they reject would be a simple expression of how strong their belief in earthquake predictability was. In Guttman terminology it is easiest to believe in scientific prediction and animal behavior, so everyone who believes at all should accept these two sources. At the opposite pole, religious forecasts are the hardest to believe, so only people who believe most strongly, and who believe in all of the other grounds for prediction, should take a religious forecast seriously.

The eight items from the June-July, 1978, survey were subjected to a conventional Guttman scale analysis. The resulting summary statistics were as follows: coefficient of reproducibility = .79, minimum marginal reproducibility = .67, with a resulting percent improvement = .12, and a coefficient of scalability = .36. These statistics do not satisfy the standards for establishing unidimensionality. However the model does provide measurable improvement. If our aim were to develop a measuring instrument to assess belief in earthquake predictability, we should simply reject these items as not constituting a true scale. But since we are interested rather in understanding better the underlying structure of attitudes, we note tentatively that the unidimen-

TABLE 10

FACTOR LOADINGS FOR PREDICTION SOURCES

Prediction source	Factor I	Factor II
Well-known religious leader	.519	.315
Well-known scientist	.196	.744
Self-educated earthquake student	.296	.670
Well-known psychic or astrologer	.586	.297
Mayor or Governor	.274	.486
Your own strong premonition	.621	.122
Many reports of unusual animal behavior	.405	.238
Earthquake weather	.598	.252
Percent of explained variance	85	15

sional model provides a partial explanation for the data. There may be some truth to the assumption that people differ more according to how strongly they believe in earthquake predictability than they do according to whether they accept one set of predictors as opposed to another set.

An alternative model of the relationship among the various beliefs is supplied by factor analysis. Factor analysis is a statistical technique intended for identifying a few underlying dimensions that explain a larger number of individual items of information. If there are both a dimension of scientific belief and a dimension corresponding to other types of belief, factor analysis will reveal them. Factor analysis of these data, using the method of Principal Components with iterated communalities, produces one principal factor (85 percent of explained variance) and a second minor factor (15 percent of explained variance). The principal factor is loaded most heavily with faith in psychics and personal premonitions, and also on earthquake weather, religious leaders, and animal behavior, in that order (Table 10). The minor factor is loaded most heavily with the scientist and the amateur scientist, and less heavily with the mayor or governor.

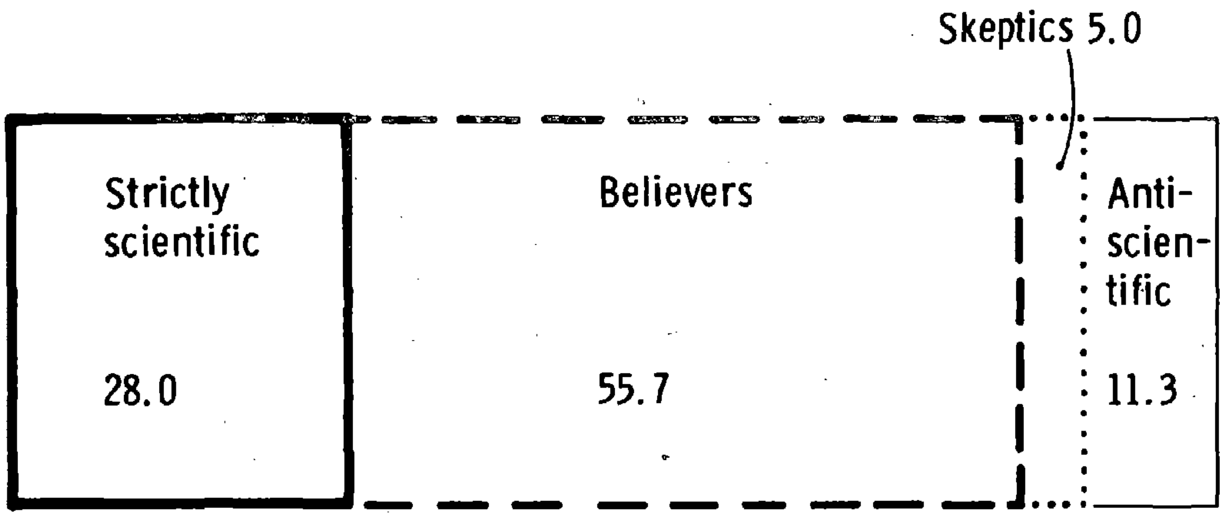
Perhaps the most important observation from this factor analysis is the extent of overlap between the two factors. All of the prediction sources load positively on both factors. The differences between the two factors are measured in degrees rather than in kind. The greatest differences apply to "your own strong premonition," which loads most strongly on the first factor and least strongly on the second, and to a "well-known scientist," which loads least strongly on the first factor and most strongly on the second. In each case the loadings on the opposite factor, though weak, are positive. The "self-educated earthquake student," which also loads strongly on the second factor, loads fairly impressively on the first factor. Differences on the other variables are even less striking, with animal behavior, the well-known religious leader, the mayor or governor, the well-known psychic or astrologer, and earthquake weather loading substantially on both factors.

It is clear that there is no polarization between scientific and nonscientific prediction belief. If there were, the respective sources would have been subsumed by a single factor with opposite signs in the extreme case, or would have shown opposite signs on the two factors in the less extreme case. The acceptance of nonscientific predictors does not imply the rejection of scientific predictors, or vice versa. What we find is what we inferred from the Guttman analysis, a balance between integration and coexistence. The perfect case of integration would find scientific and nonscientific sources subsumed by a single factor, all with positive loadings. The perfect instance of coexistence, meaning that support for scientific and nonscientific sources subsumed by two uncorrelated factors.

Our finding is, therefore, that science and nonscience do coexist in the realm of earthquake prediction in the sense that belief in one type of prediction does not imply disbelief in the other. But they do more than coexist: they exhibit considerable integration. On the whole, belief in prediction means acceptance of both science and nonscience and disbelief in prediction means skepticism about both scientific and unscientific sources.

Faith in the capability of scientists to predict earthquakes coexists comfortably with faith in folk prediction and mysticism.

In order to see the extent to which faith in scientific and nonscientific forecasting coexist in individuals, we have classified individuals into four types. People who believe that scientists will be able to predict earthquakes somewhat or quite accurately in the future or can do so quite accurately now, but reject all other predictors and folk signs except animal behavior,



TYPES OF PREDICTION BELIEF

FIGURE 3

are called strictly scientific. Since many scientists are taking seriously the possibility of using animal behavior as an earthquake sign, we felt that one could believe in animal behavior as an earthquake sign and still be strictly scientific. People who express faith in scientific prediction but also believe in one or more other ways of predicting have been called believers. These are people who combine faith in science with faith in nonscience in their view of earthquake prediction. The anti-scientific are those who do not believe in the future of scientific prediction, but accept some other kind of predictor. And the skeptics are those who reject both scientific and non-scientific prediction capabilities.

More than half of the people in our sample are classified as believers, indicating that they have faith in the prospect for scientific prediction, but also accept some nonscientific form of prediction (Figure 3). There are about half as many strictly scientifics as believers. About one person in nine accepts some nonscientific basis for anticipating an earthquake but lacks confidence in the eventual prediction of earthquakes by scientists. Skeptics make up the smallest group, only about one person in twenty disbelieving altogether in the forecasting of earthquakes.

In various sections throughout this report we refer to the prediction belief typology and relate it to variables of more obvious significance, such as awareness and understanding of prediction announcements, how seriously announcements are taken, and the extent of personal preparedness.

Causal Frame, Prediction Belief, and Attitude toward Science

We have examined favorability toward science, causal frames of reference, and prediction belief patterns as separate dimensions of orientation toward science. But it seems obvious that they overlap and should be interrelated. In an effort to understand what we have learned about orientations toward science in our sample of Los Angeles County residents we shall conclude by examining the interrelations among these three dimensions and their mutual relationships to certain other variables that can shed clarifying light on their meanings.

The correlation between causal frames of reference and prediction belief patterns is highly significant but the relationship is not a close one. There is an affinity between the Physical-Natural and the Strictly Scientific types, between the Physical-Human and Believer types, between Nonphysical-Natural and Skeptic types, and Nonphysical-Human and Antiscientific types. As Table 11 shows, the Physical-Naturals are most favorable to science, the Nonphysicals and No Idea types are least favorable, and the Physical-Humans are intermediate. The intermediately favorable attitude toward science and the association with the believer type lend support to the assumption that the physical-human type dilutes the physical framework with a nonscientific or nonphysical framework, such as the sacred-nature or moralist orientation.

The Strictly Scientifics are most favorable to science, the aptly named anti-scientifics are least favorable, and the believers and skeptics are intermediate (Table 12).

The relationship between these measures and two variables, namely <u>importance of religion</u> and <u>earthquake fatalism</u>, can shed further light on the meshing of scientific and nonscientific frameworks. Importance of religion is measured by a single direct question, as described in Chapter Two. The index of earthquake fatalism is based on four questions. The index is explained in Chapter One or Part Five of this report. People to whom religion is most important are most highly concentrated in the nonphysical and especially nonphysical-natural frames, and in the anti-scientific prediction

TABLE 11

CAUSAL FRAME AND PREDICTION BELIEF TYPOLOGIES

	Percent					Number
Causal frame	Strictly scien-tific	Believers	Skeptics	Anti scien-tific	Total	Total
Physical-Natural	36.3	50.2	4.0	9.5	100.0	482
Physical-Human	22.2	66.9	2.1	8.8	100.0	432
Physical-Contradictory	22.2	58.3	6.9	12.5	100.0	72
Nonphysical-Natural	28.2	51.3	10.3	10.3	100.0	39
Nonphysical-Human	7.8	64.7	2.0	25.5	100.0	51
Nonphysical-Contradictory	(12.5)	(75.0)	0	(12.5)	100.0	8
No Idea	28.7	47.9	9.2	14.2	100.0	359
Total	28.2	55.7	4.9	11.2	100.0	
Total number	406	804	71	162		1443

TABLE 12

FAVORABILITY TOWARD SCIENCE BY CAUSAL FRAME AND PREDICTION BELIEF

Causal Frame; Prediction Belief Typology	Percent					Number
	Least favorable	Less favorable	More favorable	Most favorable	Total	Total
			Causal frame			
Physical-Natural	33.8	21.4	22.2	22.6	100.0	482
Physical-Human	38.1	23.3	17.9	20.7	100.0	430
Physical-Contradictory	40.3	22.2	16.7	20.8	100.0	72
Nonphysical-Natural	51.3	15.4	23.1	10.2	100.0	39
Nonphysical-Human	49.0	21.6	15.7	13.7	100.0	51
Nonphysical-Contradictory	(57.1)	(28.6)	(14.3)	0	100.0	7
No Idea	49.4	24.6	17.9	8.1	100.0	358
Total	40.4	22.7	19.3	17.6	100.0	
Total number	582	326	278	253		1439
			Prediction belief			
Strictly Scientific	32.9	21.2	24.9	20.9	100.0	401
Believers	37.7	24.8	19.1	18.4	100.0	803
Skeptics	53.5	16.9	14.1	15.5	100.0	71
Anti-scientific	66.5	18.0	9.3	6.2	100.0	161
Total	40.4	22.6	19.4	17.6	100.0	
Total number	580	325	278	253		1436

TABLE 13

IMPORTANCE OF RELIGION BY CAUSAL FRAME, PREDICTION BELIEF, AND FAVORABILITY TOWARD SCIENCE

Causal Frame; Prediction Belief Typology; Favorability	Percent					Number
	Very important	Fairly important	Fairly unimportant	Not important	Total	Total
			Causal frame			
Physical-Natural	44.1	35.4	16.2	4.3	100.0	395
Physical-Human	49.5	37.9	8.8	3.8	100.0	364
Physical-Contradictory	58.5	32.1	7.5	1.9	100.0	53
Nonphysical-Natural	77.1	17.1	2.9	2.9	100.0	35
Nonphysical-Human	70.8	22.9	2.1	4.2	100.0	48
Nonphysical-Contradictory	(62.5)	(25.0)	(12.5)	0	100.0	8
No Idea	56.8	30.9	9.0	3.3	100.0	333
Total	51.8	33.7	10.8	3.7	100.0	
Total number	640	417	133	46		1236
			Prediction belief			
Strictly Scientific	45.8	37.8	11.2	5.2	100.0	347
Believers	52.0	34.4	10.5	3.1	100.0	685
Skeptics	57.9	28.1	8.8	5.2	100.0	57
Anti-Scientific	61.4	23.5	11.7	3.4	100.0	145
Total	51.8	33.7	10.7	3.8	100.0	
Total number	637	417	133	47		1234
			Favorability toward science			
Least Favorable	54.8	32.5	8.9	3.8	100.0	496
Less Favorable	51.7	34.0	11.5	2.8	100.0	288
More Favorable	46.9	36.5	11.2	5.4	100.0	241
Most Favorable	49.7	33.2	13.7	3.4	100.0	205
Total	51.7	33.8	10.7	3.8	100.0	
Total number	636	415	132	47		1230

belief category (Table 13). They are least frequent in the physical-natural and strictly scientific types. But the relationships are not linear. The physical frames are most clearly associated with the intermediate categories of religious involvement. The physical-human frame contains more religiously involved people than the physical-natural frame. In contrast, the prediction belief is not significantly related to the importance of religion. There are grounds in these data for concluding that deep commitment to religion for some people is not compatible with a scientific frame of reference, though the extent of successful accommodation is indicated by the fact that more of the physical-naturals say that religion is very important to them than select any of the less involved answers. But the relative acceptance of scientific and nonscientific forms of prediction is not related to religious importance.

Favorability toward science is also unrelated to the importance of religion. This finding, in juxtaposition to the others, is rather important. If there were an active anti-scientific campaign among the religious, we should expect a more clear-cut relationship between these transparent attitude-toward-science questions and the importance of religion than between the causal frame typology and religion. But the opposite is true. Thus, incompatibilities inhere in the way objects and events are understood rather than in self-consciously pro and anti-scientific attitudes. But even with frames of reference, the incompatibility appears to apply to only a small segment of religious persons.

Four items addressing the extent to which people believe that risk from earthquakes can be reduced by active forethought and adaptive response at the time of a quake were used as the basis for a simple Earthquake Fatalism index. The largest proportion of fatalists are found among the nonphysical-natural and no-idea frames, the skeptical and anti-scientific prediction beliefs, and those least favorable to science (Table 14). The relationship with favorability

TABLE 14

EARTHQUAKE FATALISM BY CAUSAL FRAME, PREDICTION BELIEF, AND FAVORABILITY TOWARD SCIENCE

Causal Frame; Prediction Belief Typology; Favorability	Percent				Number
	Low fatalism	Medium fatalism	High fatalism	Total	Total
Causal frame					
Physical-Natural	27.0	43.8	29.2	100.0	482
Physical-Human	31.3	39.1	29.6	100.0	432
Physical-Contradictory	33.3	30.6	36.1	100.0	72
Nonphysical-Natural	23.7	21.0	55.3	100.0	38
Nonphysical-Human	27.4	41.2	31.4	100.0	51
Nonphysical-Contradictory	0	(62.5)	(37.5)	100.0	8
No Idea	15.1	36.6	48.3	100.0	358
Total	25.4	39.3	35.3	100.0	
Total number	366	567	508		1441
Prediction belief					
Strictly Scientific	24.9	42.2	32.9	100.0	405
Believers	29.1	39.3	31.6	100.0	801
Skeptics	17.1	28.6	54.3	100.0	70
Anti-Scientific	13.0	36.4	50.6	100.0	162
Total	25.5	39.3	35.2	100.0	
Total number	367	565	506		1438
Favorability toward science					
Least Favorable	20.1	38.7	41.2	100.0	582
Less Favorable	24.8	39.0	36.2	100.0	326
More Favorable	25.5	44.2	30.3	100.0	274
Most Favorable	39.3	35.3	25.4	100.0	252
Total	25.6	39.2	35.2	100.0	
Total number	367	562	505		1434

to science is simple and linear, linking a positive attitude toward science with faith that one can control his destiny. The relationships with the two typologies are not so simple. Fatalism increases inversely to the range of earthquake predictors that people believe in, from believers to the strictly scientific to the more fatialistic skeptics, in keeping with the Guttman scale model. But the anti-scientfic prediction believers who accept nonscientific means of prediction are considerably more fatalistic than would be expected on the basis of a linear relationship. Among the frames of reference the physicals are least fatalistic and whether they believe in naturally occurring causes or human interferences makes no difference. But the nonphysicals polarize according to whether they see naturally occurring causes or human action. Since most of the nonphysical-naturals speak of Divine Plan, there is an image of inalterable predestination that is akin to fatalism. But if the risk is from Divine retribution, or human ineptness, one's fate is to a greater extent in one's own hands.

We conclude this review of data with a brief observation that the physical frameworks and pro-scientific attitudes are associated to a degree with the male sex, higher socioeconomic status and education, regular newspaper readership, and White Anglo as contrasted to Mexican American and Black ethnic identity. These associations are quite consistent with those reported in a variety of other studies. Since they are tangential to the main purposes of this report, we shall not examine them in greater detail.

Conclusion

Public announcement of the scientific discovery of a vast uplifted area on the critical San Andreas Fault near Los Angeles, with a serious possibility but no assurance that it is precursory to a severe earthquake, created the occasion for popular discourse over scientific ideas. We have used this discourse as an opportunity to explore the accommodation between scientific and folk thinking. We could not disagree with Perlman's (1974, p. 209) observation that "only a small fraction of the public understands science as scientists or science reporters might hope they would." Nor should we expect anything different. But we have been concerned for both theoretical and practical reasons to understand whether there is a pro and anti-scientific polarization that might embroil the community in nonconstructive controversy just when the need for concerted action was greatest, and whether a natural disaster such as an earthquake is interpreted through frames of reference that are incompatible with scientific thought.

Our principal conclusion is that coexistence rather than polarization is the rule, so far as science and nonscience and naturalistic and non-naturalistic frames of reference are concerned. Our findings confirm Morison's (1969, p. 151) assertion that "The progress of science undoubtedly has some effect in reducing the grosser forms of superstition . . . But . . . it is doubtful that the scientific way of the world has ever completely displaced older, more magical approaches to deep questions." We find both secular and religious mysticism important at certain phases of the encounter between scientific and popular thought, and we see a naturalistic frame of reference diluted by a moralistic or sacred-nature perspective. But the coexistence for most people does not seriously undermine the faith in science, the primacy of physical frames of reference in interpreting physical events such as an earthquake, and the prospect for scientific prediction of earthquakes.

These findings also have practical implications for the communication of scientific information about earthquakes. Scientists must be prepared to deal constructively with a public that puts its faith overwhelmingly in science, but is not ready to pledge exclusive allegiance to science. Scientists must expect most of the believers in science to turn occasionally to other realms for whatever help they can get in foretelling earthquakes.

A brief concluding note on science and religion may be in order. Although the great majority of our respondents say religion is important in their lives, very few of them suppose that religious leaders can forecast earthquakes and few try to explain earthquakes in religious terms. It is the secular mystics rather than religious mystics who today offer an alternative to scientific prediction of earthquakes. Likewise, those to whom religion is most important are no less favorable toward science and no less confident in the prospect for scientific earthquake prediction than the less religiously inclined. In short, there is no evidence here to suggest that religion plays a part in whatever resistance we have found to the acceptance of scientific earthquake prediction.

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CHAPTER FIVE

WHERE DO PEOPLE HEAR ABOUT EARTHQUAKE DANGER AND EARTHQUAKE SAFETY?

Public awareness and response to earthquake danger is likely to be affected by the channels of communication through which information is received and exchanged. An examination of the principal sources of information and extent of discussion of earthquake matters is important for two reasons. First, it will indicate which channels of communication provided the public with information about the earthquake threat. Second, it will enable scientists and government officials to select the most effective channels for disseminating information about earthquakes, predictions, and preparedness to the public. In this chapter we shall focus on three basic questions. First, how have people acquired the information (and misinformation) they have? Second, where do people look for more information? Finally, in sorting out what people have heard, how do they make up their minds about the danger and about actions to be taken?

The Mass Media

One question in the interview provides the most general answer to the queries we have just posed. During the latter half of the interview respondents were asked:

> 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?

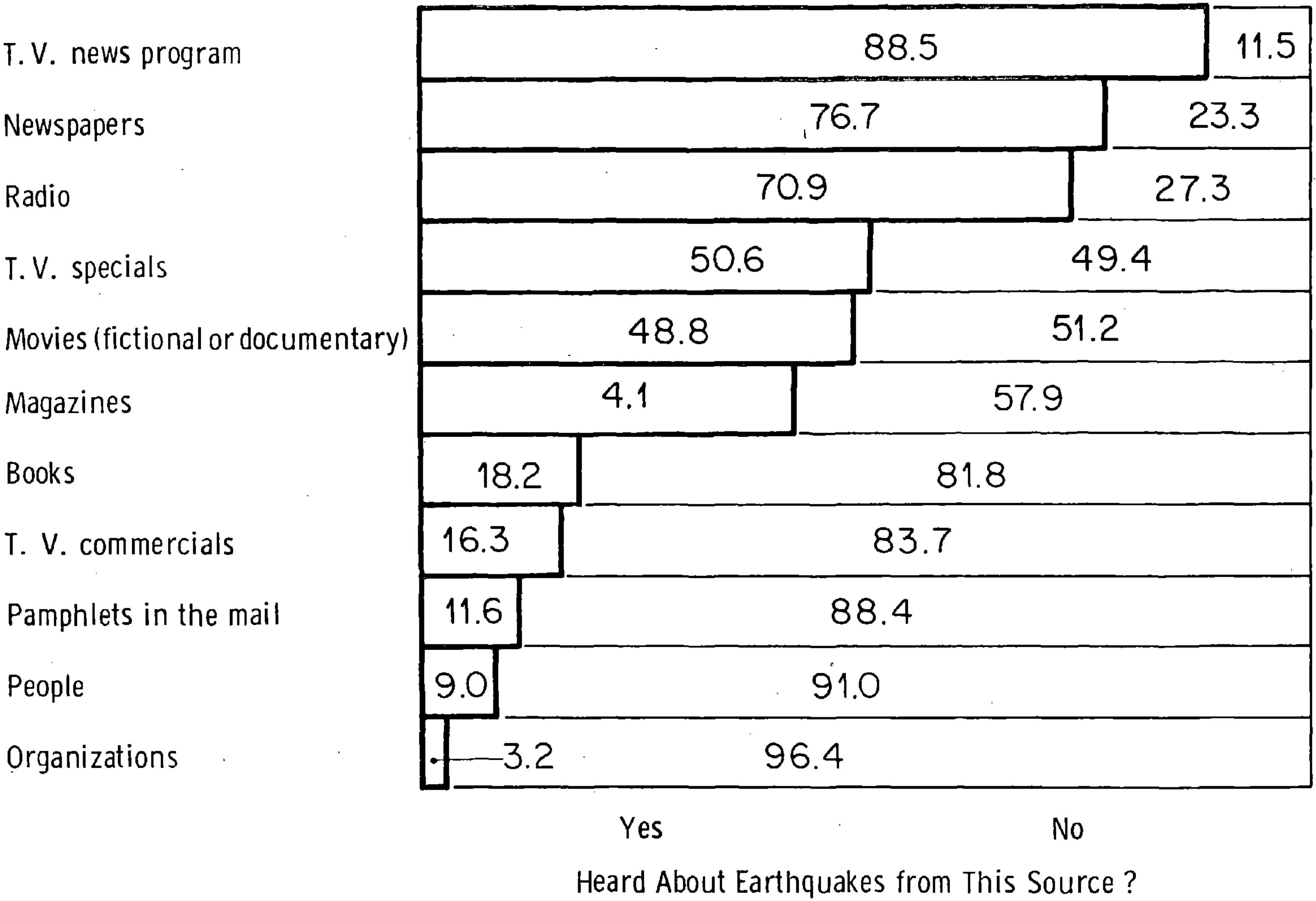
Respondents answered "yes" or "no" to each item on a list of sources, which are given in Figure 1. The sources "people" and "organizations" were not on the list that was read to the respondents, but were most frequently mentioned in response to the concluding item, "Any other source?"

Television news was the most frequently cited source of earthquake information. This finding is not unexpected in light of recent trends in media usage which indicate that an increasing percentage of the public receive most of the news about world events from television (Sterling and Haight, 1978). However, the finding is significant because of the unique way information is presented.

In addition to being first to report news, along with radio (albeit brief), television news programs have provided an audience for predictors who bypass scientific authorities or critical colleagues. In the case of Henry Minturn, television news was the primary source of information on this prediction when it was first issued on November 22. It was not until December 1 that newspapers first featured articles on Minturn's prediction.

The credibility of television as a source also may contribute to segments of the public taking a particular announcement seriously. A Gallup poll released in 1974 (A Report to Client Newspapers, 1974) indicated that television is the most credible news medium in the US. In studies conducted for the Television Information Office between 1959 and 1976, fifty one percent of the people said that in case of conflicting reports from radio, television, magazines or newspapers, they would be most inclined to believe TV reports (Sterling and Haight, p. 273). Thus, we can see the significance of television as a source of information on prediction announcements.

Newspapers were the second most frequently mentioned source of earthquake information; 77 percent of our sample used this source. Newspaper coverage differs from TV news coverage in that newspapers reach a smaller, more specialized audience. While television can provide the viewer with facts and



SOURCES OF INFORMATION ABOUT EARTHQUAKES,
EARTHQUAKE PREDICTIONS, AND EARTHQUAKE PREPAREDNESS

FIGURE 1

findings (Wade and Schramm, 1969), the print media can offer perspective and interpretation of events.

In a separate tabulation not reproduced in the report we find that most of the respondents who acknowledged receiving earthquake information from newspapers were regular readers. Over three-fourths of them read at least one paper regularly, while over a fourth read more than one regularly. However, newspaper reports on earthquake topics reach many who are not regular readers. Fully 23.2 percent of the respondents who gave newspapers as a source of information on earthquakes did not claim to be regular readers.

Radio provided a substantial proportion of our respondents with earthquake information in a variety of ways. It was an educational tool to inform listeners about earthquake safety, and talk shows provided a forum for discussion of earthquake topics, both for hosts and the participating public, in a way unique to this medium. While radio coverage is similar to TV news programing in that it reaches all segments of the population and information is often quite brief, a unique feature of the radio audience is their casual attention to the medium. Most often the radio is used as a source of background entertainment while the listener is involved in some other task, rather than as a target for concentrated attention. This pattern should have a significant impact on the amount of recall and retention of earthquake information, thus we would expect minimal learning from this medium at best.

Some media were less widely used as sources of earthquake information. These sources include television specials, movies, magazines, books, pamphlets, and television commercials. These media seem to have certain characteristics in common. First, they can provide expanded coverage of current topics. Second, they can provide further interpretation of events. Finally, they can legitimize public opinion. While these media often provide treatments of topics in depth, public interest in the topic is an important factor in determining whether these sources will be utilized by the public.

Close to half of our respondents acknowledged receiving earthquake information from television specials, motion pictures, or magazines in 1976.

Television specials dealing with earthquake topics focused on two major areas--earthquake events and earthquake preparedness. They also lent credibility to earthquake issues such as building safety, home preparedness, and prediction, and legitimized public concern about the current danger by presenting scenarios about the effects of a future earthquake. Some specials were repeated during the past year, increasing the likelihood that the individual would be exposed to this information.

The entertainment value of earthquakes was further illustrated by the first nationally televised showing of "Earthquake." While we do not know how many people in our sample actually watched this movie, 49.8 percent obtained earthquake information from a movie source of some kind. What is unique about film as a medium is that it commands greater attention on the part of viewers than radio or TV news programs. However, the sensationalistic presentation of earthquake events in movies like "Earthquake" may do more harm than good in creating public misunderstanding of predictions and perpetuate myths about panic and looting during the post-disaster period.

About two-fifths of our respondents acknowledged receiving earthquake information from magazines. Similar to newspaper coverage, magazines provide more extensive accounts of earthquake topics while addressing themselves to a small, more specialized audience than television or radio. Both magazines written for popular consumption and for the scientific community focused on scientific predictions and research as well as major earthquake events. Magazines also emphasized the urgency of the current earthquake threat, lending further credibility to public concern.

The third group of information sources was the least utilized. Less than 20 percent of our sample acknowledged obtaining information from books, television commercials and pamphlets in the mail.

In a survey of reference librarians in branch libraries conducted in 1977, we found that the number of earthquake references available to the public varied from three to forty; the average number of references was fourteen. Only fourteen of the thirty-nine librarians interviewed indicated that their branches had received new earthquake materials in 1976. Of the ten books reported to us as being available through the library system, eight dealt with earthquake folklore and nonscientific prediction, while only two had scientific orientations. Therefore, individuals requesting earthquake information from books in the public library were limited both in the number of sources and the type of information available. This, along with the fact that earthquake prediction is a relatively new area of interest, may explain why books were not a major source of earthquake information at that time.

In listing television commercials and pamphlets in the mail as sources we were thinking of the short cartoons on earthquake preparedness distributed by the California Office of Emergency Services and the home preparedness pamphlets distributed in the utility bills. These two media sources were used to arouse public awareness of earthquake safety, increase factual knowledge, and encourage participation in the diffusion of information. While these campaigns served basically the same purpose, they employed different strategies of information diffusion. Sending pamphlets through the mail was relatively inexpensive, compared to broadcasting public service announcements. Pamphlets were directed toward a reading audience, while television commercials were directed toward television viewers. While the information presented on television was transitory in nature, the pamphlets could be kept, periodically reviewed, and passed along to others. Despite these different efforts to educate the public, these media did not command the public attention that items on regular television news programs might have done.

Finally, "people" and "organizations" appear to have played a rather insignificant part in the information process, though more respondents might have mentioned these sources if they were listed in the interview.

It is important to remember that most people do not rely exclusively on one source for their information. In Table 1 we have indicated the number of different media sources from which each person has heard or read about the earthquakes. The cumulative percentages show that nearly half of the respondents have heard or read about earthquakes from five or more of the sources. Nearly two-thirds have used four or more sources. Only one person in every fourteen has heard of earthquakes from just one media source.

Which segments of the public used the media most extensively? The answer to this question can be obtained by examining the demographic characteristics of respondents who used media sources for information on earthquakes.

Sex, age, ethnicity, income, and education are significantly related to the use of the mass media. Men are more likely than women to use a variety of media to obtain earthquake information (Table 2). There is a negative relationship between age and use of a number of media sources (Table 3). People over fifty are less likely to report using a variety of media than younger respondents. In examining the relationship between ethnicity and use of media sources, we find that Anglos use a wider range of media than either Blacks or Mexican Americans (Table 4). Blacks and Mexican Americans are quite similar in the numbers who use the media very little if at all for earthquake information. But more Blacks than either Whites or Mexican Americans are included among persons who learn about earthquakes from nearly all the media, indicating more polarization between high and low media use among Blacks. The higher

TABLE 1

NUMBER OF MEDIA SOURCES OF INFORMATION ABOUT EARTHQUAKES, EARTHQUAKE PREDICTIONS, AND EARTHQUAKE PREPAREDNESS

Number of sources	Percent	Cumulative Percent
None	2.3	---
One	7.2	97.7
Two	10.7	90.5
Three	15.5	79.8
Four	17.9	64.3
Five	17.7	46.4
Six	15.5	28.7
Seven	8.3	13.2
Eight	3.8	4.9
Nine	1.1	1.1
Total	100.0	
Number of persons	1450	

TABLE 2

NUMBER OF MEDIA SOURCES OF INFORMATION ABOUT EARTHQUAKES BY SEX

Number of Media Sources	Male	Female
None	2.6	2.0
One-two	17.3	26.4
Three	23.2	20.9
Four	21.5	22.6
Five or more	35.4	28.1
Total	100.0	100.0
Total number	608	842

$X^2 = 20.442$, df = 4, $p < .001$.

TABLE 3

NUMBER OF MEDIA SOURCES OF INFORMATION ABOUT EARTHQUAKES BY AGE

Number of Media Sources	Age Categories 18–25	26–33	34–50	51–98
None	2.2	1.2	2.6	2.7
One-two	16.7	18.8	19.5	31.2
Three	21.2	19.9	19.5	25.3
Four	23.8	28.0	21.3	17.9
Five	36.1	32.1	37.1	22.9
Total	100.0	100.0	100.0	100.0
Total number	269	321	380	475

Tau =$-.124$, $p < .001$. Five respondents did not give their ages.

TABLE 4

NUMBER OF MEDIA SOURCES OF INFORMATION ABOUT EARTHQUAKE BY ETHNICITY

Number of Media Sources	Ethnicity			
	Anglo	Black	Mexican American	Other
None	1.5	3.9	2.1	4.4
One-two	18.7	30.4	31.4	28.9
Three	23.3	14.9	21.3	21.1
Four	25.3	12.2	18.6	17.5
Five or more	31.2	38.6	26.6	28.1
Total	100.0	100.0	100.0	100.0
Total number	959	181	188	114

$X^2 = 51.929$, df = 12, $p < .001$. Eight respondents did not answer the ethnicity question.

TABLE 5

NUMBER OF MEDIA SOURCES OF INFORMATION ABOUT EARTHQUAKES BY EDUCATIONAL ATTAINMENT

Number of Media Sources	Educational Level: Through Some High School	Graduated High School	Some College	Graduated College
None	9.3	2.3	0.8	1.1
One-two	36.2	21.7	16.0	14.2
Three	26.8	21.5	19.9	18.4
Four	11.8	26.1	25.0	26.1
Five or more	20.9	28.4	38.3	40.2
Total	100.0	100.0	100.0	100.0
Total number	373	437	376	261

Tau = .206, $p < .001$. Three respondents did not give their educational attainment.

one's level of education, the more likely several media are used to obtain earthquake information (Table 5). Similarly there is a positive relationship between income and media use (Table 6). The higher one's income, the wider the range of use of the mass media.

We also expected to find that the less deeply involved individuals are in community social networks, the more they will rely on several media sources for information about the earthquake threat. Marital status, the presence of school-aged children in the home, and attachment to the local community, were used to measure involvement in social networks. We expected to find that individuals without these social ties would use more media sources than individuals with such ties. However, none of these measures of social involvement is significantly related to the use of the media. There is no significant difference in media use between married and single respondents, people with and without school children, and individuals with high and low levels of community attachment.

The data indicate that while social background characteristics affect the use of mass media sources, involvement in social networks is neither a substitute for extensive media use nor a reinforcer of media use.

Further evidence on information sources comes from questions asked about each of the earthquake predictions, forecasts, and warnings people remembered hearing. Respondents who remembered hearing such announcements were asked the following question for each of the up to five announcements they mentioned:

> Do you remember what your chief source of information about this prediction was?

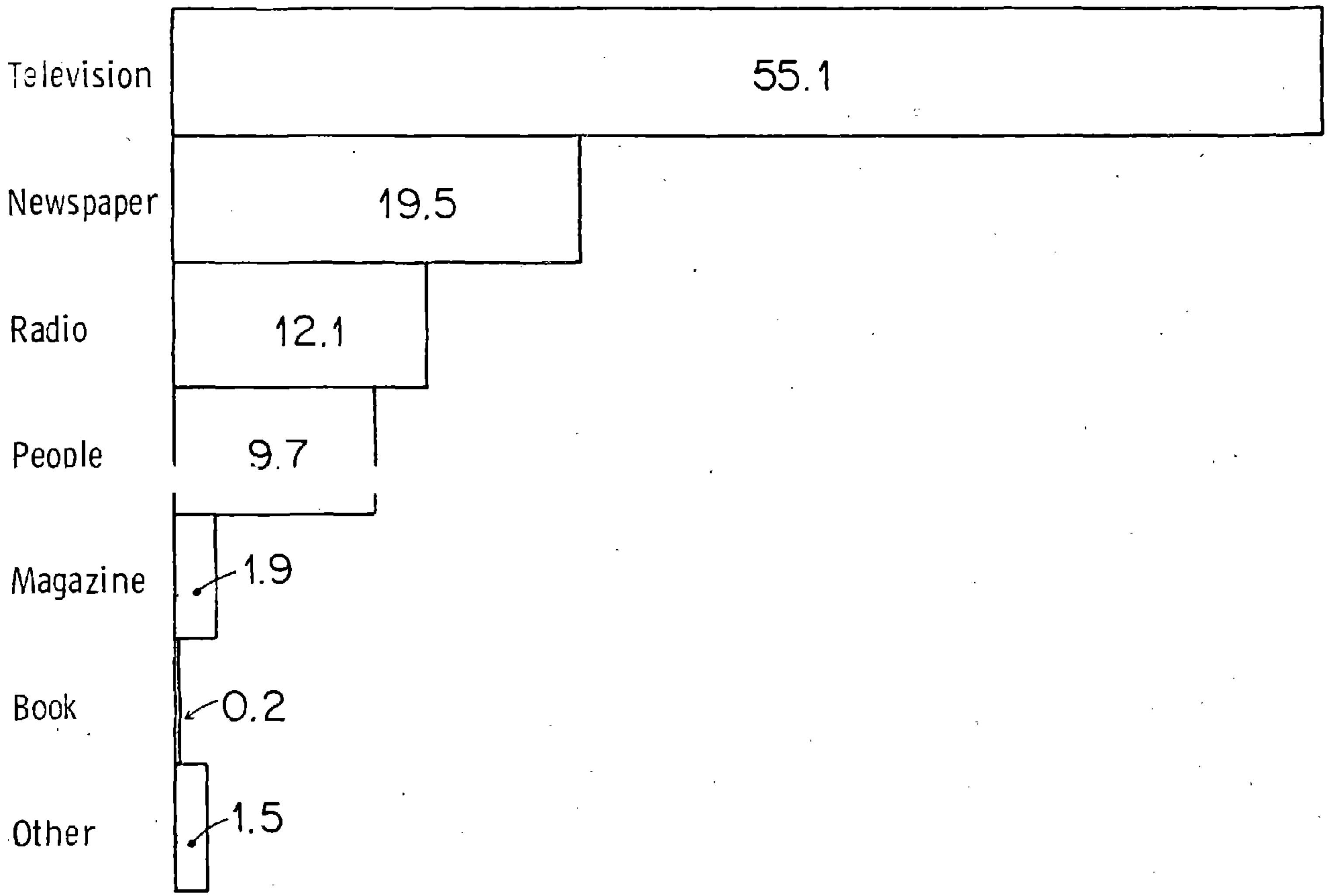
Specific answers were not suggested to the respondents, and the interviewer recorded only one chief source. Since the question was asked about each of the announcements the respondent mentioned, the question was not asked at all for people who did not remember any announcement, while for others

TABLE 6

NUMBER OF MEDIA SOURCES OF INFORMATION
ABOUT EARTHQUAKES BY HOUSEHOLD INCOME

Number of Media Sources	Household Income Under $6,000	$6,000-$11,999	$12,000-$19,999	$20,000-$40,000
None	4.0	1.5	1.7	1.3
One-two	37.3	23.3	15.2	11.5
Three	23.3	22.4	23.8	19.1
Four	13.3	20.8	26.1	28.0
Five or more	22.0	32.0	33.2	40.1
Total	100.0	100.0	100.0	100.0
Total number	300	331	349	314

Tau = .194, $p < .001$. Household income estimates were not supplied by 156 respondents.



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

FIGURE 2

it could be asked as many as five times.

The graph based on this question cannot be precisely compared with the previous graph because percentages are based on the 1788 reports of announcements rather than the 1450 respondents, and because the volunteered answers could not be broken down into exactly the same categories (Figure 2). However, we can make a general comparison between where people most frequently hear about earthquake matters and which sources they rate as most important.

The three primary sources and their order remain the same. But the differences in relative importance are greatly accentuated. Television stands out as the principal source for the majority of people. Television is named by nearly three times as many people as newspapers, and more than four times as many as radio. Later in the chapter we will report a breakdown of "people" sources. But here we see that "people" sources assume greater importance than before, surpassing magazines and books. While not many respondents think of their family, friends, and associates as a source of information on earthquakes, many of those who do are inclined to rely on people as their chief source of information. Thus, in spite of the preponderant reliance on the three principal media of mass communication, it may still be necessary to reach some people through personal networks.

Informal Discussion of Earthquake Topics

Studies of response to disaster warnings indicate that people often turn to informal sources to seek verification of the warning message. The opportunity to share and exchange information within primary groups should affect individual response to near predictions, for through this casual exchange people acquire interpretations of facts and formulate beliefs about the impending danger.

We already know that the majority of people in our sample received earthquake information from the mass media. However, it is equally important to determine to what extent earthquake near predictions and other communication have stimulated informal discussion of the earthquake threat.

A series of questions was devised to let us know how much discussion occurred, with whom it took place, and on what aspect of the earthquake concern. Questioning began as follows:

> To this point, we have discussed public sources of information on earthquakes. We would now like to know whether, within the last year, you have talked with anyone about the possibility of an earthquake happening in southern California.

A large majority (72.8 percent) said they had participated in such a discussion.

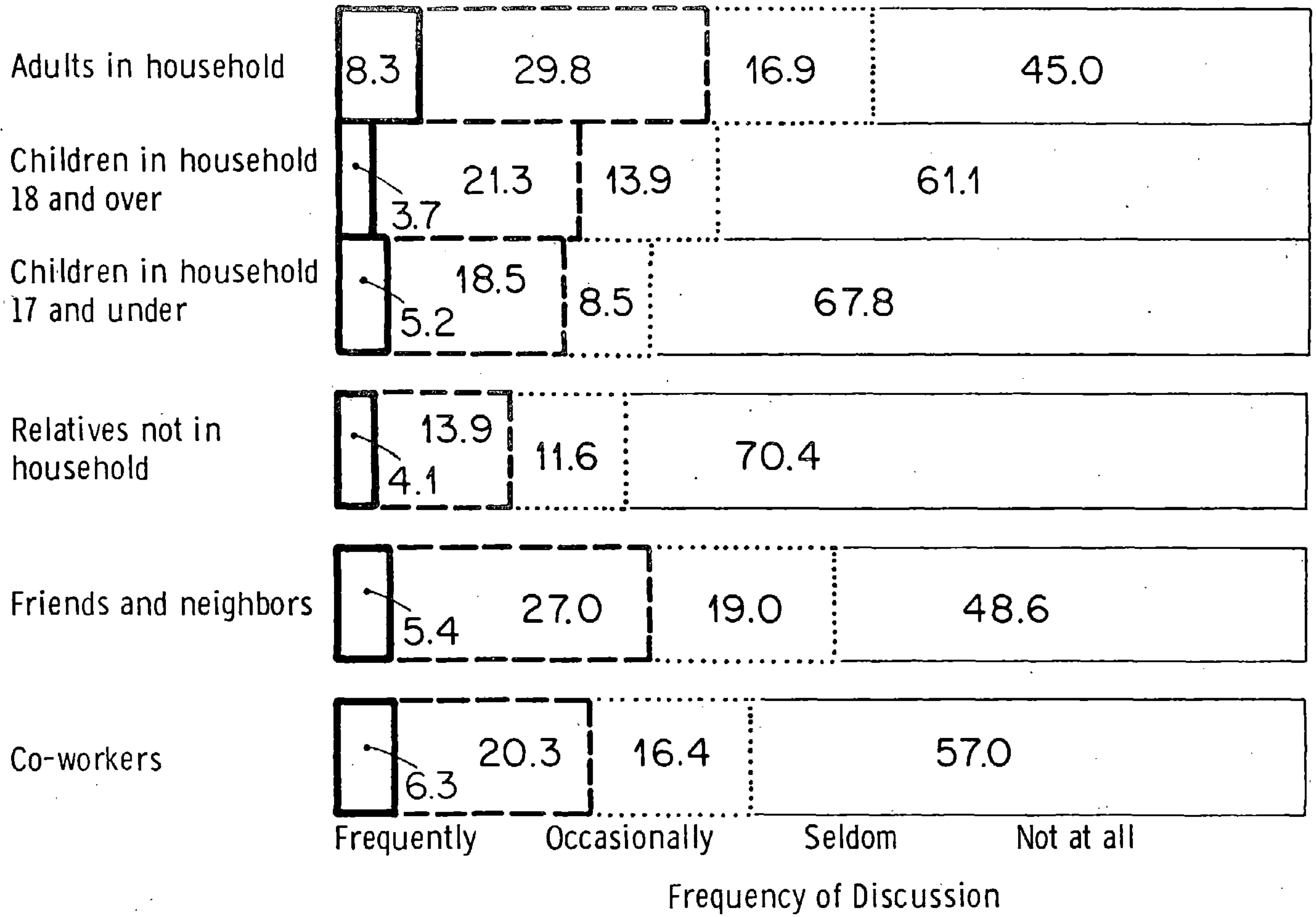
Discussion partners. All respondents who answered affirmatively were then asked the following question:

> With whom did you discuss the possibility of an earthquake happening in southern California in the near future?

The question was open-ended, but the interviewer was given a list of six types of discussion partners under which to code the replies. The categories were: adults in my household (other than children); children in household 18 years and over; children in household 17 years and under; other relatives not in household; coworkers; friends/neighbors. The schedule also allowed space for other responses that could not be coded under the six headings, and space in which to specify more precisely some of the answers that fell into the six categories. After the respondent had mentioned all of the types of partners in earthquake discussion, he or she was then asked to indicate:

> Within the past year, how often have you discussed the possibility of a future earthquake with (. . .)? Frequently, occasionally, or seldom?

The responses to these two questions, indicating the partners with whom the respondents most frequently discussed earthquake matters, are summarized in Figure 3. So few people gave responses that could not be coded into the



PARTNERS IN INFORMAL DISCUSSION OF EARTHQUAKE MATTERS

FIGURE 3

six preestablished categories that we have omitted the seventh category of "Others" from the graph. As would be expected, adults in the household are most often partners in discussion. But children are either sheltered from these discussions or considered less interested or knowledgeable. Friends and neighbors are next in importance after adults in the same household, and co-workers come next.

In computing the percentages used in the graph we have made adjustments for the number of people who could possibly have discussions with each type of partner. Since only 944 of our respondents lived in households with one or more other adults, we used 944 rather than 1450 in computing the percentage of people who discussed earthquake topics with "adults in the household." Similar adjustments were made for the 884 who were employed full- or part-time, the 600 with children in the household under the age of 18 years, and the 108 with children eighteen years old and over in the household. It was assumed that everyone could talk with friends and neighbors and with relatives not in the household, so these percentages are based on the total sample of 1450 persons.

If we were measuring the contribution of discussion with each type of partner to total public consideration of earthquake matters, the rank order would be changed. Conversations with friends and neighbors make the greatest contribution to total public discussion, followed (in order) by conversations with adults in the same household (35.8 percent), with relatives not in the household (29.6 percent), and co-workers (26.2 percent). Children make a much less numerous contribution to public discussion, with 13.3 percent of respondents discussing earthquakes with children under eighteen and only 2.9 percent doing so with children eighteen years and older.

At least two simple observations are warranted by this analysis. First, although there is a good deal of discussion within the family or household, discussion is important in establishing linkages between the household and the neighborhood, the extended family, and the workplace. All of these linkages can be important in supplying perspective from which to interpret the news. Second, children are less often mentioned than might have been expected if they are learning things of relevance at school or if they are regularly part of planning for family wellbeing in case of disaster.

Range of interpersonal communication channels. The six categories of discussion partners provided a way of assessing the range of interpersonal relations within which the concern over earthquakes was expressed and through which information was received, transmitted, and sifted. An index was computed to measure the range of interpersonal channels used by each respondent in discussions of earthquake topics. Someone who had not entered into discussion of earthquake topics with anyone received a score of zero. Someone who had talked only with a spouse or only with coworkers, for example, received a low score. Someone who talked about earthquakes both in and out of the household and family, with coworkers and with friends, with adults and with children, received a high score.

The index was not intended to measure the absolute range of discussion partners, but the extent to which available partners were used in discussion. The index ranged from a possible value of zero for those who engaged in no discussion to 1.00 for those who discussed the possibility of an earthquake with all types of partners available to them. As in the percentages reported in Figure 3, the index incorporated adjustments for the presence or absence of other adults in the household, children in the household, and involvement in full-or part-time employment. For convenience, the index scores were finally divided into four levels, identifying the range of discussion partners as none, limited, moderate, and broad.

We hypothesized that respondents in stable social networks would utilize a wider range of interpersonal communication channels to obtain and sift earthquake information than respondents who were not embedded in such networks. Barton (1969) provides support for this assumption and concludes that in communities where kinship and friendship patterns are minimally developed, only a low level of informal communication takes place. Rose (1968) recognized the importance of one's physical location in the communication process in his study of ecological influentials. He characterized the ecological influential as an individual who exercised undue influence solely because his physical location puts him in contact with people from different social groups. With this in mind, we will see whether involvement in a marital relationship or in formal groups within the local community facilitates discussion of earthquake topics, an important step in formulating public opinion about the earthquake threat.

Evidence supports the hypothesis that participation in stable social networks facilitates the use of informal channels. When we compare respondents who are married with those who are not, we find that the former use significantly more informal channels to obtain and sift earthquake information (Table 7). Similarly, when we examine the extent of participation in local formal organizations and the range of informal discussion partners for earthquake topics, we find a significant relationship between the two (Table 8). However, the relationship is neither clear nor simple. When extreme frequencies of local group membership are compared, the range of discussion partners is wider among respondents with several group involvements than among respondents with none. But intermediate categories vary irregularly. Hence we can only claim weak support for the main hypothesis on the basis of this evidence.

TABLE 7

RANGE OF PARTNERS IN INFORMAL DISCUSSION OF EARTHQUAKE POSSIBILITIES BY MARITAL STATUS

Range of Partners	Single	Married
None	29.6	24.5
Limited	31.1	26.8
Moderate	18.6	22.3
Broad	20.7	27.4
Total	100.0	100.0
Total number	702	743

$X^2 = 14.282$, df = 3, $p < .01$.

TABLE 8

RANGE OF PARTNERS IN INFORMAL DISCUSSION OF EARTHQUAKE POSSIBILITIES BY NUMBER OF LOCAL GROUP INVOLVEMENTS

Range of Partners	Number of local group involvements					
	None	One	Two	Three	Four	Five or more
None	29.6	26.7	22.0	25.3	26.8	19.5
Limited	29.8	28.8	25.4	31.3	24.4	28.1
Moderate	20.6	18.6	25.4	19.3	26.8	18.3
Broad	20.0	25.9	27.2	24.1	22.0	34.1
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total number	685	382	173	83	41	82

Tau = .070, $p < .001$.

TABLE 9

RANGE OF PARTNERS IN INFORMAL DISCUSSION
OF EARTHQUAKE POSSIBILITIES BY SEX

Range of Partners	Male	Female
None	29.2	25.6
Limited	32.0	26.5
Moderate	18.3	22.2
Broad	20.6	25.7
Total	100.0	100.0
Total number	607	841

$X^2 = 11.862$, df = 3, $p < .01$.

Sex is significantly related to the utilization of informal communication networks. Women are more likely than men to engage in discussion with a variety of partners. Earlier we found that women were less likely than men to utilize formal channels. Thus, we conclude that women, as compared with men, rely more heavily on interpersonal networks than on formal channels as their source of earthquake information (Table 9).

There is a clear negative relationship between age and the use of informal sources (Table 10). Younger respondents are more likely to engage in discussion about the earthquake threat with a wide range of partners than older respondents. On the whole, younger respondents utilize both formal and informal channels more fully than older respondents.

Not only is education significantly related to the use of formal channels of communication, but it is significantly related to the use of informal channels as well. The higher one's level of education, the more likely the individual discussed the earthquake possibility with several partners (Table 11). A similar relationship is found between household income and interpersonal discussion (Table 12). The higher the level of income, the more extensive the use of informal networks.

Finally, we examine the relationship between ethnicity and interpersonal discussion. The widest use of informal discussion is among White Anglos. Blacks differ most markedly from the other two ethnic groups in their involvement in discussion, engaging in conversations about the earthquake threat with fewer partners than either White Anglos or Mexican Americans. In this respect, many Blacks seem to be only marginally integrated into communication networks which attend to earthquake topics. Earthquakes may not be a salient topic of concern in the Black community. This observation is supported by the fact that the leading Black newspaper in the Los Angeles area published only one item pertaining to earthquakes in the first six months of 1976. If we can assume

TABLE 10

RANGE OF PARTNERS IN INFORMAL DISSCUSSION
OF EARTHQUAKE POSSIBILITIES BY AGE

Range of Partners	Years of Age			
	18-25	26-33	34-50	51-98
None	22.7	19.3	22.2	38.6
Limited	28.2	33.6	29.3	25.5
Moderate	25.7	19.9	22.2	16.9
Broad	23.4	27.2	26.3	10.0
Total	100.0	100.0	100.0	100.0
Total number	269	321	379	474

Tau = −.108, $p < .001$.

TABLE 11

RANGE OF PARTNERS IN INFORMAL DISCUSSION OF EARTHQUAKE POSSIBILITIES BY EDUCATIONAL ATTAINMENT

Range of Partners	Less Than High School Graduation	High School Graduation	Some College	College Graduation
None	40.1	27.9	19.4	18.4
Limited	26.6	30.2	27.9	30.2
Moderate	15.1	21.7	24.8	20.7
Broad	18.2	20.1	27.9	30.7
Total	100.0	100.0	100.0	100.0
Total number	372	437	376	261

Tau = .155, $p < .001$.

TABLE 12

RANGE OF PARTNERS IN INFORMAL DISCUSSION OF EARTHQUAKE POSSIBILITIES BY HOUSEHOLD INCOME

Range of Partners	Household Income			
	Under $6,000	$6,000-$11,999	$12,000-$19,999	$20,000-$40,000
None	43.0	23.6	19.5	18.5
Limited	26.0	32.2	27.8	30.9
Moderate	16.3	20.6	24.9	21.0
Broad	14.7	23.6	27.8	29.6
Total	100.0	100.0	100.0	100.0
Total number	300	330	349	314

Tau = .160, $p < .001$.

TABLE 13

RANGE OF PARTNERS IN INFORMAL DISCUSSION OF EARTHQUAKE POSSIBILITIES BY ETHNICITY

Range of Partners	White Anglo	Black	Mexican American
None	22.2	42.5	35.1
Limited	30.2	26.5	19.7
Moderate	22.2	14.9	19.7
Broad	25.4	16.0	25.5
Total	100.0	100.0	100.0
Total number	959	181	188

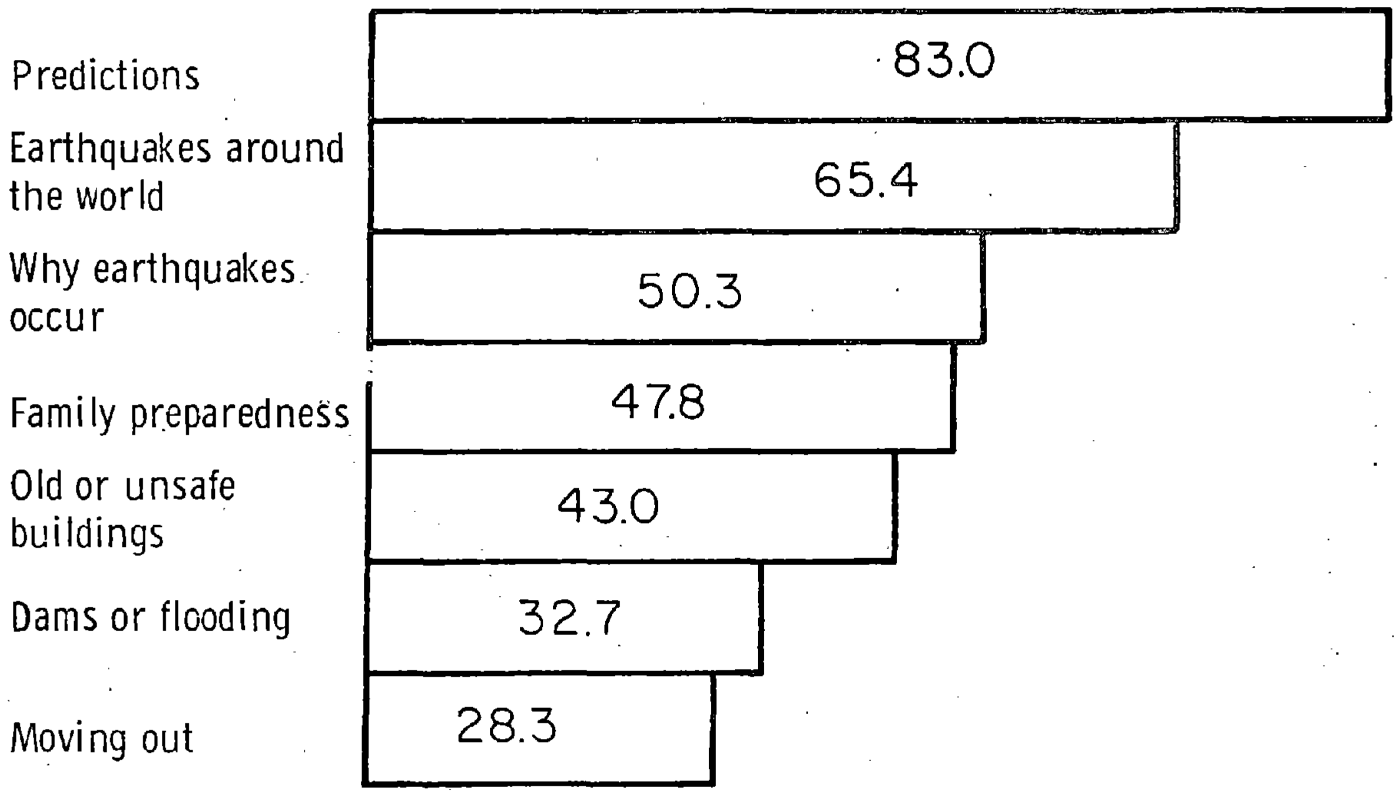
$X^2 = 52.707$, df = 6, $p < .001$.

that the Sentinel focuses on news items of particular interest to the Black community, earthquake topics are apparently not in this category. In comparison, Mexican Americans discussed the earthquake threat with a fairly wide range of partners, more similar to the White Anglo pattern of informal discussion. Given the amount of attention devoted to the Guatemalan and other earthquakes in Latin America in the Spanish-language newspaper, La Opinion, the inference can be drawn that earthquakes also are a topic of concern in the Mexican-American community. This concern also appears to be reflected in the extensive amount of informal discussion about the earthquake threat. (A fuller analysis of ethnic differences will be found in Part Six of the report.)

The foregoing analysis supports the hypothesis that involvement in stable social networks facilitates discussion of earthquake topics by bringing the individual into contact with a variety of discussion partners and by creating the occasion for discussing earthquake topics. One's social identity also plays a part in determining the use of these channels. Women, younger people, people with high levels of income and education, and White Anglos and Mexican Americans are more likely to use informal channels to obtain and sift information about the earthquake threat than other segments of the population.

Informal discussion topics. After the interviewer had recorded each of the types of discussion partner used by the respondent and the frequency of discussion, he or she then inquired about discussion topics. The interviewer presented the respondent a card on which seven topics were listed, along with space for other topics not explicitly mentioned. The interviewer then went down the list of partners checked, asking the same question for each, as follows:

> Looking at this card, please tell me which of these issues you've discussed with (. . .).



INFORMAL DISCUSSION BY EARTHQUAKE TOPICS

FIGURE 4

The frequency with which each topic was discussed is reported in Figure 4 without respect to discussion partner. Again, too few people took advantage of the opportunity to name "other" earthquake topics to warrant inclusion. The relative frequencies for the seven topics are surprising from one point of view. If we assumed that people are most interested in the immediately practical matters, we might have expected more discussion of family preparedness. Because of the sensational character of news about the Tangshan and northern Italy earthquakes and others during the preceding year, it is not surprising that "earthquakes around the world" is a popular topic for conversation. But it is striking that 83 percent have discussed predictions and that half the people say they have discussed "why earthquakes occur." Here is an indication that many people want to understand what is going on about them, consistent with the findings already reported in Chapter Four.

These observations suggest that most people would like to hear more rather than less about even the relatively abstract topic of scientific earthquake prediction. That the topic of predictions commands nearly double the attention that family preparedness does may lend support to the view that people are not likely to turn much attention to preparedness until they are confident that they are subject to fairly certain and imminent danger. Perhaps at this stage people are more interested in knowing <u>whether</u> there will be an earthquake than in <u>what to do</u> about it.

One function the media often serve is agenda setting. That is, the media confer status on events, make issues legitimate, and facilitate formation of public opinion by virtue of media attention to certain topics. One means of testing whether the media have served an agenda setting function with regard to earthquake matters would be to compare the incidence of newspaper coverage of various earthquake topics with the extent of interpersonal discussion of these topics. If the amount of media coverage of topics corresponds to the amount of interpersonal discussion of these topics, or if the media place little emphasis on topics that members of the public do not discuss extensively, the data would be consistent with the agenda-setting function of the media. On the other hand, if the media focus a great deal of attention on topics that are not widely discussed within interpersonal networks, the agenda-setting function of the media would be disconfirmed.

We used the percent of newspaper coverage of earthquake topics as our indicator of media attention to these topics because these data were readily available from monitoring the six local newspapers. Interpersonal discussion of specific earthquake topics was obtained from the list of topics suggested to respondents in the field survey.

Again we must caution the reader about interpreting these results. First, we are looking only at newspaper coverage of topics since we lack quantitative indicators of the other media's attention to these topics. Second, we do not know whether respondents actually received information on these topics from the newspaper or whether they received their information from other sources. However, these data can be used to compare media attention and informal discussion of the same topics.

Overall there is a definite correlation between the rank ordering of the two sets of rates. Predictions and earthquakes around the world are highest in both lists, family preparedness and older or unsafe buildings are intermediate, and dams or flooding come last in both lists. "Moving out" and "why earthquakes occur" were not included in our coding of newspaper content, so they have been omitted from the comparison. Family preparedness and older and unsafe buildings are in reversed order in the two lists, but the differences, especially in discussion rates, are too small to merit serious attention. The

TABLE 14

COMPARISON OF NEWSPAPER COVERAGE WITH INFORMAL DISCUSSION OF SPECIFIC EARTHQUAKE TOPICS

Topics	Percent of Newspaper Coverage*	Percent of Respondents Engaged in Informal Discussion**
Predictions	20.4	83.0
Earthquakes around the world	59.8	65.4
Older or unsafe buildings	5.1	43.0
Family preparedness	4.8	47.8
Dams or flooding	3.3	32.7

*Percentages based on the total number of mentions of all earthquake topics from January, 1976, through April, 1977 (N = 1802).

**Base = 1056

only substantial difference between the two lists is in the reversal of order between predictions and earthquakes around the world. Reports of actual earthquakes receive far more attention in the newspapers than do accounts of earthquake predictions and prediction techniques. But substantially more respondents have discussed predictions than have discussed earthquake events. While scientists and public officials often believe that the public prefer not to be told about predicted quakes, the relatively high incidence of informal discussion might be interpreted as suggesting that many people would welcome more media attention to the topic of prediction.

The data are generally consistent with the assumption that the newspapers set agendas for public discussion and concern. But interpersonal discussion also varies independently of newspaper emphasis. At a broader level of generalization, the media serve as the primary source of information on earthquake topics for most respondents, but interpersonal networks make an important supplemental contribution to the preoccupation and concern.

Local experts. We recall that some of our respondents heard about earthquakes from family members, friends, and associates, and that "people" were given as the chief source of information about nearly 10 percent of the predictions, forecasts, and cautions remembered. Table 15 shows that most respondents who name some person as their chief source of information name someone outside of the family and the work group. Neighborhood and friendship networks are most important here.

Lazarsfeld, Berelson and Gaudet (1944) were among the first to recognize that certain members of the public are especially influential in shaping the opinions and decisions of their peers. Studies of public opinion formation have shown that before people make a commitment to action, they often turn for information and advice to specific friends or acquaintances who are believed

TABLE 15

PEOPLE AS THE CHIEF SOURCES OF INFORMATION ABOUT EARTHQUAKE PREDICTIONS, FORECASTS AND CAUTIONS

Type of relationship	Percent of all respondents
Friend or neighbor	5.6
Family member	1.7
Co-worker	1.5
Relative	.9
Total	9.7
Total number	167

to have special knowledge or wisdom on the subject under debate. These so-called "opinion leaders" often play a crucial role in shaping public opinion.

The concept of opinion leadership has important implications for the newly emerging science of earthquake prediction as well. Coleman, Katz, and Menzel (1966) note that personal influence often plays an important role in decision-making when the situation is uncertain. Since opinion leaders are often regarded by others as "experts," they are likely to be influential with respect to opinions concerning this new area of expertise.

We will refer to this special member of one's social circle as the "local expert." The local expert is an individual who has identified him or herself as the most knowledgeable among his or her circle of friends on earthquakes and earthquake predictions. It is important to remember that the local expert as identified among our respondents is strictly self-designated, that is, he or she possesses a self-image of expertise which may not be recognized by others. On the other hand, when the respondent identifies someone in his circle of associates as a local expert we cannot say whether the designated expert would make a corresponding self-designation. And in neither case can we be sure that the local expert is truly an authoritative source who exerts influence on others because people recognize he or she possesses special expertise (Weber, 1914).

Due to the expert's potential as a source of information and influence on decisions about earthquake matters it is important to determine the concentration of local experts within the community. In order to determine whether such experts exist, we asked our respondents the following:

> Including yourself, is there anyone in your circle of friends who seems most knowledgeable about earthquakes or earthquake predictions?

If the answer was "yes," respondents were asked:

> Who is that?

TABLE 16

PERSONS WHO ARE MOST KNOWLEDGEABLE ABOUT EARTHQUAKE TOPICS

Most Knowledgeable Person	Frequency		Percent of Total Sample	Percent of "Other"
Self	36	36	2.5	
Other	221		15.2	
Friend/neighbor		103		46.6
Other relative		50		22.6
Adults in household		31		14.0
Co-worker		27		12.2
Children in household		5		2.3
Other		5		2.3
No one named	1187	1187	81.9	
No answer, don't know, refused	6	6	.4	
Total	1450	1450	100.0	100.0

A total of 257 respondents, or 17.8 percent of the entire sample, could identify a local expert (Table 16). When we separate the 36 respondents who named themselves, 15.2 percent of the sample knew someone among their circle of friends they regarded as expert. About half of the local experts were identified as friends, about a third as relatives and members of the immediate household, and about one eighth as work associates. The overwhelming majority of respondents indicated that they had no one in their social circle they could turn to for information about earthquakes and earthquake predictions. We will discuss the implications of this finding at a later point.

Now that we have established the existence of local experts, we will focus on two important questions. First, do the self-proclaimed local experts differ from the rest of our respondents? Second, what is the nature of the relationship between local experts and the people they influence?

For purposes of analysis, respondents were divided into three groups: individuals who designate themselves most knowledgeable about earthquake topics--the local experts; individuals who acknowledged a member of their circle of friends most knowledgeable--the associates; and individuals who did not acknowledge anyone most knowledgeable--the unacquainteds.

A stepwise multiple descriminant function analysis (MDA) was used to determine whether there are any systematic differences among the three groups of respondents. This methodology was selected for four reasons. First, it performs an analysis on individuals assigned to a priori groups. Second, a stepwise MDA enters variables sequentially and selects the variables in order, according to how much they contribute to differentiating among the groups. Variables that do not contribute to further discrimination are eliminated from the analysis. In this way we can determine which variables are the best discriminators and how well specific variables discriminate among the groups. Third, by summarizing each group's location in a reduced discrim-

TABLE 17

SUMMARY TABLE OF THE DISCRIMINANT ANALYSIS

Step Number	Variable Entered/Removed	F to Enter or Remove	Wilks' Lambda
1	Extent of interpersonal discussion of earthquake possibility	24.49997	0.96199
2	Favorability toward science	13.74760	0.94110
3	Years of education	12.34180	0.92270
4	Acknowledged hearing about earthquakes from books	9.62851	0.90856
5	Number of group meetings attended	9.17995	0.89526
6	Sex	4.52303	0.88875
7	Marital status	5.57107	0.88080
8	Awareness of endangered groups	5.26933	0.89332
9	Acknowledged hearing about earthquakes from TV specials	5.42420	0.86570
10	Employment status	3.39110	0.86095

inant space, it determines whether there are significant differences between the groups. Finally, by interpreting the discriminant function in terms of these variables we can specify the nature of group differences, that is, "name" the dimension on which the groups differ.

Twenty-six variables were initially entered into the analysis. Most of these variables will be new to the reader and will be more fully explained in later chapters of the report. Our basic strategy was to select variables according to two criteria: the theoretical interest to disaster research, and previous research on opinion leader-follower differences.

In reporting the findings we shall discuss each group of variables in turn, indicating which variables discriminated among the three groups and which did not. The data revealed two patterns of group differences. In some cases the local experts were a distinct group; in other cases the experts and the associates were similar to each other but different from the unacquainteds. As we review the findings, we shall call attention to these two patterns of group differentiation.

Only ten of the twenty-six variables originally entered into the analysis were selected for contributing substantially to discriminating among the groups. Table 17 shows the reduced set of variables with their associated Wilks' Lambda, F needed for entry, and the step at which each variable was entered into the analysis. For the individual variables, the higher the F ratio value, the more discriminating the variable.

In examining the reduced set of variables, we find that the measures of awareness of earthquake predictions (cf. Chapter 7) and understanding of the Uplift (cf. Chapter Six) fail to discriminate among the groups. When we examine these findings more closely, an interesting pattern emerges. The data in Table 18 indicate that over forty percent of the unacquainteds, as compared to 28.5 percent of the associates and 19.4 percent of the experts,

TABLE 18

AWARENESS OF THE UPLIFT BY LOCAL EXPERTS, ASSOCIATES, AND UNACQUAINTEDS

Understanding of Uplift	Unacquainteds		Associates		Experts	
			Frequency			
Heard of Uplift	667		158		29	
Heard, not understood		187		36		8
Heard and understood		193		54		9
Heard and relevant		287		68		12
Not heard of Uplift	520		63		7	
Total	1187		221		36	
			Percent			
Heard of Uplift	56.2		71.5		80.6	
Heard, not understood		28.1		22.8		27.6
Heard and understood		28.9		34.2		31.0
Heard and relevant		43.0		43.0		41.4
Not heard of Uplift	43.8		28.5		19.4	
Total	100.0		100.0		100.0	

TABLE 19

AWARENESS OF PREDICTIONS BY LOCAL EXPERTS, ASSOCIATES, AND UNACQUAINTEDS

Number of Predictions Heard	Unacquainteds		Associates		Experts	
			Frequency			
Did not hear any	170		25		3	
Heard predictions	1017		196		33	
Heard one		698		106		20
Heard two		261		65		9
Heard three or more		58		25		4
Total	1187		221		36	
			Percent			
Did not near any	14.3		11.3		8.3	
Heard predictions	81.7	100.0	88.7	100.0	91.7	100.0
Heard one		68.6		54.1		60.6
Heard two		25.7		33.2		27.2
Heard three or more		5.7		12.7		12.1
Total	100.0		100.0		100.0	

are unaware of the Uplift. However, regardless of whether they were in contact with an expert or not, the proportions of those who understood that the Uplift might signify a coming quake and expected damage where they lived were much the same. The same relationship exists between awareness of earthquake predictions and group membership (Table 19). The unacquainteds are least likely to be aware of earthquake predictions and forecasts. However, unacquainteds who are aware of any announcements are as likely as members of the other two groups to have heard more than one announcement. Experts and associates are more likely than unacquainteds to be aware of the Uplift and of earthquake warnings, but they are no more likely to have more than minimal awareness.

Awareness of endangered groups is the only measure of knowledge that significantly discriminates among the groups. However, it is the associates who are the most aware. The local experts are similar to the unacquainteds in their level of awareness. In awareness of the needs of especially vulnerable groups, the local experts' actual knowledge is not consistent with their self-image of expertise.

Among the ten items used to compare the groups' mass communication exposure, only two discriminated among the groups. Although the three groups are not distinguished by their use of most mass media, the experts and associates are distinguished from the unacquainteds by their reliance on sources that provide more extensive coverage of earthquaek topics. The local experts and associates are similar to each other in their use of television specials. Books provide the most intensive treatment of all and their use sets the experts apart from the other two groups. This finding suggests that the experts and associates may be distinguished from the unacquainteds by their interest in earthquake topics since both groups utilize sources which provide information on earthquake topics in depth.

The two variables that measure the extent of interpersonal communication, discussion of the earthquake possibility and attendance at group meetings, separate the expert and associate groups from the unacquainteds. However, it is the associates who utilize these channels more extensively. This suggests that the associates play a significant role in soliciting opinions through frequent interaction in groups where earthquakes are a topic of conversation.

The observation that the local experts and associates have greater exposure to formal and informal channels of communication than the unacquainteds must be viewed in light of the earlier finding that the experts and associates are more likely to understand the significance of the Uplift and be aware of endangered groups than individuals without this social contact. This observation also reaffirms our earlier assumption that there is a greater degree of interest in earthquake topics among these two groups.

Socioeconomic status, age, community attachment, and the presence of school-children in the home, did not discriminate among the groups. However, four social background variables did. The unacquainteds and the associates are more similar in sex, education, employment, and marital status, than either group is to the local experts. Individuals who are single, male, have higher levels of education, and are not working, are more likely to claim to be local experts. Although there is clearly not a simple dimension of socioeconomic status at work here, higher educational attainment and being male do suggest that more strictly <u>social</u> status differences may be at work. The fact that "experts" are more often single and not at work, coupled with the higher education, suggests that a disproportion of the self-designated local experts may be students.

In our attempt to characterize the local expert we find that they are not unlike the people they influence, namely the associates. The experts and the associates are quite similar in their use of the mass media and their knowledge of earthquake issues. On the one hand, the two groups differ in their use of interpersonal communication and social status. The experts are less likely to use interpersonal sources and are more likely to have certain higher social status characteristics than the associates. Although local experts are distinct from others, the differences are quite small.

Discriminant function analysis produces a table of standardized discriminant function coefficients which can be treated as axes of a geometric space. The analysis produced two significant functions, indicating that the groups differ along two dimensions. By examining the values associated with each variable we can characterize each dimension somewhat analogously to naming a factor in factor analytic techniques (Table 20).

Four variables are associated with Function 1, namely, television specials, books, the number of group meetings attended, and the extent of discussion of the earthquake possibility. Variables associated with this function refer to media and interpersonal channels of communication; therefore, this function characterizes groups according to their use of "earthquake information sources." Three variables are highly associated with Function 2; these include employment status, marital status, and sex, This dimension discriminates among the groups on "social status characteristics."

The values of the group centroids appear in Table 21. These values summarize the groups' locations in the reduced space and can be used to determine the distance between groups along the dimensions named above. On Function 1 the group centroid for the associates is closest to that of the local experts; therefore "earthquake information sources" is the dimension

TABLE 20

STANDARDIZED DISCRIMINANT FUNCTION COEFFICIENTS

Variable	Function 1	Function 2
Employment Status	0.11852	-0.47857
Years of Education	0.02650	-0.00196
Awareness of Endangered Groups	0.06368	-0.08422
Favorability toward Science	0.04019	0.05289
Acknowledged hearing about earthquakes from TV specials	0.32883	0.07075
Acknowledged hearing about earthquakes from books	0.28092	0.31565
Number of group meetings attended	0.40218	-0.21184
Extent of discussion of the earthquake possibility	0.37681	-0.19125
Marital Status	-0.25888	-0.39743
Sex	-0.03997	-0.77831

TABLE 21

CENTROIDS OF GROUPS IN REDUCED SPACE

Groups	Function 1	Function 2
Unacquainteds	-.19635	.01064
Associates	.83522	-.24378
Local Experts	1.14772	1.02102

on which the latter two groups differ from the unacquainteds. The fact that Function 1 discriminates between those in and out of an expert-associate relationship further supports the notion that there is mutual attention to earthquake information among the experts and associates. Along Function 2 we find that the associates are closer to the unacquainteds. This indicates that local experts are discriminated from the other two groups on the basis of social status. The fact that social status discriminates between self-designated experts and others lends support to our earlier interpretation. The role attribution of expert may, in part, reflect one's higher social status rather than being an accurate reflection of individual knowledge differences.

The final step in discriminant function analysis is to measure how accurately people can be classified on the basis of the analysis. MDA classifies individuals into the most likely group membership according to their score on the discriminant function. The fewer the number of misclassification, the more distinct the groups. Correctly classified cases appear along the diagonal in Table 22. A substantial proportion (81.6 percent) of the cases are correctly classified. However, if we examine the table closely, we find that most of the associates and local experts are misclassified. Almost all the unacquainteds (98.1 percent) are correctly classified; however, only 6.8 percent of the associates and 8.6 percent of the local experts are correctly predicted. The latter two groups are more often misclassified as unacquainteds. The data indicate that the three groups are not as distinct as originally theorized. The variables used to characterize the local experts are poor discriminators and in fact there is a great deal of overlap among the three groups. This finding is noted in our earlier discussion of discriminating variables and is further reiterated by the canonical correlation. The closer the correlation is to zero, the less the separation among the groups.

TABLE 22

CLASSIFICATION BASED ON DISCRIMINANT FUNCTION SCORES

Actual Group	Number of Cases	Predicted Group Unacquainteds	Predicted Group Associates	Predicted Group Experts
Unacquainteds	1017	998 (98.1%)	18 (1.8%)	1 (0.1%)
Associates	191	177 (92.7%)	13 (6.8%)	1 (0.5%)
Experts	35	31 (88.6%)	1 (2.9%)	3 (8.6%)

Percent of "grouped" cases correctly classified: 81.58%

A canonical correlation of .337 on Function 1 and .170 on Function 2 indicates a great deal of overlap among the groups. While the variables associated with "earthquake information sources" are moderate discriminators, there is relatively little difference among the groups on the social status dimension. This can partly explain why the experts and associates are frequently misclassified as unacquainteds.

Much of the evidence suggests that we should view the expert-association system as a unit of analysis rather than the individual. The fact that Function 2, which is a status dimension, discriminates between local experts and others, while the earthquake information dimension only discriminates between those in and out of the system, lends support to this interpretation. Let us examine some of the components of this system.

Experts and associates are homophilous with regard to their interest and knowledge of earthquake matters. The experts pass on information and exchange opinions with individuals just as active and knowledgeable as themselves, while individuals who have less exposure and are less aware of earthquake issues are excluded from the system. The vertical flow of information from opinion leaders to their followers does not adequately describe information diffusion in the expert-associate system. Instead, information disseminates horizontally between the highly interested experts and the somewhat less interested associates, rather than to the uninterested unacquainteds as the two-step flow model suggests. Since members of this system are more likely to obtain information on earthquake topics than those outside the system, it appears that interest in earthquake topics is the basis for interaction among members of these two groups. By interacting with individuals who share a common interest, communication is more effective, hence more rewarding.

The data suggest that the expert-associate relationship is characterized by a system of reciprocity. Some basic principles of exchange theory can be used to explain how this system operates (Homans, 1961; Blau, 1964). Each party has certain resources and activities the other needs and expects to exchange. A basic premise of this theory states that a person who gives others valuable services makes a claim for superior status by obligating others to him. To discharge this obligation, the other must furnish benefits to the provider of the services. Now we will examine how these principles apply to the expert-associate system.

First, we examine the experts' claim to superior status. Individuals who possess a higher social status, in this case males or individuals with a high level of education, are more likely to perceive themselves in the "expert" role. While both groups obtain information from media sources that provide earthquake information in detail, local experts are more likely to use books as a source. Weiss (1969) states that reading print material enhances ones' prestige, therefore reading books may represent what is expected of an "expert." While the role attribution of "expert" may be a result of one's social status, it is further enhanced by the use of this media source.

In an exchange system, leadership is based upon rendering rare but valuable services to members of a group (Homans, 1961, p. 314). Due to the small number of people who occupy this position and the limited supply of information on these topics, the experts' services are highly valued. Local experts provide two valuable services to the members of this system. First, they provide a scarce resource to individuals seeking information on earthquakes and earthquake predictions. Second, this role attribution provides a mechanism to facilitate discussion of earthquake topics. The local experts' presence allows a type of interaction to take place in which the associate asks for advice or information, relates what he has heard to others, and offers personal speculation. The expert affirms the merit of the communication solely by his image of expertise. However, by asking the experts for information and advice the associates reinforce the experts' image of expertise.

Three factors seem to contribute to the local experts' role. First, they have higher social status than other members of the system. Second, their image is reinforced by the associate's request for information. Finally, they demonstrate a higher level of interest in earthquake issues by reading books on the subject, thereby exemplifying the norms of the system.

Finally, the data support a notion suggested by Van den Ban (1966) that there may be a hierarchy of opinion leadership. Our findings indicate that while the local experts play an active role with regard to certain mass media, they play a passive role with regard to informal communication. The division of labor between the experts and the associates creates this hierarchy. The local experts, because of their availability to the associates for conversation and knowledge, are likely to be the opinion leaders for this group. However, the associates' involvement in informal networks suggests they may be the opinion leaders for the unacquainteds. Information that is exchanged between experts and associates may eventually be disseminated, via the associates, to the less interested unacquainteds. For this reason, the associates may constitute an important link between the book-reading experts and the general public. This contact allows the associates to understand more fully the potential human implication of the earthquake threat and to convey this understanding to others. The fact that the associates are more aware of endangered groups appears consistent with this special role as the bridge between impersonal knowledge and popular understanding.

The overwhelming majority of the people have no one in a personal relationship that they can turn to for their special knowledge or wisdom on earthquake matters. If theories about the role of local expert or opinion leader are correct, this lack may contribute to public uncertainty and indecisiveness. Perhaps, too, it leaves public attitudes more directly at the mercy of the mass media than is true in many other realms of public concern.

We conclude that membership in an expert-associate system is significant for two reasons. First, being a member of this social circle seems to facilitate exposure to certain communication channels which can lead to a more comprehensive understanding of earthquake issues. Second, individuals who are part of this system benefit by being better able to appreciate the significance of the earthquake threat as a relevant topic of concern than those outside this social network. While this system may not be instrumental in disseminating earthquake information to large segments of the public at the present time, it appears to be instrumental in keeping public interest in earthquake topics alive by providing an audience that focuses its attention on earthquake issues.

Combining Media With Interpersonal Discussion

Disaster researchers note that media communicated warnings alone seldom stimulate people to take adaptive response. Before people respond to disaster warnings, mass communicated messages are often filtered through interpersonal networks for further interpretation. This pattern of response is similar to the pattern of communication known as the two-step flow model (Lazarsfeld, Berelson, and Gaudet, 1944). This model describes the flow of information from the mass media to opinion leaders and then from opinion leaders to less active segments of the public.

Studies designed to test the two-step flow model indicate that this model does not adequately describe the dissemination of information to all segments of the public. Separate studies by Deutschman and Danielson (1960) and Greenberg (1964) demonstrate that a great deal of information flows directly from the media to members of the public without being relayed through interpersonal channels. Much information is disseminated to the public via a one-step flow model in which the media are the sole source of information.

On the other hand, when the media fail to meet the high demand for information, researchers have found that interpersonal communication often fills the gap and rumor activity supplies individuals with needed information. This model describes a situation in which interpersonal channels are used to a greater extent than the mass media in supplying information on near predictions of earthquakes.

Because we expect that people who rely on different patterns of communication are likely to differ in awareness and response, it is important to identify people who rely on these different patterns of communication.

We will distinguish broadly between those people who rely exclusively on the media, those who get their information principally from informal sources, and those who use informal discussion to sift and extend what they receive from the media. The first group is easy to identify as consisting of respondents who have learned about earthquakes from media sources but have not engaged in discussion of earthquake topics. The second and third groups are more difficult to distinguish. The number who rely exclusively on discussion to too small for separate analysis. But we can combine those few with all respondents who mention family members, friends, coworkers, or other discussion partners as the <u>chief</u> source of information about one or more earthquake predictions, near predictions, or forecasts. The result of this sorting process is to separate those respondents who identify the media as the source of their information and use informal discussion to sift and extend their understanding from respondents who place greater than customary reliance on informal discussion as an authoritative source of information.

The frequency of these three patterns is presented in Table 23. The use of interpersonal discussion to supplement the mass media characterizes the majority of respondents, which indicates that the two-step or multi-step flow model may describe the typical pattern of communication used to obtain information about the earthquake threat. About a quarter of the respondents rely exclusively on the mass media, indicating that a sizeable minority may not be exposed to the important effects of interpersonal influence in interpreting and responding to earthquake forecasts. A relatively small percentage of the respondents use interpersonal discussion as a substitute for media sources. Two conclusions can be drawn. First, although informal discussion does not take the place of the mass media, it is extensively enough used as a supplement to play an important role in shaping public opinions and actions. Second, the need to know and understand earthquake matters is not totally satisfied by the media; therefore, it is supplemented by discussion in informal networks.

Although it has been presented only briefly here, this typology will be used extensively in later portions of the report in the course of our efforts to understand the nature of awareness and response to the earthquake threat.

TABLE 23

PATTERNS OF COMMUNICATION USE

Patterns of Use	Frequency	Percentage
Exclusive reliance on media	352	24.6
Discussion supplementing media	952	66.4
Disproportionate reliance on discussion	128	8.9
Total	1432	100.0

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CHAPTER SIX

ARE SOUTHERN CALIFORNIANS AWARE OF THE UPLIFT?

Salience

Public attention shifted constantly throughout the year 1976 between earthquake predictions and near predictions, reports of devastating earthquakes such as those in Guatemala, the north of Italy, and the People's Republic of China, and controversial issues such as nuclear power plant safety, dam dafety, and the safety of unreinforced masonry buildings. But the existence of the great Uplift along the San Andreas fault, near to California's largest metropolis, was the constant that gave meaning and urgency to all of the discussion. After a year of exposure to reports and debate, how aware and concerned were people about the Uplift?

We first approached this question indirectly, in order to see how often the Uplift came to mind when people were asked about earthquake predictions and warnings. We use the term salience as distinguished from mere awareness to indicate that people think immediately of the Uplift when the topic of earthquake predictions and warnings is broached. Respondents were asked the following 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 the answer was positive, the respondent was then asked:

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

Respondents were encouraged to give more than one answer, and up to five different answers were recorded and coded for each respondent.

TABLE 1

SIGNIFICANCE OF THE UPLIFT

Answer to the question: Do you happen to remember what scientists are saying the bulge signifies? Does it signify that:	Percent
There is definitely an earthquake coming,	10.8
There is probably an earthquake coming,	15.8
There might be an earthquake coming, or	16.3
The bulge doesn't signify that an earthquake is coming?	6.1
DON'T KNOW AND NOT ANSWERED	10.1
Total who heard of the Bulge	59.1
All others	40.9
Total percent	100.0
Total number	1450

The range of answers to these questions will be discussed in the next chapter of the report. But only 110 people, or 7.6 percent of the sample, mentioned the Uplift by one of its names or in vaguer but recognizable terms. The existence of the Uplift plainly has little salience for most of the residents of Los Angeles County. When we compare other responses in the next section, it may be possible to speculate on why this should be.

Awareness

In order to measure awareness of the Uplift, we later asked the following question of everyone who had not volunteered a reference to the Uplift:

> Do you remember hearing about a bulge in the earth near Palmdale in the Mojave Desert?

Combining respondents who answered "yes" to this question with respondents who mentioned the Uplift in answer to the prior questions, we find that 857 people, or 59.1 percent of the sample, were aware of the Uplift. Depending upon how one chooses to interpret these figures, we can be pleased that three out of five residents have heard of the Uplift, or disturbed that two out of five have not even heard of the Uplift after a year of public attention.

Merely having heard about a bulge in the desert may not signify any real awareness of the Uplift and its significance. Hence we asked people if they remembered what scientists were saying that the bulge signified. The objective of this question was to ascertain whether people understood that the bulge might be the precursor to an earthquake. The actual wording of the question is given in Table 1. The 157 respondents who believe that scientists make a definite connection between the Uplift and a coming quake have overestimated scientific confidence in the meaning of the Uplift, but at least have the right idea about the Uplift. The 466 who believe scientists interpret the Uplift as probably or possibly an earthquake precursor have

TABLE 2

EXPECTED DAMAGE WHERE RESPONDENT LIVES

Answer to the question: If the bulge should signify a coming earthquake, in your opinion, do you think there will be damage where you live? Would you say:	Percent
A great deal,	5.7
Some,	23.7
Not very much, or	13.6
None at all?	5.5
DON'T KNOW AND NOT ANSWERED	4.5
Total asked (see text)	53.0
All others	47.0
Total sample	100.0
Total number	1450

most adequately grasped the view presented in the responsible media. But the 234 persons who don't know, or who believe scientists are saying the Uplift is not an earthquake precursor lack something in awareness of the Uplift and its significance. If we eliminate these 234 persons, we find that 72.7 percent of the people who have heard of the Uplift understand that it may be an earthquake precursor. This constitutes 43.0 percent of the entire sample, down from the 59.1 percent who have heard of the Uplift.

Relevance

Awareness of the Uplift and of its possible significance as an earthquake precursor still does not insure that the earthquake threat has a personal meaning for the individual. Some people may think of Palmdale as a long way off and any associated earthquake as equally remote. Some may view the earthquake threat with interest and curiosity but not seriously examine whether it might affect them. Still others may be aware of scientific discussions but not take them seriously. We asked two questions in order to judge whether the earthquake threat associated with the Uplift was personally meaningful to our respondents.

First, we asked all of the respondents who had heard of the Uplift, except for the 88 people who said the Uplift didn't signify a coming quake, whether they expected damage where they lived in case of an Uplift-connected earthquake. The precise wording of the question appears in Table 2. Only 82 people expected a great deal of damage where they lived, but a total of 426 or 29.4 percent of the entire sample expected either some damage or a great deal of damage where they lived. Only 5.5 percent were prepared to say there would be no damage where they lived. If we eliminate people who don't know whether scientists are saying the Uplift might signify an earthquake,

TABLE 3

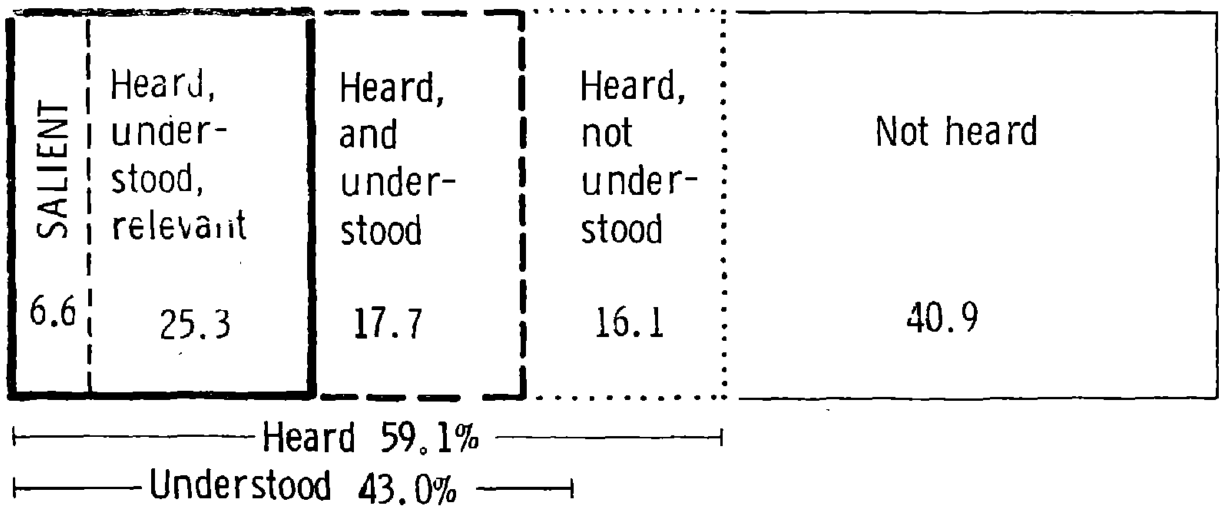
HOW SERIOUSLY RESPONDENTS TAKE THE UPLIFT

Answer to the question: How seriously do <u>you</u> take the Palmdale bulge as the sign of a coming earthquake?	Percent
Quite seriously,	11.4
Fairly seriously,	17.9
Not very seriously, or	14.3
Not seriously at all?	6.4
DON'T KNOW AND NOT ANSWERED	3.0
Total asked (see text)	53.0
All others	47.0
Total sample	100.0
Total number	1450

25.3 percent have heard of the Uplift, understand that it may be an earthquake precursor, and expect some damage where they live in case of an Uplift-connected earthquake. From our total sample, 29.7 percent have heard of the Uplift but either don't see it as an earthquake precursor or don't anticipate much damage where they live.

We also asked the same set of respondents how seriously they took the Uplift as a sign of a coming earthquake (Table 3). More than half these respondents said they took the Uplift seriously (fairly and quite seriously). More than one in five said they took it quite seriously. However, a substantial 39.0 percent of persons who had heard of the bulge said they did not take it seriously. As parts of the total sample, 11.4 percent had heard of the Uplift and took it quite seriously, and 29.3 percent had heard and took the Uplift either fairly seriously or quite seriously. From 25 to 29 percent find the Uplift personally relevant, depending on which of these last two questions we use.

The findings on awareness, understanding, relevance, and salience can be summarized in the simple accompanying graph (Figure 1). From left to right the graph identifies groups to whom the Uplift is decreasingly significant. The solid block on the left includes those who have heard, understood, and seen the relevance of the Uplift. The next segment includes those who have heard and understood, but don't see the Uplift as personally relevant. Next come those who have heard of the Uplift but missed its significance as a possible earthquake precursor. And on the extreme right are those who have not even heard of a "bulge in the earth near Palmdale in the Mojave Desert," or have forgotten about it. The small segment to whom the earthquake threat is salient is included in the graph for comparison, although it does not necessarily correspond with knowledge and understanding of the Uplift.



AWARENESS OF THE SOUTHERN CALIFORNIA UPLIFT

FIGURE 1

Salience, Seriousness, and Expected Damage

A first clue to whether the Uplift is salient and whether it is taken seriously or not may lie in the amount of damage people expect where they live in case of an Uplift-related earthquake. While scientists debated whether the Uplift was a precursor to an earthquake or not, they all agreed that any quake that might occur would be a large and destructive one. Yet a substantial proportion of even the respondents who understood the Uplift as a possible earthquake precursor did not expect much damage where they lived. It is reasonable to suppose that the Uplift was more likely to be salient and to be taken seriously by people who expected severe damage where they lived than by those who expected only little or no damage.

The 143 respondents who spontaneously mentioned the Uplift when the question about predictions, statements, and warnings was broached were compared with the 626 respondents who remembered the Uplift only when asked specifically about it, according to the expected quake intensity. About 63 percent of those for whom the Uplift was salient expected some or a great deal of damage where they lived, compared to about 54 percent of the others (Table 4). The table reveals a weak and marginally significant relationship between salience and expecting damage. Respondents who expect damage where they live are slightly more disposed to have the Uplift on their minds than those who don't expect damage, but the explanatory power is not great.

In comparing the respondents who took the Uplift seriously with those who did not, we have kept the _salients_ and the _awares_ separate because of the slight correlation just reported. There is an apparent positive relationship between expecting damage and taking the Uplift seriously for both the _salients_ and _awares_. Only the relationship for the _awares_ is statistically significant, however. The sample of _salients_ is much smaller, so it is not

TABLE 4

EXPECTED DAMAGE AS A RESULT OF THE UPLIFT BY SALIENCE

Expected Damage	Uplift salient	Aware of Uplift but not salient	Total	Total number
A great deal	20.7	79.3	100.0	82
Some	21.5	78.5	100.0	344
Not very much	15.2	84.8	100.0	198
None at all	8.8	91.2	100.0	80
Don't know or no answer	23.1	76.9	100.0	65

(X^2 = 9.174, df = 4, $p < .05$)

TABLE 5

SERIOUSNESS OF THE UPLIFT BY DAMAGE EXPECTED

Damage Expected	Take the Uplift seriously	Do not take the Uplift seriously	Total	Total number
Respondents for whom Uplift is salient				
Great deal	82.4	17.6	100.0	17
Some	74.6	25.4	100.0	71
Not very much	60.0	40.0	100.0	30
None	60.0	40.0	100.0	5
(X^2 = 3.602, df = 3, not significant)				
Respondents for whom the Uplift is not salient				
Great deal	76.6	23.4	100.0	64
Some	61.1	38.9	100.0	265
Not very much	49.7	50.3	100.0	161
None	37.3	62.7	100.0	67
(X^2 = 25.888, df = 3, $p < .001$)				

TABLE 6

SERIOUSNESS OF THE UPLIFT BY PREDICTION BELIEF

Prediction belief	Take the Uplift seriously	Not take the Uplift seriously	Total	Total persons
Believer	62.8	37.2	100.0	420
Strictly scientific	58.2	41.8	100.0	223
Anti-scientific	45.0	55.0	100.0	60
Skeptic	18.2	81.8	100.0	22

($X^2 = 22.525$, df = 3, $p < .001$)

surprising that the relationship does not reach significance. Inspection of percentage differences suggests that the relationship for the awares is also considerably stronger. The combined Chi-square of 29.490 is highly significant ($p < .001$) for the six combined degrees of freedom. The extent of personal damage expected in case of an earthquake can make a moderate but clear contribution to the seriousness with which respondents take the Uplift, especially among persons for whom the Uplift is not salient (Table 5).

In Chapter Four we introduced the prediction belief typology, which groups people according to the kinds of prediction they believe in. Since the Uplift is a scientific discovery, we expected to find that people who are confident of scientists' ability to predict earthquakes will take the Uplift more seriously than people with alternative orientations. We find a significant relationship between prediction belief and how seriously the Uplift is taken ($X^2 = 22.525$, $df = 3$, $p < .001$). Over sixty percent of the people who believe in both scientific and nonscientific prediction take the Uplift seriously (Table 6). People who believe in only scientific prediction are slightly less likely to take the Uplift seriously. On the other hand, less than half of the anti-scientific respondents take the Uplift seriously. Skeptics, who do not believe in any form of prediction,are the least likely to take the Uplift seriously. Only 18 percent take the announcement seriously. We conclude that the confidence people have in scientists as predictors plays a significant role in determining whether people take the Uplift seriously or not. But belief in other kinds of prediction also plays a part, as demonstrated by the finding that more believers than strictly scientifics take the Uplift seriously and more anti-scientifics than skeptics do so.

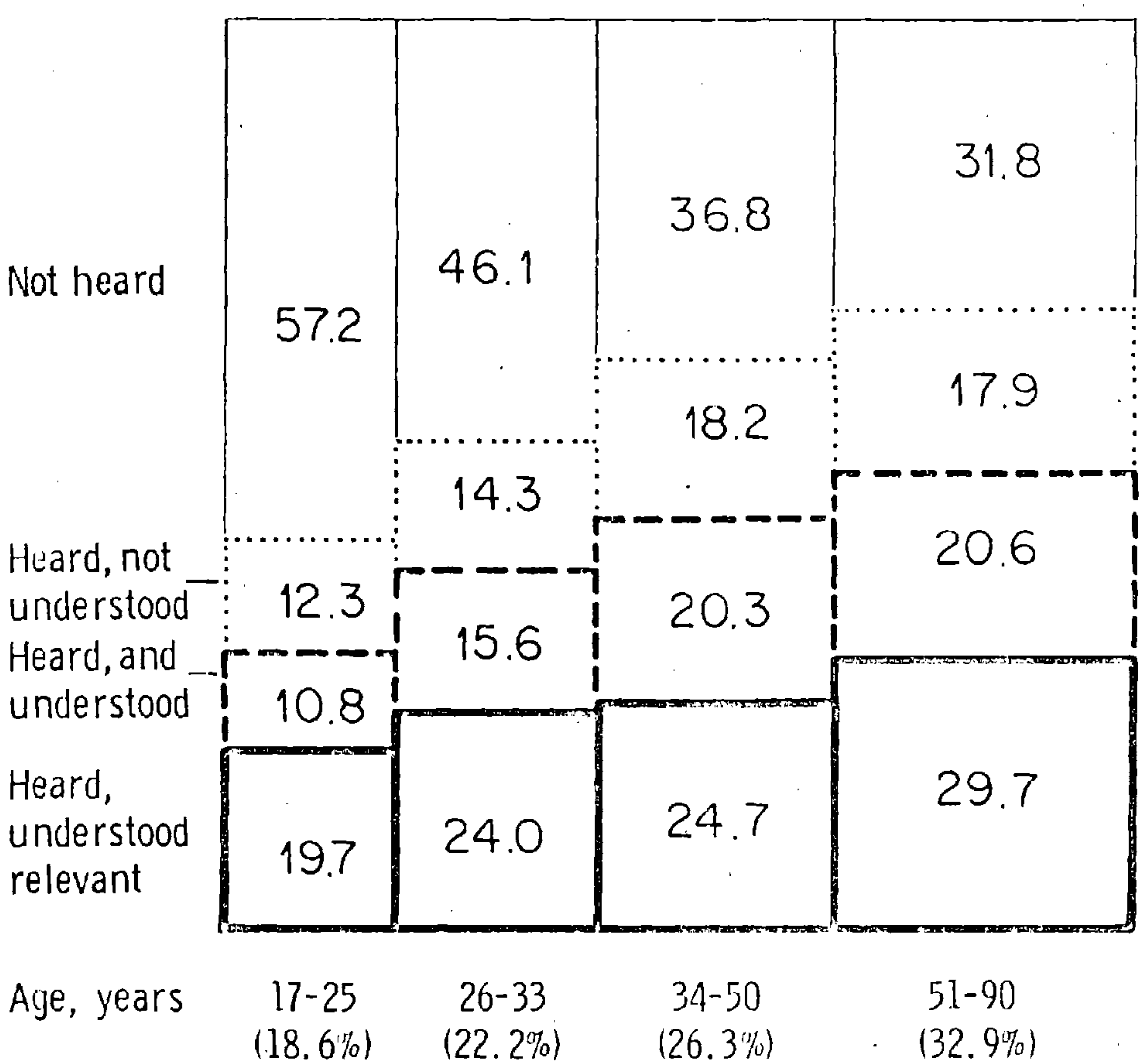
By inspection the correlation here is much stronger than the correlations for expected damage. The range from 62.8 to 18.2 percent is striking. The underlying prediction belief pattern is a fairly impressive predictor of how seriously the Uplift will be taken.

Correlates of Awareness

It has long been recognized that news spreads unevenly through any population, that some groups of people hear and grasp the significance of important information quickly and others frequently fail to hear the news or grasp its significance when they hear it. An important task in preparing the community to cope successfully with an earthquake and respond constructively to an earthquake prediction is to identify groups of people who are out of the mainstream of public communication. Public officials and leaders in the private sector can then devise ways to see that these people have the same opportunity to protect themselves from danger as others do. Comparing awareness of the Uplift among different population segments is one way to identify groups in need of special attention.

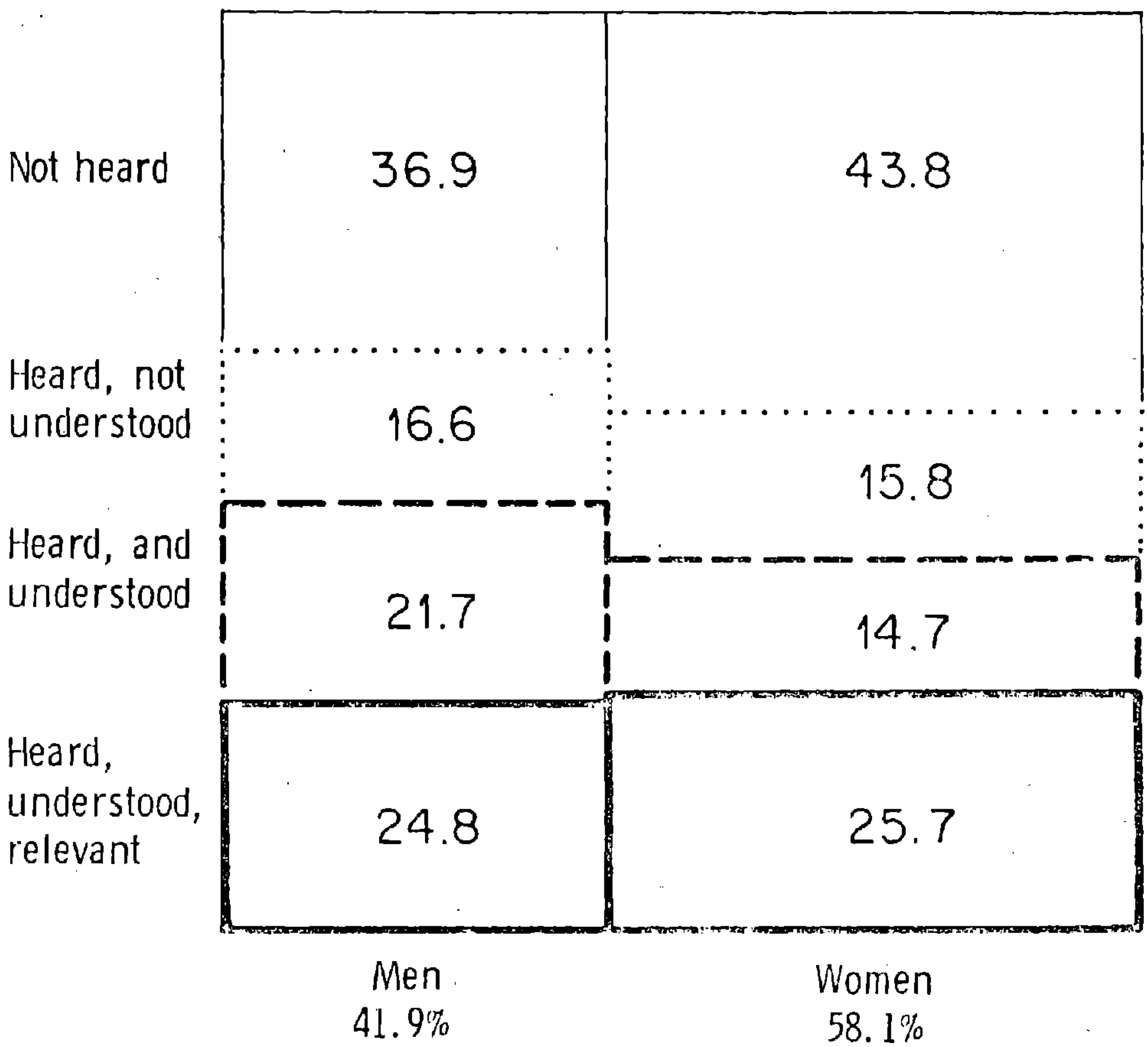
We have selected a few important ways of dividing the general population for examination. Those that show interesting differences in awareness of the Uplift are presented graphically.

Studies of communication in disaster situations and knowledge of public issues often show that the elderly are not in the communication mainstream. Various explanations are offered--that they are more often isolated socially, that they lack the benefit of the more relevant and extended education received by later generations, that they are less future-oriented and thus less concerned or hopeful about the future. Although we do not separate the very old from the rest of the population, we find a consistent relationship between age and awareness of the Uplift that is precisely the opposite. There is a steady increase in awareness, understanding, and sense of relevance with age



AWARENESS OF UPLIFT BY AGE

FIGURE 2



AWARENESS OF SOUTHERN CALIFORNIA UPLIFT BY SEX

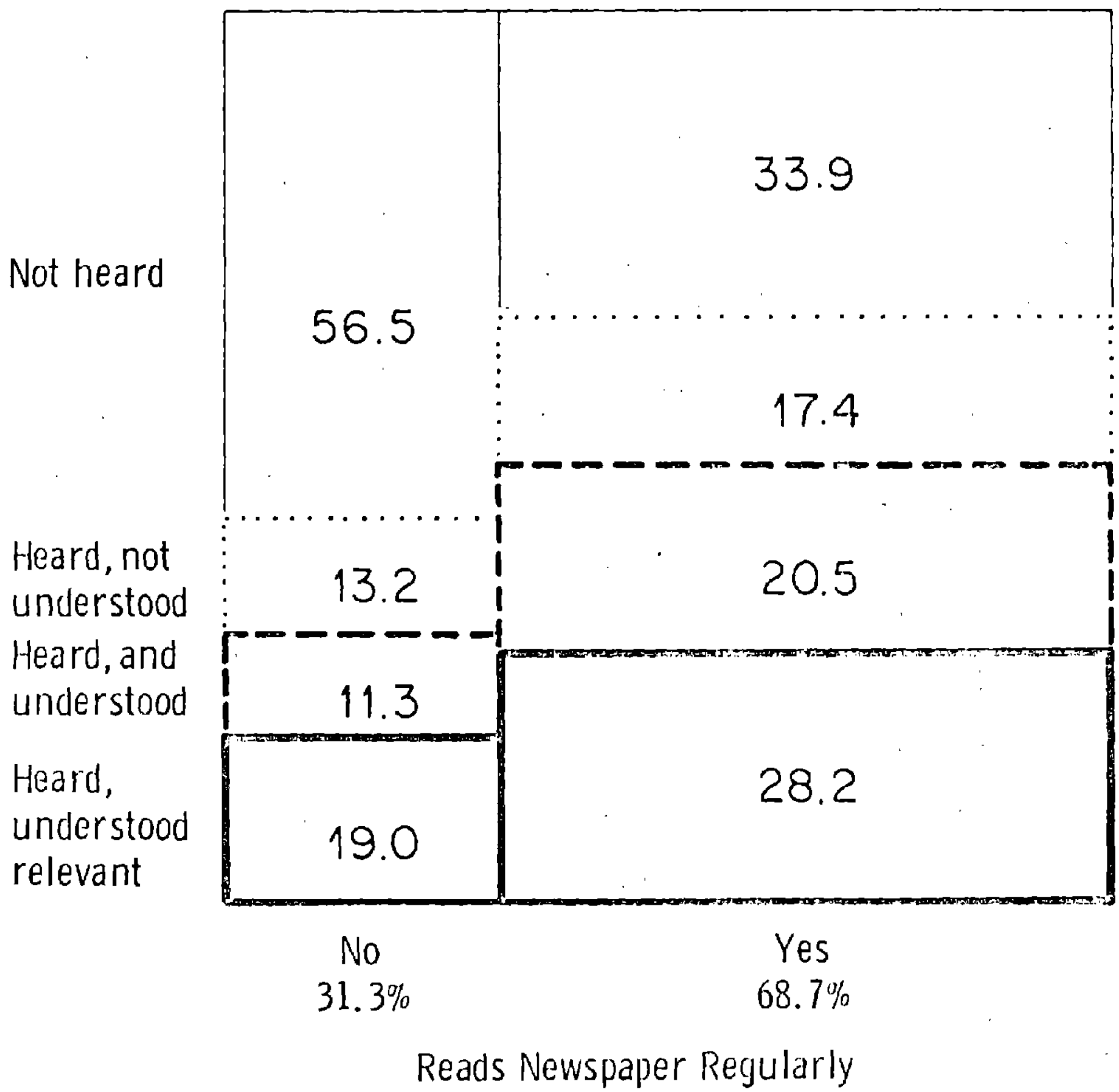
FIGURE 3

(Figure 2).

In a metropolitan environment with extensive television, radio, and newspaper coverage, the elderly may be at no significant disadvantage. The alienation of a generation or more of young people, many of whom responded by taking no interest in public affairs, may have made youth rather than the elderly the communication problem. The preoccupation with schooling, becoming established in a vocation, or establishing a family may translate hypothetical future events like a possible earthquake into low priority concerns. Whatever the correct explanation or combination of explanations, it must be a matter of concern that fully 57 percent of adults under 26 years of age do not even remember hearing of the Uplift.

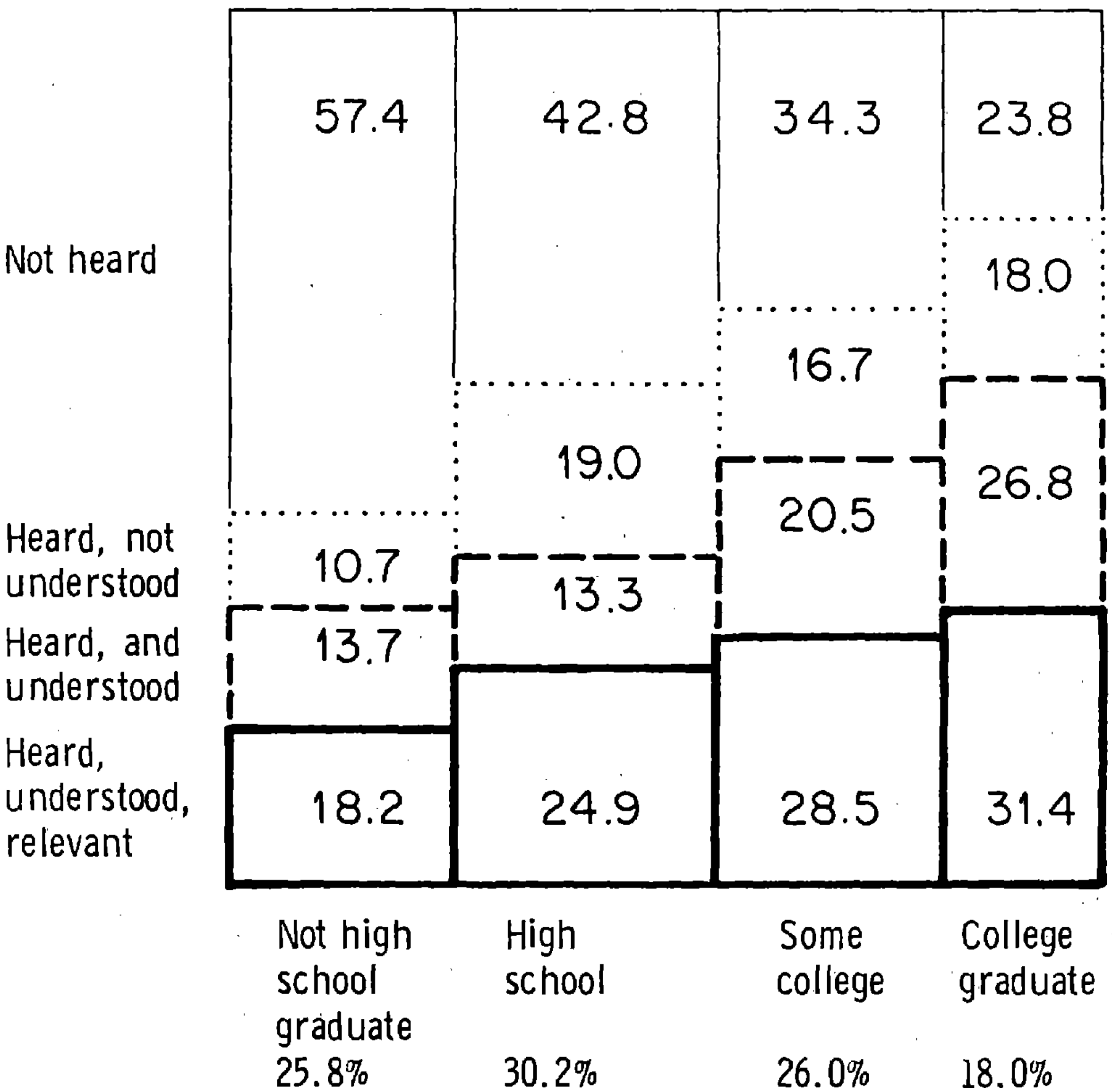
There is a difference between the awareness patterns for men and women, but it is more complex than the relationship with age (Figure 3). Women are less likely to say they have heard of the Uplift than men, but those who have heard are more likely to expect damage where they live in case of an Uplift-connected earthquake. As research into other kinds of information has revealed, men are superficially better informed on public matters, but women are more likely to make what they hear relevant.

We examined two relationships that seem rather obvious, more as a check on the validity of our own prodecures than to demonstrate the obvious. Clearly, those who expose themeselves systematically to information sources and those who have more background for appreciating information should be more aware of the Uplift. As expected, we find that people who say they read a newspaper regularly have more often heard, understood, and seen the relevance of the Uplift than those who do not read a newspaper regularly (Figure 4). And the more formal education people have had, the more likely they are to have heard, understood, and seen the relevance of the Uplift (Figure 5).



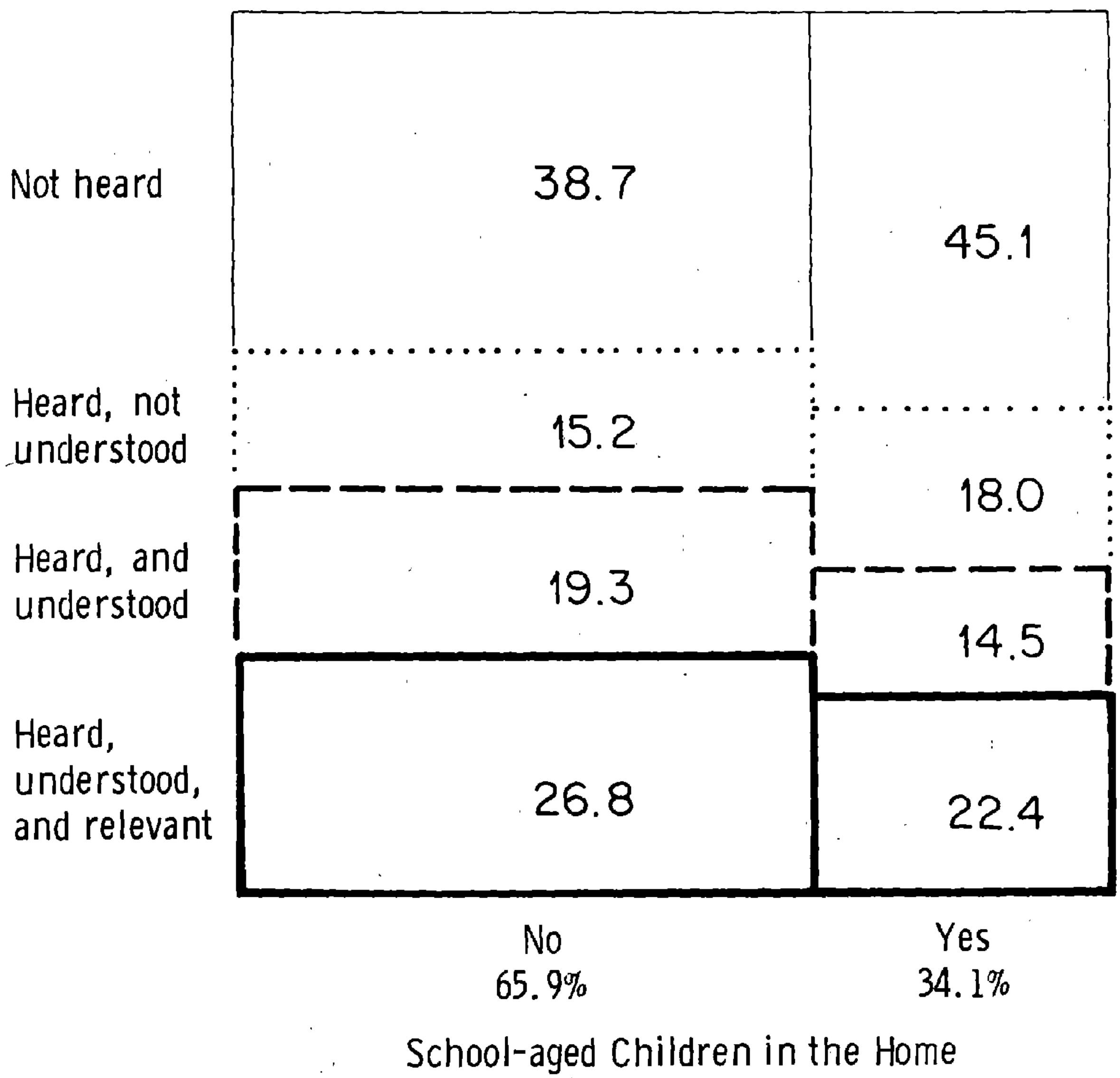
AWARENESS OF
THE UPLIFT BY NEWSPAPER READERSHIP

FIGURE 4



AWARENESS OF THE SOUTHERN CALIFORNIA UPLIFT
BY EDUCATIONAL ATTAINMENT

FIGURE 5

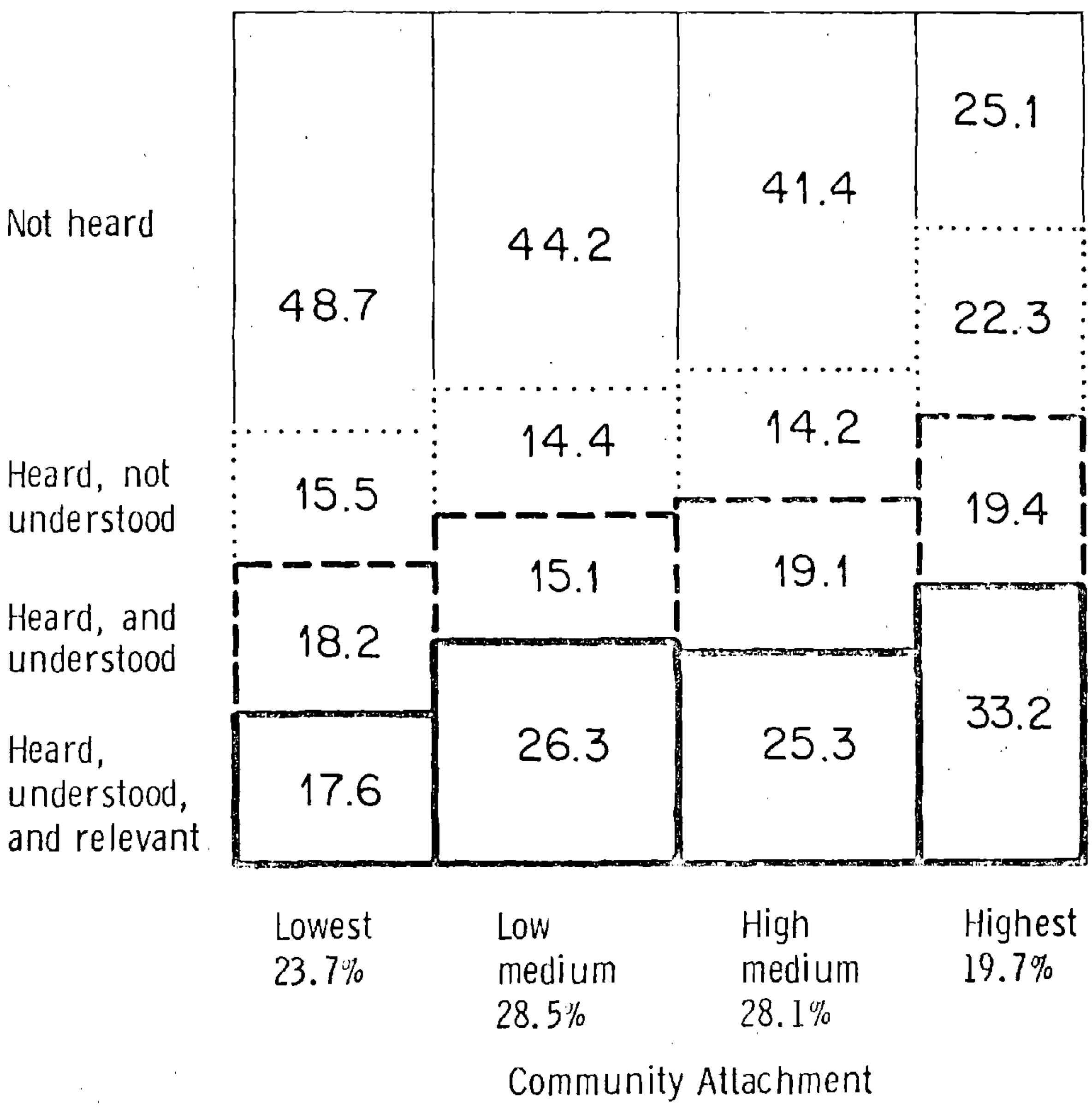


AWARENESS OF THE UPLIFT BY PRESENCE OR ABSENCE OF SCHOOL-AGED CHILDREN IN THE HOME

FIGURE 6

From what we know about the spread of other kinds of information, there is good reason to suppose that people who have social ties and commitments in the local community should be more aware of whatever affects community welfare than people without ties. Being married, living in a household with school-aged children, and being personally attached to the local community all indicate the presence of social ties. The greater the number of adults in the household, the more opportunities there should be to hear whatever news is locally important. To our surprise we found no association between marital status and awareness of the Uplift. Likewise, number of adults in the household is unrelated to awareness of the Uplift.

The presence of school children in the home should be doubly significant because the schools often educate adults indirectly through their children. School children are often taught safety procedures, hygiene, and similar matters, and then relay their knowledge to parents and others at home. Often they are given study materials to bring home. Since there have been some efforts in the public and private schools to alert children to earthquake safety, children may have stimulated parental awareness of the currently important concern with earthquakes. In addition, adults should feel a special responsibility for the safety of their minor children, and might therefore be more alert to earthquake news than adults without responsibility for children. Figure 6, however, shows that just the opposite is true. Adults who live in households with school-aged children are less often aware of the Uplift than others. Perhaps some of the same explanations apply here as were suggested to explain the low awareness on the part of younger people. Whatever the merits of these explanations, the school-to-child-to-parent communication linkage is not being used effectively to stimulate interest in the current earthquake threat.



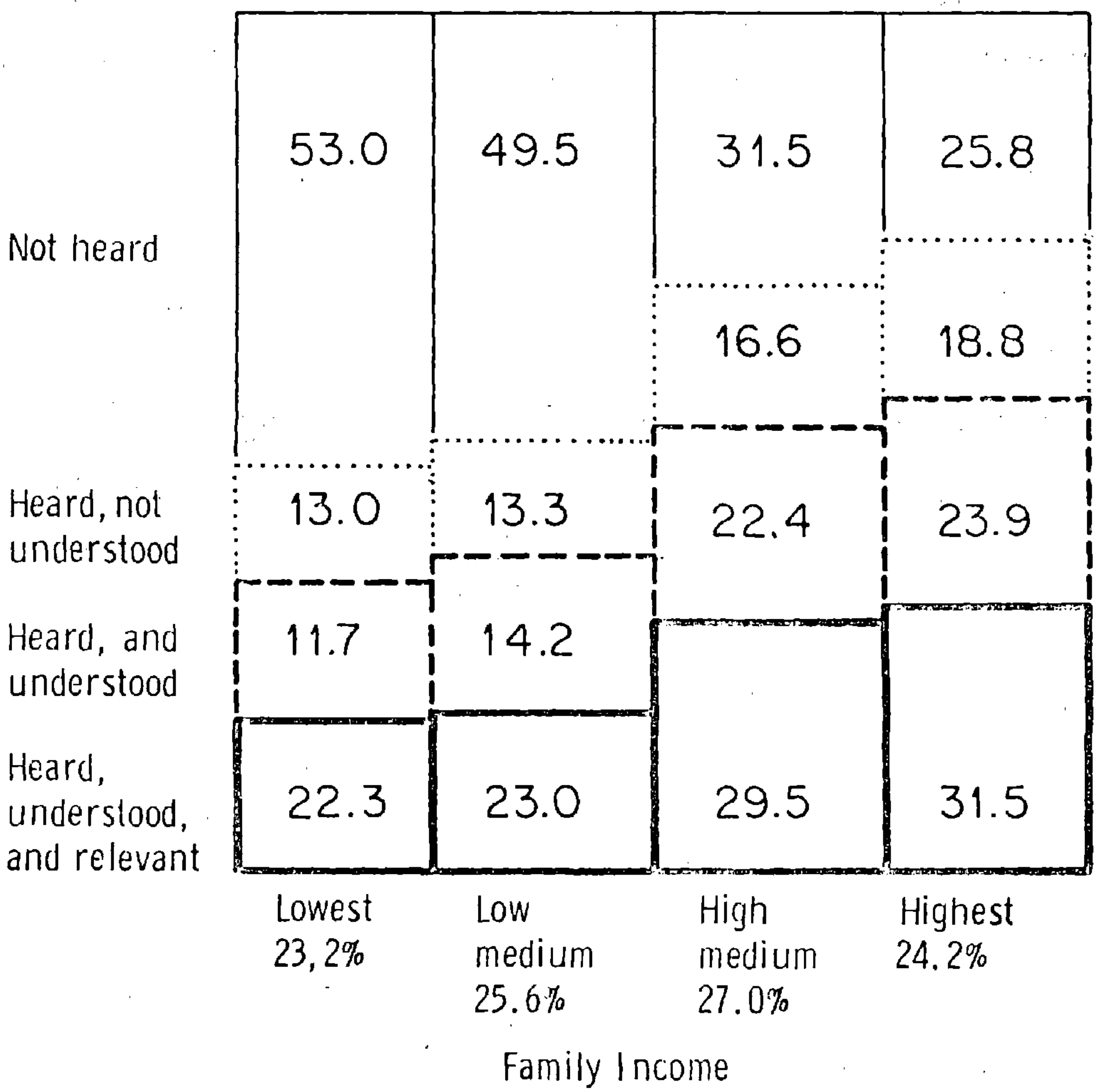
AWARENESS OF UPLIFT BY COMMUNITY ATTACHMENT

FIGURE 7

In order to measure community attachment we combined answers to several questions on length of residence in the local community, thinking of the local community as one's real home, having relatives and friends in the immediate area, participating in local groups and organizations, and considering it unlikely that one will move from the immediate area in the next five years. The relationship between the index of community attachment (cf. Chapter 2) and awareness of the Uplift is in the expected direction (Figure 7). Although the relationship is not perfectly consistent, people with strong attachment to the local community are strikingly more often aware of the Uplift and its relevancy than people with low attachment.

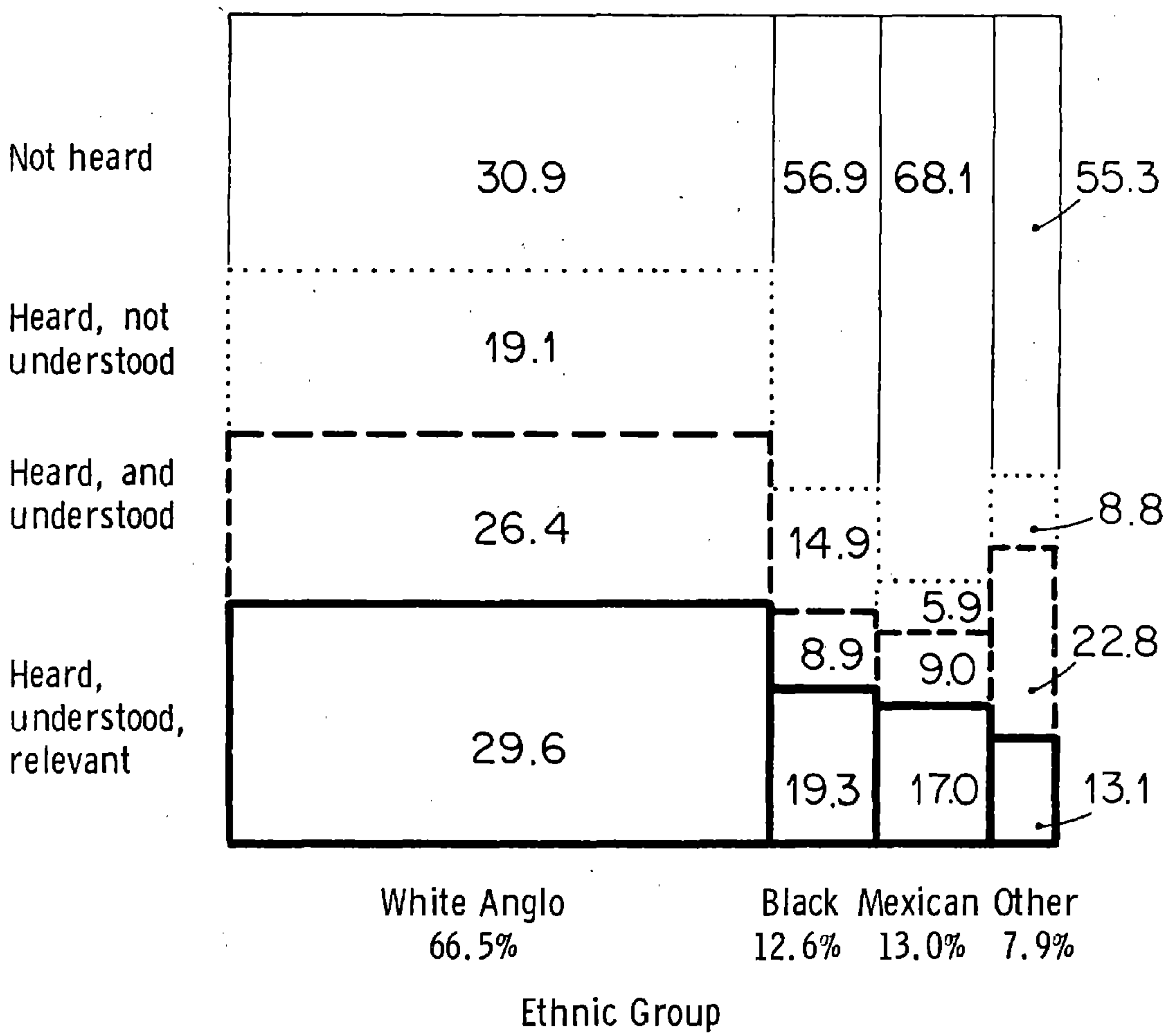
From the evidence on marital status, living with school-aged children, and number of adults in the household, we need to rethink any simple theory that having social ties enhances the likelihood of hearing and appreciating news of possible future disaster in the local area. Attachment to the community is more important than simply having ties.

Most kinds of significant information get to the wealthy and middle classes before they reach the working and poorer classes, and to the white majority before they reach ethnic and racial minorities. The graph of family income shows the expected relationship (Figure 8). However, there is little difference between high and high medium income households, and there is also little difference between low and low medium income households. Only between the upper and lower income halves of the income distribution is there a difference. And this difference applies more to hearing of the Uplift than it does to experiencing it as personally relevant. Indeed, a larger share of upper income respondents who heard of the Uplift thought there would not be damage where they lived, than among lower income respondents.



AWARENESS OF SOUTHERN CALIFORNIA UPLIFT
BY FAMILY INCOME

FIGURE 8



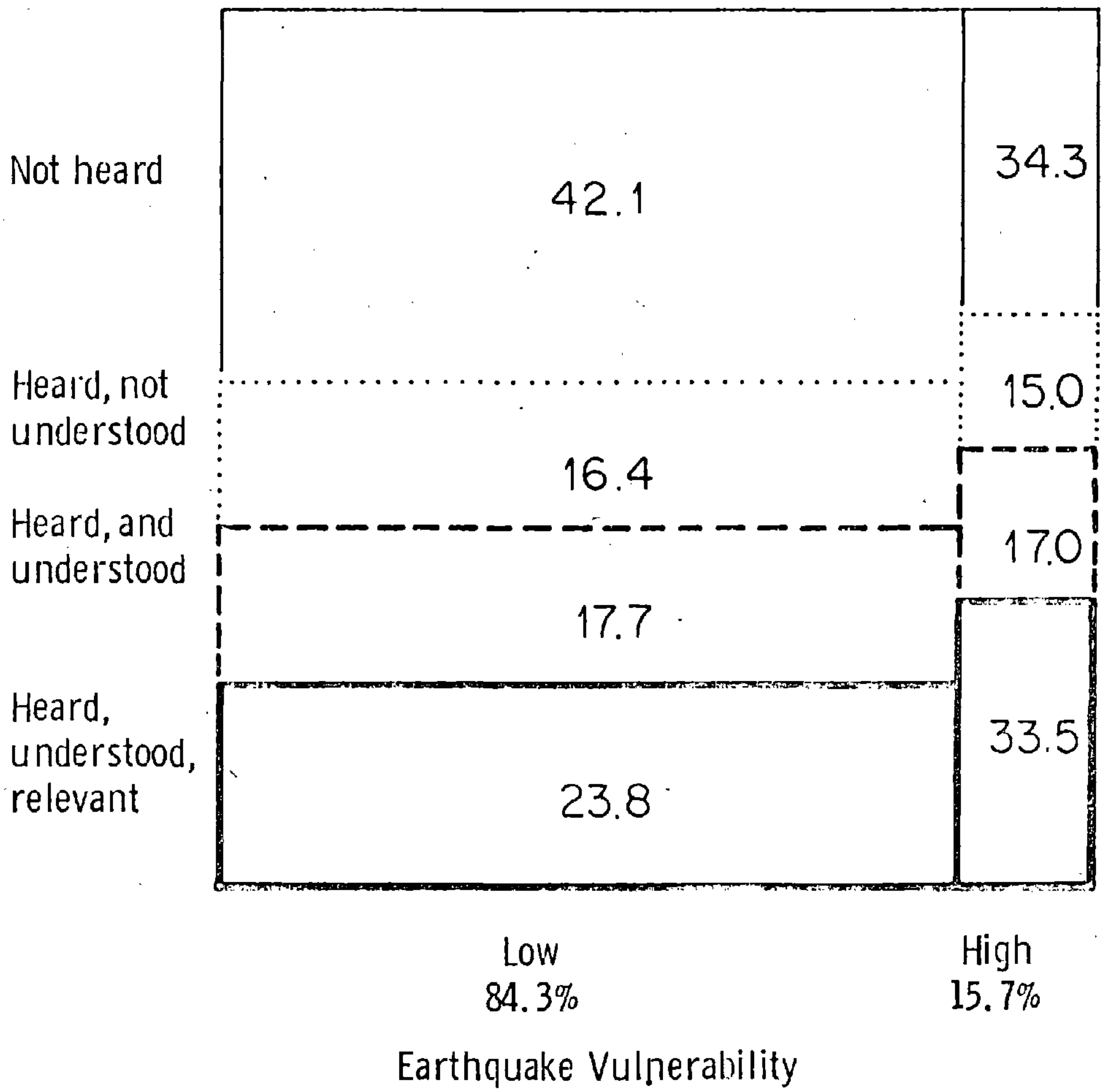
AWARENESS OF SOUTHERN CALIFORNIA UPLIFT BY ETHNIC GROUP

FIGURE 9

Blacks and Mexican Americans are much less likely to have heard than Whites (Figure 9). Mexican Americans are least likely to have heard. Contributing to this finding may be the fact that the principal Spanish-language paper in the Los Angeles metropolitan area almost completely ignored the southern California Uplift. By featuring extensive coverage of the Guatemalan earthquake of February 3, 1976, in the same period, the paper may have reflected a tendency for attention to be turned away from local concerns and problems and toward concerns of the international Latin community throughout the Western Hemisphere (cf. Part Six). But those Mexican Americans who have heard of the Uplift are more likely than Whites, Blacks, or other ethnic groups to feel it will mean damage where they live.

A final question is whether the news gets to those who need it most. Based on the very limited information at our disposal we prepared an index to identify the residences that were potentially more vulnerable to earthquake damage (cf. Chapter Three). The index counted constructions before 1934 of brick, stone, or concrete block, height of three or more stories, location in a canyon or on a steep incline or very close to a freeway bridge or overpass, and mobile home construction as contributing to vulnerability. Most residences were not distinctively vulnerable. But the small group of people who live in especially vulnerable residences were indeed more often aware of the Uplift and more likely to appreciate its personal relevance (Figure 10).

Since the Uplift announcement has been the only credible, long-term, continuing forecast of a potentially damaging earthquake in the Los Angeles area, it is important for us to know what factors are important in determining people's degree of awareness of this forecast. In order to identify the factors that characterize those who are aware of the personal relevance that the Uplift may have if it is a precursor to a major quake, a multiple regression model has been constructed using three clusters of background or independent variables



AWARENESS OF UPLIFT
BY RESIDENTIAL EARTHQUAKE VULNERABILITY

FIGURE 10

and two clusters of intervening variables.

Independent variables. These variable clusters include demographic, past experience, and environmental vulnerability variables. Socioeconomic status indicators--income, occupational ranking, and educational attainment--were included in a demographic variable cluster with the expectation that people with higher status and higher levels of education would have a greater awareness of the Uplift's meaning. Age of the respondent was also included since location within the life cycle is known to have consequences for attitudes toward science. Also, ethnicity and sex were included in this cluster since major differences already had been found among ethnic groups and between men and women on knowledge and attitudes toward science and earthquake prediction in general.

It was hypothesized that those people who had had past experience with disasters, particularly damaging ones, would be more sensitive to a scientific announcement indicating that a future damaging quake may be coming. It could be argued that such past experiences would result in the denial of personal consequences from any future quakes because of heightened fear. However, we hypothesized that past experience with disaster will make people more interested in specific, credible forecasts, and will make them want to know as much as possible about them.

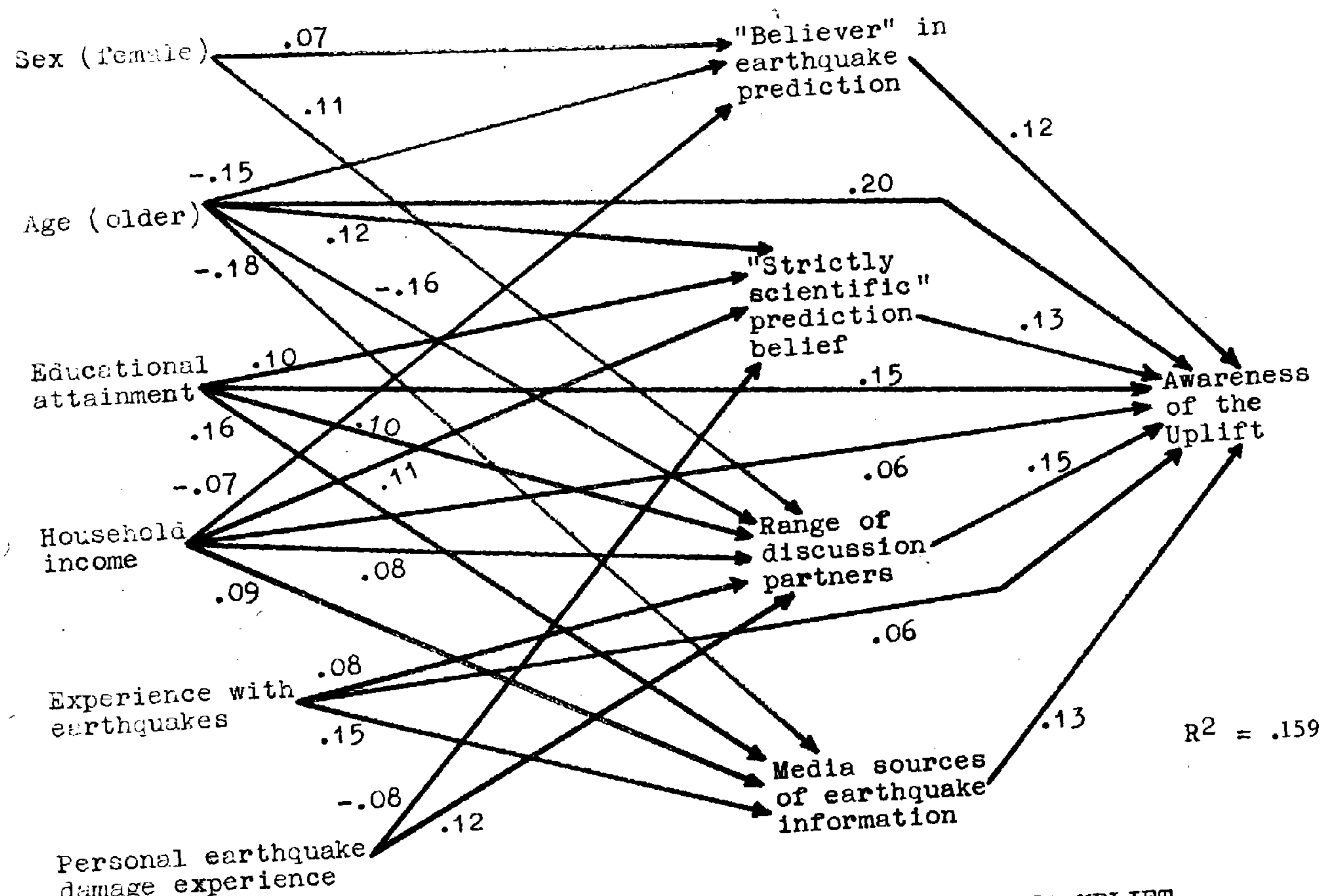
Since our indicators of environmental vulnerability are all objectively determined--residence in one of the ecologically hazardous areas or in a structurally unsound building--these items were not included in this model. However, belief that one was a member of an endangered group (see Part V, Chapter 1) in the event that a damaging earthquake occurs was included to determine whether perceptions that one is living-at-risk are likely to lead to a greater understanding of the Uplift's significance.

Intervening variables. Two clusters of mediating variables were included in this model--those that indicate an orientation toward science and those that reflect the use of communication on earthquake topics.

It was assumed that the variables reflecting attitudes toward science and prediction would be a very important cluster in the model. Variables included were the favorability towards science index, whether the respondent believed that scientists were making all information on predictions available to the public, the belief in scientists' prediction ability index, and patterns of belief in various types of predictors (strictly scientific, believers, skeptics, and antiscientific--cf. Chapter Four). Also included was an indicator of the respondent's belief that he or she knew the cause of earthquakes. This was a dichotomous variable, either the respondent believed he or she knew or did not. No discrimination was made between explanations of causality for purposes of the model.

The fatalism index was also included on the assumption that those who do not think that earthquake planning will do any good would be less likely to be interested in accumulating information about an earthquake-related anomaly such as the Uplift and its significance.

Since it was assumed that people who engaged in more interpersonal discussion of earthquake topics would be more likely to be familiar with specific earthquake predictions and forecasts, like the Uplift, the number of different earthquake topics and the number of groups of people with whom the prospect of a damaging earthquake had been discussed were included in the model. Similarly, the number of formal sources from which earthquake information could be collected were included in this cluster by measures indicating the number of newspapers the respondent read regularly, the number of formal media sources from which earthquake information was heard, and the number of group meetings the respondent had attended at which earthquakes were a major topic of interest.



MODEL FOR AWARENESS OF THE SOUTHERN CALIFORNIA UPLIFT

Figure 11

The regression model. The model (Figure 11) was moderately successful (R^2 = .159) in explaining knowledge of the Uplift's significance. The background variables in the model (with the exception of sex and experiencing damage or injury in a previous earthquake) all had significant direct and indirect effects. As expected, people of higher status--those with higher incomes and the better educated--were likely to have a better understanding of the Uplift's meaning. Age was the single strongest variable in the model, older people being more informed about the significance of the Uplift. Also, people who had had more earthquake experiences in the past were more likely to be aware of the Uplift's significance and believe it to be personally threatening. Rather surprisingly, perceptions of being endangered in the event of a damaging earthquake did not have any significant effects in this model. Perceptions of hazards in one's personal environment, then, did not seem to motivate people to seek out special information on the Uplift's significance. Neither did ethnicity have any effect on the dependent variable once other variables were controlled.

The orientation variables were not quite as significant as was originally assumed. Both belief in scientists as predictors and belief in a variety of people who could predict (scientists as well as psychics and religious leaders, for example) had significant direct effects on the dependent variable. Belief in predictors was positively associated with an understanding of the Uplift's significance and potential consequences. Those who believed only in scientific predictors were likely to be wealthier, better educated, and older, but less likely to have experienced damage or injury during a past earthquake event. Those who are willing to accept a wider range of predictors are likely to be poorer, younger, and women.

Fatalism, which was an important variable in models of governmental and individual preparedness (see Part V), was not significant in predicting who would be aware of the Uplift's significance. A fatalistic attitude toward earthquake, then, does not appear to be important in the acquisition of knowledge about predicted events.

Two communication variables--one measuring extent of interpersonal discussion of a coming destructive quake and the other an indicator of the number of formal sources from which one received information on earthquakes--were significant intervening variables in the model. People who had used more communication channels, whether formal or informal, were better informed about the Uplift's significance. Very similar profiles of the people who had more active communication channels emerged in the model. They tended to be wealthier, have better educations, be younger, and have more past earthquake experiences. Those who had more discussions about a coming quake (i.e., those having more active informal communication networks on earthquake subjects) were also likely to be women and those who sustained either damage or injury in a past quake.

One apparent discrepancy in the model concerns the effects of age on knowledge about the Uplift. As pointed out above, age had the strongest direct effect on the dependent variable, after all other variables were controlled. Older people more often heard, understood, and appreciated the relevance of the Uplift. However, age was significantly related negatively to both of the communication variables and to one of the orientation variables, which in turn were related positively to the dependent variable. This may indicate that the variable age is actually "standing in" for some other, non-model variable. For instance, if older people are more fearful or concerned about their personal environments due to their impaired ability to handle any threatening situations (for example, muggings or robbery by juvenile delinquents is a concern that older people frequently mention), they may be more likely to perceive that any quake caused by the Uplift may have serious consequences for them. Particularly since older people are more likely to believe in scientific predictors and since the Uplift has been given a great deal of credibility by the scientific community, the elderly may be more likely to translate scientific forecasts into events which have personal consequences.

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CHAPTER SEVEN

WHAT EARTHQUAKE PREDICTIONS, FORECASTS, AND CAUTIONS DO PEOPLE REMEMBER?

While the southern California Uplift is the most scientifically credible and timely reason for increased attention to the prospect of a serious earthquake in the near future, the message of impending disaster comes from many quarters. Messages from scientists have ranged from the perennial reminders that a great earthquake is overdue in southern California to the relatively specific near prediction issued by James Whitcomb. From outside of the scientific establishment but wearing the mantle of science have been the forecasters of a "Jupiter effect" epidemic of great earthquakes in 1982 and Henry Minturn with his December 20, 1976, prediction for Los Angeles. Annual forecasts by an assortment of seers and psychics often include earthquakes. The forecast that much of California would break off and slide into the Pacific Ocean as a result of great earthquakes in 1969, proclaimed in a best-selling work of fiction, has been preserved as an enduring element in California earthquake lore. The original date has generally been forgotten. A television evangelist devoted an hour-long special and a paperback book to the forecast of an earthquake for 1982, claiming converging evidence from the Uplift, the Jupiter effect, and the biblical Book of Relevations. Thus forebodings of earthquake disaster are in the air in southern California.

The question for this chapter is how aware people are of these forecasts and forebodings. If there is considerable awareness, how accurate is their understanding of the announcements? To what extent do they discriminate among

TABLE 1

NUMBER OF EARTHQUAKE PREDICTIONS, FORECASTS, AND CAUTIONS HEARD

Number of announcements heard	Percent	Cumulative percent
None	13.4	
One	57.4	86.6
Two	23.2	29.2
Three	4.9	6.0
Four	.7	1.1
Five	.4	.4
Total percent	100.0	
Total number of persons	1450	

them, keeping them separate, or merge them into one multifaceted prediction?

Announcements People Remember

One of the preliminary stages of the warning process is the transmission of a warning message, or messages, to those who are to be warned (Williams, 1964). Whether the warning is successful or not depends upon whether people receive the warning message. Because earthquake prediction announcements are unique in that they usually are not accompanied by visual precursors, awareness of predictions should be a minimal requirement for adaptive response.

The basic source of information on prediction announcements is the series of questions already presented in the preceding chapter, beginning with the query:

> 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 times, or from specific people?

If the answer was positive, the respondent was then asked:

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

Up to five answers were recorded. The interviewer then took up each answer in turn, asking a series of questions about the particular announcement.

As Table 1 indicates, most southern Californians have heard some prediction or announcement about a coming earthquake. From the column of cumulative percentages we find that 86.6 percent said they had heard one or more announcements. However, the majority of the people were only able to give one answer to the follow-up question. Only 29.2 percent were able or willing to identify two or more announcements. Only a meager six percent could name three or more.

The many forecasts and cautions to which southern Californians have been exposed are not kept separate in memory by most of our respondents. Either people lump together the many announcements into a generalized forecast of disaster, or they allow one specific announcement to speak for all. Our subsequent analysis will help us decide which pattern prevails.

Interviewers tried to get enough detail from respondents about each of the announcements they mentioned so we could tell whether they had some specific forecast or forecaster in mind. We hardly expected people to remember exact names and details of an announcement. But we looked for clues: for example, if someone mentioned a Caltech professor's prediction, or spoke of an earthquake predicted to occur by April, 1977, we assumed they were referring to the James Whitcomb announcement. In order to allow for possible confusion between different announcements, we provided that each answer could be coded under from one to three headings. For example, a reference to the "the Caltech professor who predicted an earthquake for December" was coded under Whitcomb/Minturn, since the respondent had apparently mixed the two in his mind.

The announcements that people mentioned are summarized in Table 2. They have been grouped under four general headings and under "mixed" types. For clarity of communication we shall distinguish between "combined" and "mixed" types. If an answer confuses two or more announcements that fall within the same general category, such as scientific announcements, we call it a "combined" answer. For example, reference to a "a Caltech professor who predicted an earthquake by April, 1977, based on a bulge in the desert" confuses two announcements. But since both sources are scientific, we place this under the combined type, "Uplift/Whitcomb." On the other hand, if we are told that "Minturn predicted an earthquake in December on the basis of the Palmdale bulge," the confusion is between a scientific and a pseudo-scientific announcement. We classify this response under the mixed type, "Uplift/Minturn."

More than a third of the answers were quite nonspecific; for example: "I heard on television that an earthquake is overdue," or "Everybody says there will be an earthquake soon." These "general forecasts" are detached from the specific source, nature, or grounds for the forecast. Only slightly more specific are the "General scientific" forecasts, such as "Scientists have predicted an earthquake in southern California." If we combine these types, 42.2 percent of all answers were nonspecific. Another 6 percent either mixed or combined types of announcements, thus achieving specificity at the cost of confusion.

Of those who were specific about an announcement, the great majority referred to the pseudoscientific prediction by Henry Minturn. If we include the combined and mixed references to Minturn's prediction, a total of 34.6 percent of the answers referred to this prediction. The interviewing took place from one to three months after the date when the predicted quake failed to materialize, so recency and intensive media coverage undoubtedly account for much of the salience of Minturn. Without the inflated reference to Minturn, the general category of pseudoscientific announcments probably would not have been so prominent in the table. The later evidence reported in the analysis of change and stability confirms this assumption (Part Nine). Nevertheless, the second most frequent specific answer was another pseudoscientific tenet, that California will someday break off and slide into the ocean in a great earthquake. If we include mixed and combined references, 6.9 percent of the answers mentioned this belief.

Other answers were quite scattered, reflecting the diversity of forecasts to which southern Californians have been subjected, but indicating no consensus. Different people clearly think of quite different kinds of forecasts when asked about announcements concerning a coming earthquake. It is important to remember, when interpreting these findings, that respondents volunteered their answers without help from the interviewer. Their answers

TABLE 2

EARTHQUAKE PREDICTIONS, FORECASTS, AND CAUTIONS

Type of announcement	Percent of all answers	
General forecasts	36.9	36.9
Scientific announcements		15.4
General scientific	5.3	
Uplift	5.0	
Whitcomb	3.9	
General scientific/Uplift	.3	
General scientific/Whitcomb	.2	
Uplift/Whitcomb	.7	
Pseuoscientific announcements		37.2
Minturn	30.5	
California breakoff	6.0	
Jupiter effect	.3	
Minturn/California breakoff	.3	
Minturn/Jupiter effect	.1	
Prophetic announcements		6.1
Religious prophecies	.8	
Secular prophecies	5.3	
Mixed types		4.4
General scientific/Minturn	1.3	
Whitcomb/Minturn	1.0	
Minturn/Secular prophecies	1.2	
Other mixed types	.9	
Total percent	100.0	100.0
Total number of answers	1788	1788

do not detail all of the announcements they have heard, but just those that were sufficiently at the forefront of memory that people immediately recalled them when the general subject of earthquake predictions was broached. If we had been able to follow up each announcement as we did the southern California Uplift by mentioning the forecast or prediction and asking whether respondents had heard of it, many of the announcements would undoubtedly have been recognized by a large share of the people.

In selecting from the array of mass media information, communication theorists note a tendency for individuals to use the media selectively. Individuals are more likely to attend to messages that support their existing opinions and interests then messages that are inconsistent with their beliefs. Let us examine whether the phenomenon of selective exposure applies to awareness of earthquake predictions as well. Are people more likely to be aware of predictions which are compatible with their general belief in scientific and nonscientific grounds for prediction? In answering this question we will examine the relationship between the prediction belief typology and the type of prediction announcements heard.

According to the hypothesis of selective exposure individuals with a strictly scientific orientation should be more aware of scientific announcements than individuals holding alternative prediction beliefs. Likewise, individuals who hold an anti-scientific orientation should be more aware of prophetic announcements. Although there are apparent differences in the hypothesized direction, they are trivial and the overall relationship does not satisfy the minimal standards of statistical significance (Table 3). We cannot draw support from this evidence for the supposition that respondents tend to hear and remember mostly the type of earthquake prediction, forecast, and caution that corresponds most closely with their disposition toward science and alternative frames of reference. The finding that what people hear and

TABLE 3

TYPE OF FORECAST HEARD BY TYPE OF PREDICTION BELIEF

Type of announcement	Prediction belief pattern			
	Strictly scientific	Believer	Skeptic	Anti-scientific
Scientific	18.6	14.9	12.5	11.2
General	35.8	35.3	46.9	43.3
Pseudoscientific	35.8	38.9	31.2	34.8
Prophetic	4.9	6.5	7.8	7.0
Other	4.9	4.4	1.6	3.7
Total	100.0	100.0	100.0	100.0
Total number	509	1021	64	187

$X^2 = 12.370$, df = 6, not significant, with "skeptic" and "anti-scientific" types collapsed and "general" and "other" types of announcement collapsed. Coefficient of contingency (without collapsing categories) = .083.

remember is not substantially biased by their frames of reference is encouraging. We can now entertain the possibility that many of our respondents practice "open minded cognition" (Donahew and Palmgreen, 1971, p. 420), which allows them to evaluate opposing evidence fairly and to restructure their cognitions so as to make them compatible with some of the opposing points. We shall examine the relationship between prediction belief and the credibility of different kinds of announcements in Chapter Eight.

Sources of Information by Type of Announcement

Answers to the question on chief source of information can be analyzed further to determine whether people learn about different kinds of predictions, forecasts, and cautions from different media sources. First we grouped the announcements people mentioned into scientific, general, pseudoscientific, and prophetic. In addition we looked separately at the Minturn forecast and the forecast that California will break off and fall into the Pacific Ocean. These two forecasts merit separate attention because of the wide recognition they received. For each we record the chief source of information as given to us by the respondents. By comparing the columns in Table 4 we can decide whether different media are associated with different kinds of predictions and near predictions.

The most general observation from the table is that the order of reliance on the media remains largely the same irrespective of the type of prediction. Television is the principal source for all types of announcement and newspapers come next. There is a reversal, however, between radio, which usually ranks third, and "people," which usually ranks fourth, in case of prophetic announcements. A similar reversal also applies to the folkloristic belief that California will fall into the ocean. Magazines and books fall behind the other

TABLE 4

CHIEF SOURCE OF INFORMATION BY TYPE OF EARTHQUAKE PREDICTION, FORECAST, OR CAUTION

	Inclusive types of announcements				Specific announcements	
Type of Medium	Scien-tific	General	Pseudo-scientific	Pro-phetic	Minturn	Calif. Breakoff
Television	47.1	58.3	51.3	43.7	54.9	37.4
Newspapers	27.5	14.1	18.5	23.6	17.9	22.0
Radio	10.1	11.4	13.6	5.6	13.4	11.4
People	6.2	8.8	11.1	7.6	9.7	15.4
Magazines	22.2	1.5	1.3	5.6	1.0	4.1
Books	0	0	.3	.7	.2	.8
Other, Don't know	6.9	5.9	3.9	13.2	2.9	8.9
Total	100.0	100.0	100.0	100.0	100.0	100.0
Number of announcements mentioned	276	660	708	144	619	123

media except again in the case of prophetic announcements, in which they rank ahead of radio but behind "people."

Bearing in mind that the general order of reliance on the media is more similar than dissimilar and that television and newspapers are the most important media in all cases, we can still observe some affinities between particular media and types of announcements. There is some affinity between television and general announcements. Relatively more of the people who mentioned rather vague and general earthquake forecasts credited them to television. Perhaps television commands a low level of attention for detail, or specializes in very brief news items, or perhaps it is just that more people are exposed for longer periods to television. In contrast, there is an affinity between newspapers and scientific announcements. The reporting of scientific announcements is facilitated by the provision for longer items in the newspaper, and people who are interested in science are probably more motivated to make the effort to read newspaper stories. Radio and "people" as sources show affinity with pseudoscientific announcements. The affinity also shows separately for both the Minturn and "Breakoff" forecasts. It is quite in accordance with theories of rumor that pseudoscientific beliefs should be spread especially by word of mouth while the printed word is especially prominent in the spread of scientific information. The special role of radio, however, may be a historical accident relating to the circumstances under which the Minturn forecast was publicized. On the other hand, radio "call in" and "talk" shows may contribute to the spread of rumors by airing them and being especially responsive to timely public preoccupations, even while program moderators attempt to discredit them.

Prophetic announcements, while credited principally to the leading media, show a distinct affinity with books and magazines and with "other and don't know" as a source. One interpretation of this affinity is that the worlds of secular and religious prophecy have their own networks and media for communicating among those who are interested in prophecy. To a greater extent than is true for the other types of announcement, they supplement the standard media with their own books and magazines and, perhaps, tracts and meetings.

We also have a separate record of people's chief source of information about the southern California Uplift. The record includes people who mentioned the Uplift in answer to the open-ended question about predictions, forecasts, and cautions, and the much larger number of people who remembered hearing about the Uplift when asked about "a bulge in the earth near Palmdale in the Mojave Desert." The pattern of information sources is almost identical to that for all scientific announcements, and equally different from the pattern for general, pseudoscientific, and prophetic announcements.

Knowledge and Understanding of Near Predictions

Just because scientists, public officials, or others issue announcements conveying certain information, we cannot assume that what people hear and remember will correspond precisely to the intended message. On the one hand the media filter the announcement in relaying it to the public, often giving it a distinctive slant, emphasis, or even distortion. On the other hand public interest, comprehension, and retention of details will affect the version of information as remembered. We have already observed that much of what is remembered is quite general and vague. But we can examine further the specificity and accuracy with which the three important near predictions of 1976 were remembered.

For each announcement that respondents mentioned, there was a series of follow-up questions which asked the respondent to identify the name of the predictor, the type of person issuing the announcement, and the date and place for the predicted quake. This information will be used to determine what specific bits of information people heard and remembered, and how they interpreted information presented by the media. This information in turn can be compared with the record of media coverage (Part Two) to determine how the media treatment may have affected the image people had of the expected event.

First, we will examine what people remember about the specific source of the near prediction. For each announcement mentioned the respondent was asked:

Do you happen to remember who it was that originally made this prediction?

Since we were looking for the name or any other type of identification of the predictor, interviewers were instructed to record any information mentioned by the respondent.

The majority of respondents could not recall the specific name or other details about the predictor for any of the three near predictions (Uplift, Whitcomb, Minturn; Table 5). While there were 619 references to Minturn's December 20th prediction, only 13 respondents could recall his name. Only one person could associate Whitcomb's name with his announcement. However, we find that more general information such as the agency, institutional affiliation, or the instititutional role of the person issuing the announcement is more salient than the name of the person. Nearly a third of the predictions referring to Whitcomb mentioned his affiliation with Caltech and almost nine percent volunteered that the announcement was made by a scientist. Seventeen percent of the references to the Uplift mistakenly associated it with Caltech; however nearly thirteen percent correctly volunteered that the prediction was issued by scientists. However, while Minturn was not affiliated with any institution or agency and had no relevant institutional role, 64 people identified him with some agency, 31 stated that he was a scientist, and 21 identified him as a psychic.

TABLE 5

HOW PREDICTOR IS IDENTIFIED BY SPECIFIC ANNOUNCEMENT

Predictor as identified by respondent	Near prediction as classified		
	Uplift	Whitcomb	Minturn
Minturn	0	0	2.1
Whitcomb	0	1.0	0
Caltech	17.2	31.4	2.1
Scientist	12.8	8.6	5.0
General reference to a person or agency	1.0	0	8.4
Psychic	0	1.0	3.3
Information source	5.4	1.9	3.0
Other	1.8	1.9	1.6
Don't know, not answered	61.8	54.2	74.5
Total	100.0	100.0	100.0
Total number	110	105	619

The time and place forthe predicted quake should also play an important part in determining public response to predictions. For instance, many people may fail to prepare for a quake related to the Uplift if they assume that the quake would only affect the Palmdale area. On the other hand, if people believe the predicted quake is likely to affect a large area many more residents may prepare. Similarly, if individuals think that a quake will occur in the near future they may take action immediately or decide not to do anything in expression of fatalistic despair. On the other hand, if the predicted quake has a long lead time, people may postpone preparation in anticipation that the government will take steps to safeguard the community.

In a separate question respondents were asked whether they could recall the date for the predicted quake:

Do you remember whether a date was given for the earthquake to occur?

Respondents who could recall the information were asked to specify the date for the predicted quake. Verbatim responses were recorded by the interviewer and responses were later collapsed to facilitate analysis. These data appear in Table 6.

While most articles referring to the Uplift were quite vague as to when, if ever an Uplift-related quake might occur, a few articles mentioned that scientists believed a quake could be expected within a decade. This lack of specificity about the date of the predicted quake is reflected in our findings. Over eighty percent of the respondents who mentioned the Uplift either did not know of a date or could not recall when a quake was likely to occur. Only one person mentioning the Uplift recalled that scientists expected a quake within a decade. Seven people mentioned that they expected a quake within a year, while the other responses showed no consensus as to when they expected a quake.

TABLE 6

DATE OF THE PREDICTED QUAKE BY SPECIFIC ANNOUNCEMENT

Date of quake as identified by respondent	Near prediction as classified		
	Uplift	Whitcomb	Minturn
December 20-21, 1976	2.7	7.6	46.0
Other December date	1.8	9.5	29.1
April '76-77	1.8	7.6	.3
April '77	1.8	6.7	1.2
Pre March '77	.9	5.7	5.0
Within a few years	2.7	1.9	.2
Within a decade	.9	1.0	0
Within a year	6.4	9.5	.8
May '77 or later	0	1.9	0
Don't know, not answered	80.9	48.6	18.4
Total	100.0	100.0	100.0
Total number	110	105	619

Whitcomb's announcement was more specific. In his forecast he stated that a quake would occur "within a year" meaning any time between April, 1976 and April, 1977. Despite this fact, nearly half of the respondents could not recall any date or time. About eight percent of the references to Whitcomb correctly identified the one-year time window; however, seven respondents believed that Whitcomb stated that the quake would occur specifically in April, 1977. This indicates some confusion on the part of the public between what scientists mean by a one-year time window as contrasted to a one-year lead time.

Minturn issued the most precise prediction of all, specifying that a quake would occur on December 20, 1976. Nearly 50 percent of the respondents who mentioned his prediction identified the date correctly, while another 29 percent referred to some other December date. The specificity of this announcement and the publicity it received undoubtedly contributed to a high degree of accuracy.

Respondents were finally asked to recall where the predicted quake was supposed to occur.

> Do you remember whether this earthquake is/was supposed to occur in any particular location?

Respondents who could recall the location were asked to specify it by name.

This information is particularly pertinent to the Uplift for if people think that a quake will occur only around Palmdale many will conclude that any associated earthquake will not affect them personally. While most articles about the Uplift made it clear that an Uplift-related quake was a "threat to public safety and welfare in the Los Angeles area," the greatest number of respondents (17%) mentioning the Uplift believed that a quake was predicted for the Palmdale area (Table 7). Again we can look to the media as fostering this belief for it was the media that first referred to the anomaly as the "Palmdale Bulge." The association of the Uplift with Palmdale undoubtedly

TABLE 7

LOCATION OF PREDICTED QUAKE BY SPECIFIC ANNOUNCEMENT

Location of predicted quake	Near prediction as classified		
	Uplift	Whitcomb	Minturn
Palmdale/Lancaster	17.2	2.9	1.3
San Fernando Valley	8.2	6.7	2.6
On faults	16.4	9.5	4.2
Los Angeles	3.6	14.2	19.3
Southern California	14.5	19.0	39.9
Other California locale	6.4	8.6	7.9
Other	.9	1.0	3.0
Don't know, not answered	32.8	38.1	21.8
Total	100.0	100.0	100.0
Total number	110	105	619

contributed to this belief and made some people unaware that the quake would affect a larger area of the County. Fortunately this belief was not held by a majority of the respondents who mentioned the Uplift. On the whole, they believed that the quake would occur in a wider area, such as along faults (16.4%) or in southern California in general (14.5%). Only four people specifically mentioned that the quake would strike Los Angeles, though many more undoubtedly included Los Angeles in the larger area designated. Nine people believed the quake was predicted for the San Fernando Valley, the site of the 1971 quake.

The most controversy arose over the impact area for the quake predicted by James Whitcomb. Whitcomb originally stated that the epicenter of the predicted quake would be "near" that of the 1971 San Fernando quake. This was interpreted by the media in several ways. Some papers reported the location to be in the "Los Angeles area," another reported it would occur in an 80 mile area, approximately the same region as the San Fernando earthquake. Another paper stated that the epicenter would lie near the epicenter of the San Fernando quake. As a result of this ambiguity, a San Fernando Valley Councilman wanted to initiate legal action against Whitcomb based on the belief that Whitcomb's forecast might cause Valley property values to decline. Despite this publicity, only seven respondents mentioned the Valley as the quake location. Most respondents who mentioned the Whitcomb announcement believed the quake would affect a much wider area, such as southern California (19%), Los Angeles (14.2%), along faults (9.5%) or other areas of California (8.6%).

Scientists often criticized Minturn for his failure to specify the location of the predicted quake. However, Minturn did make it clear that the site of the December 20th quake would be southern California. Forty percent of those mentioning Minturn's prediction correctly identified the location; another 20 percent believed the impact area would be in Los Angeles, suggesting that many people felt they would be personally affected by the quake.

In examining the three near predictions we note a continuum of specificity with regard to the information disseminated to the public. By specificity we are referring to whether the prediction includes information on the projected time, place, and magnitude of the quake, three components essential to making predictions useful. The most specific near prediction of the three was Minturn's forecast which included the exact date and relative locale of the predicted quake. Less specific was Whticomb's announcement which projected a one year time window and the approximate impact area. The Uplift, while the most scientifically credible announcement, was less specific because it did not give an exact time and place for the predicted quake.

Some general observations can be made concerning the specificity of the announcements and the knowledge and understanding of these predictions. Our data indicate that the more specific the announcement, the more accurate the understanding of the information. Respondents are more likely to recall the specific date of Minturn's announcement than to recall the one year time window specified in Whitcomb's announcement or the Uplift. For the latter two announcements the majority of respondents either could not recall the information or misunderstood its content. Likewise, respondents are more likely to recall the impact area for Minturn's prediction than for the other two near predictions.

Two generalizations seem warranted. First, increased specificity of announcements increases comprehension of the prediction. People are more likely to understand predictions if exact dates and places for the predicted quake are included as part of the announcement rather than vague references to such details. This has significant implications in terms of preparedness as

well, for the immediacy of the threat is certainly diminished if respondents do not know where a quake is likely to occur or if they foresee the quake sometime in the distant future. Second, the media play a significant role in fostering public awareness and understanding of predictions. No doubt the recency effect and the extended media coverage of Minturn's prediction contributed to the accuracy of the respondents' information.
While the media contributed to some confusion as to the kind of person issuing the prediction, continued references to the place and date of the quake contributed to a high level of knowledge of these facts. On the other hand, publicity about the intended lawsuit by a San Fernando councilman and references to the "Palmdale Bulge" caused some confusion concerning the impact area referred to in Whitcomb's announcement and the Uplift.

Explaining Prediction Awareness

Hyman and Sheatsley (1974) argue that those responsible for information campaigns cannot simply rely upon an increase in the supply of information as a means of disseminating information effectively. They propose that it is important to examine the physical and psychological factors that may impede public exposure to information. For this reason we will focus our attention on the factors that account for prediction awareness.

A model was developed to analyze the relationship between the dependent variable, the number of near prediction announcements heard by respondents, and a set of predetermined independent and intervening variables thought to be significant in explaining prediction awareness. By using this approach we will accomplish two goals. First, we will be able to identify specific segments of the population who are aware of announcements and those who are unaware. Second, we can use this information to suggest possible changes in media strategies so that announcements can reach a larger segment of the population.

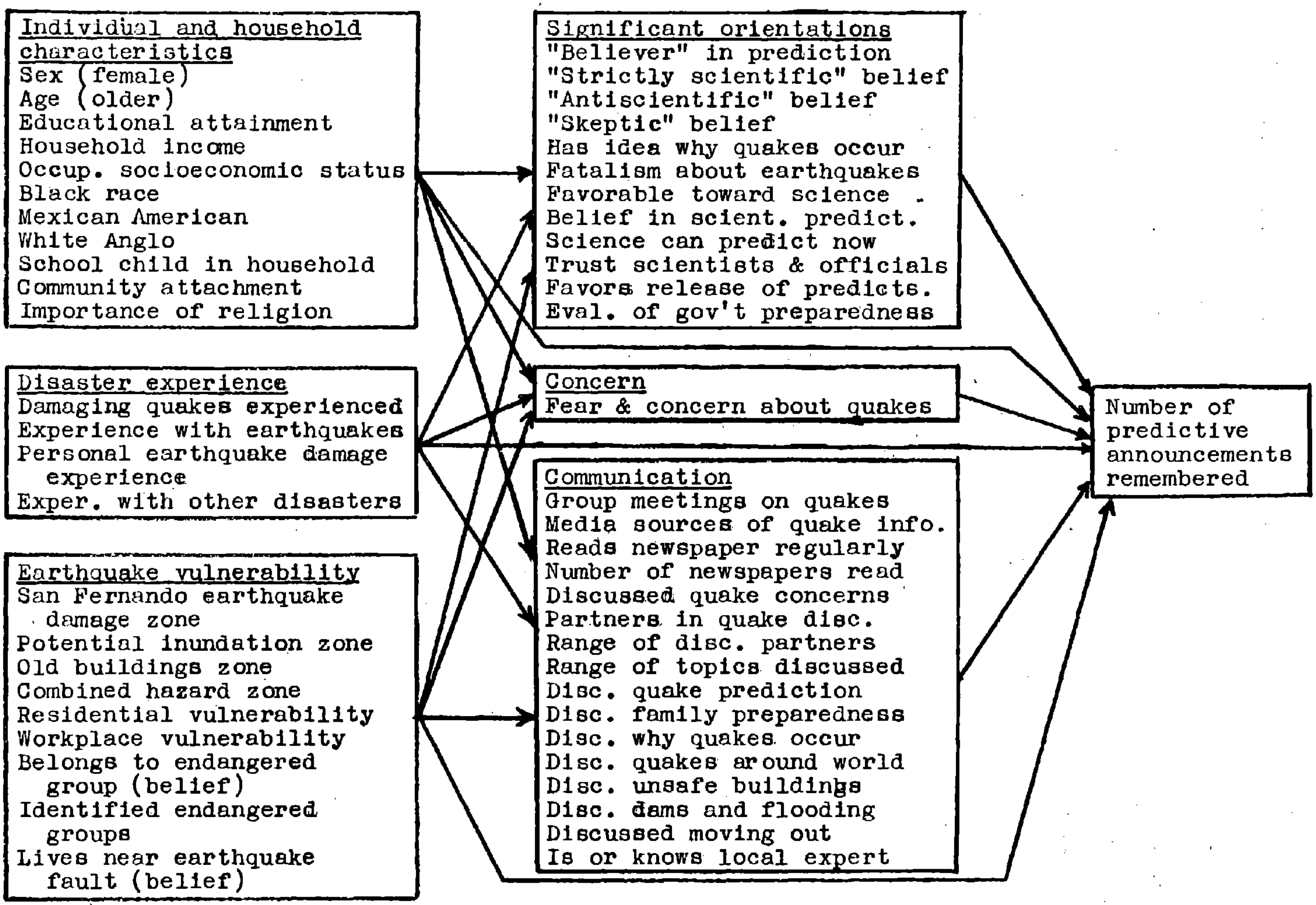
The number of near prediction announcements heard was determined by the question which asked respondents to describe the predictions, statements, or warnings about earthquakes for the southern California area heard during the past year or so. An index was formed by simply counting the number of predictions, forecasts, or cautions mentioned. The index ranges from zero, for no announcements heard or remembered, up to five, for five announcements heard.

We hypothesized that the number of near prediction announcements heard would be a function of individual background characteristics, prior disaster experience, and the vulnerability to earthquake hazards. Individual and household characteristics such as the respondent's sex, socioeconomic status, ethnicity, education, income, age, community attachment, importance of religion, and whether there are school children present in the household, were included in the model as independent variables. Measures of prior disaster experience were also entered at this stage of the model. These variables included the number of damaging earthquakes experienced, the extent of earthquake experience, and earthquake damage experienced by respondents and close associates. Residence in zones subject to inundation, zones with heavy concentrations of old buildings, zones with both inundation and old building hazards, residence in the 1971 San Fernando earthquake damage zone, vulnerability of the workplace, residential vulnerability, proximity to an earthquake fault, and self-identified membership in a vulnerable group were included as measures of vulnerability.

We also hypothesized that the number of near prediction announcements heard would be a direct function of the communication process and significant orientations and frames of reference. Thus we were interested in assessing the extent to which the number of near prediction announcements heard is affected by these two mediating processes. Fatalism about earthquakes; orientation toward science; causes given for earthquakes; belief in scientific predictions; prediction belief patterns; trust in officials and scientists; attitudes toward releasing earthquake predictions to the public; and evaluation of official handling of earthquake preparations were entered into the equation as intervening variables. Communication variables included in the model were: the range of media sources; newspaper readership; group meetings on earthquakes attended; the range of discussion partners for specific earthquake topics such as earthquake predictions, family preparedness, why earthquakes occur, quakes around the world, old unsafe buildings, dams and flooding, and moving out. The assumed interrelationships among the variables are displayed in Figure 1.

The strategy used in the regression analysis was to isolate the smallest set of variables that will account for the largest proportion of explained variance in the number of prediction announcements heard. Variables were eliminated from the analysis on the basis of two criteria: if the variable did not have a significant effect on the dependent variable ($p < .05$), or the variable was no longer theoretically meaningful.

Using these criteria only seven variables were found to be significant in explaining the number of prediction announcements heard. Figure 2 presents the standardized regression coefficients for the variables in the simplified model. We will discuss the findings by examining the variables that were eliminated from the model and the variables that had significant effects on the number of announcements heard. Since the intervening variables had the greatest direct impact on the number of announcements heard, we will begin our analysis by examining these variables.

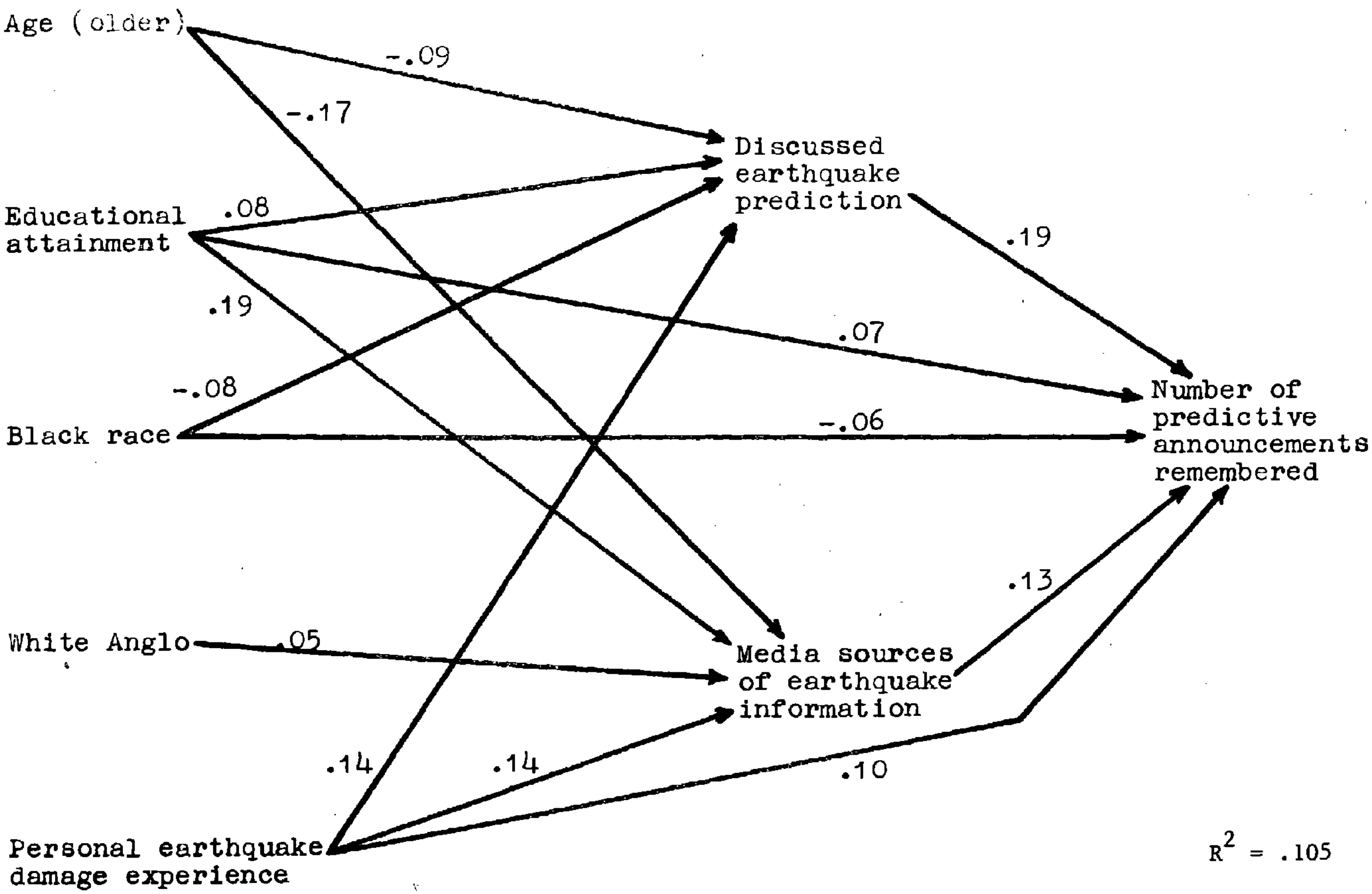


THEORETICAL MODEL FOR NUMBER OF PREDICTIVE ANNOUNCEMENTS REMEMBERED

Figure 1

It is generally assumed that attitudes influence the way people perceive, interpret, and respond to situations. Communication theorists Rogers (1962) and Klapper (1960) postulate that people attend to messages that are consistent with their existing attitudes and beliefs. Earlier in the chapter we have already called into question whether this assumption is correct when applied to the type of announcement people remember. But it is still appropriate to ask whether the extent of awareness of all kinds of announcements is affected by any of the orientations we have measured. We hypothesized that the belief that scientists can predict earthquakes, confidence in scientists, favorable attitudes toward science, the belief that public officials are doing a good job in handling earthquake preparations, and unfatalistic attitudes about earthquakes would be positively associated with the number of prediction announcements heard. Perhaps the most striking finding is that earthquake orientations and frames of reference have no direct effect on the number of prediction announcements heard. Prior attitudes and beliefs about the earthquake threat appear to have little influence on whether people become aware of predictions or not.

The media play an important role in the dissemination of near predictions. Announcements generated by scientists and other types of people usually do not pass directly to the public but are generally processed and prepared for dissimination by the mass media. Disaster researchers note that following a warning, informal communication networks often emerge to interpret and disseminate information. In order to assess the impact of the mass media and interpersonal communication on the number of prediction announcements heard, several different variables were used to measure media and interpersonal



MODEL FOR NUMBER OF PREDICTIVE ANNOUNCEMENTS REMEMBERED

Figure 2

communication use.

We find that newspaper readership does not contribute significantly to the number of prediction announcements heard. While newspapers can provide extended coverage of prediction topics, exclusive reliance on this source is unlikely to produce unusual awareness of predictions. However, the use of a range of media sources is a better predictor of announcements heard. Prediction awareness is enhanced by using a variety of media rather than limiting exposure to a few sources.

Discussion of prediction announcements with a range of partners accounts for the greatest proportion of the variance in the number of announcements heard. Insofar as the arbitrary causal ordering of the model can be accepted as valid, the significance of informal discussion in creating public awareness is demonstrated by this finding. On the other hand, whether people discussed other earthquake-related topics has no bearing on whether they have heard prediction announcements.

It is not surprising that the channels of communication are the most important factors contributing to announcements heard. However, it is important to note the effect of interpersonal communication on prediction awareness. While Deutschman and Danielson (1960), Rogers (1962), and Greenberg (1964) demonstrate the importance of the mass media in creating public awareness of innovations and crisis situations, our findings demonstrate the significance of interpersonal communication in creating public awareness of earthquake forecasts. Since the range of media sources used and discussion of earthquake announcements with a range of partners together account for 8.4 percent of the variance explained, the data suggest that the use of the media in combination with interpersonal communication is the most effective way to insure public awareness of earthquake forecasts.

By adding the independent variables to the regression equation, the proportion of variance explained increased to 10.4 percent, a minimal yet significant increment over what has been explained by the two intervening communication variables.

While we expected to find that the number of prediction announcements heard is a function of subjective and objective vulnerability, we find that these variables have no direct or indirect effects on announcements heard. The respondents' sex, socio-economic status, income, and the importance placed on religion also have no significant relationships to the number of announcements heard.

We also expected to find that people with school children in the home would be more aware of prediction announcements since children often serve a relay function in the dissemination of information (DeFleur and Larsen, 1958). Also, concern for family safety can serve as a powerful motivation to seek information about the earthquake threat. However, we find that the presence of school children is unrelated to the number of near prediction announcements heard.

Prior disaster experience has been found in many situations to have a significant impact on disaster response. Thus we expected prior disaster experience to have a significant effect on the number of near prediction announcements heard. Three measures of prior disaster experience--the number of damaging earthquakes experienced, the extent of earthquake experience, and experience in other disasters--have no prediction value. However, the extent of earthquake damage experienced by respondents and close associates has both direct and indirect effects on the number of near prediction announcements heard. People who either have personally suffered a loss in a damaging earthquake or have friends, relatives, or neighbors who have suffered loss are more likely than other people to have heard near prediction announcements. They are also likely to have learned about earthquakes from a wider range of media sources and to have engaged in discussion of earthquake prediction with a wider range of partners. Since other measures of prior earthquake experience have no significant impact on the number of announcements heard, this finding points to the experience of personal loss from an earthquake rather than the mere fact of experience with earthquakes as heightening one's awareness of announcements concerning future damaging earthquakes.

Education has both direct and indirect effects on awareness of earthquake near predictions. The strongest effect in the model is the tendency for more highly educated respondents to learn about earthquakes from a wider range of media sources. The more highly educated are also more likely to have engaged in discussion. And over and beyond the effects of their greater involvement in communication about earthquakes, they are likely to have heard or remembered more near prediction announcements.

The effect of age is substantial, but it is all indirect. Younger people learn about earthquakes from a wider range of media sources and engage in more informal discussion of earthquake predictions. But their greater awareness is fully explained by their greater involvement in communication. The effect of age on media sources is stronger than the effect on discussion, and should be emphasized in understanding age differences in earthquake near prediction awareness.

Being Mexican American has no significant effects, direct or indirect, on awareness. Being Anglo has only a slight indirect effect. Anglos are more aware than others of near predictions only because they learn about earthquakes from a wider range of media sources. The effects of being Black, however, are both direct and indirect. Blacks do not learn about earthquakes from a significantly different range of media sources than other people. But they do engage in significantly less informal discussion of earthquake prediction. And over and beyond the effects of their limited discussion, Blacks have heard or remembered fewer near prediction announcements. Findings from the more extended ethnic comparison in Part Six can shed light on this finding.

While use of the mass media and interpersonal communication account for most of the explained variance in the number of prediction announcements heard, Blacks are less likely than other groups to receive earthquake information from these channels. Slightly over eight percent of the Blacks in our enlarged sample did not obtain earthquake information from the mass media, while only 2.1 percent of Mexican Americans and 1.5 percent of White Anglos had not received information from the media. Blacks were less likely to have discussed earthquake predictions than members of other ethnic groups. Over 60 percent of Blacks did not discuss earthquake predictions within informal channels as compared to 45 percent of Mexican Americans and 34 percent of White Anglos. In addition, the leading Black newspaper in the Los Angeles area carried only one article on earthquakes during the first six months of 1976, suggesting that the earthquake threat was not a salient concern in the Black community. Furthermore, Blacks are less likely than other groups to have mentioned earthquake as an important problem facing residents of Southern California in response to an open-ended question.

The explanatory power of the model is low, since only ten percent of the total variance in the number of prediction announcements is explained. However, our results can be used to help in identifying groups that remain unaware of earthquake forecasts and to suggest possible strategies for reaching these groups.

First, significant orientations we have measured and the hazardousness of one's location do not affect whether people become aware of near prediction announcements or not.

Since use of the mass media and informal discussion account for the greatest proportion of the variance, it is appropriate to identify groups that do not utilize these channels and to suggest ways to encourage their use.

The data indicate that Blacks are less likely than other segments of the public to have heard prediction announcements. Blacks are less likely to utilize the mass media and to discuss earthquake prediction within informal channels than other residents. Other findings suggest that earthquake predictions and the earthquake threat in general need to be made more relevant to members of the Black community. This objective might be achieved by focusing attention on earthquake topics in the media particularly directed at the Black community, provided we can find media that command distinctive attention in the Black community. Since people often seek verification of mass communicated messages within interpersonal networks, increased media coverage may increase informal discussion of earthquake predictions as well. But it may be necessary to find other ways to stimulate informal discussion and interest within the Black community.

While we found no direct relationship between age and the number of announcements heard, there is an indirect relationship. The elderly may be at a disadvantage in receiving information about prediction announcements. They are less likely to utilize the media and interpersonal channels to receive earthquake information than younger people. This finding suggests that people responsible for issuing earthquake forecasts must be made aware that the elderly may not utilize the traditional channels of communication. In this case we must develop new strategies to reach this segment of the population.

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CHAPTER EIGHT

HOW SERIOUSLY ARE EARTHQUAKE ANNOUNCEMENTS TAKEN?

The warning process is not limited solely to the dissemination of warning messages. The message is simply the mechanism that enables individuals and groups within an endangered community to respond adaptively if they are able and so choose. Whether people respond adaptively to warnings depends, in part, upon whether members of the public take the warning seriously. It is important to know whether the babel of earthquake forebodings is a matter of potential concern to those who hear it, or merely an amusing diversion from more serious preoccupations.

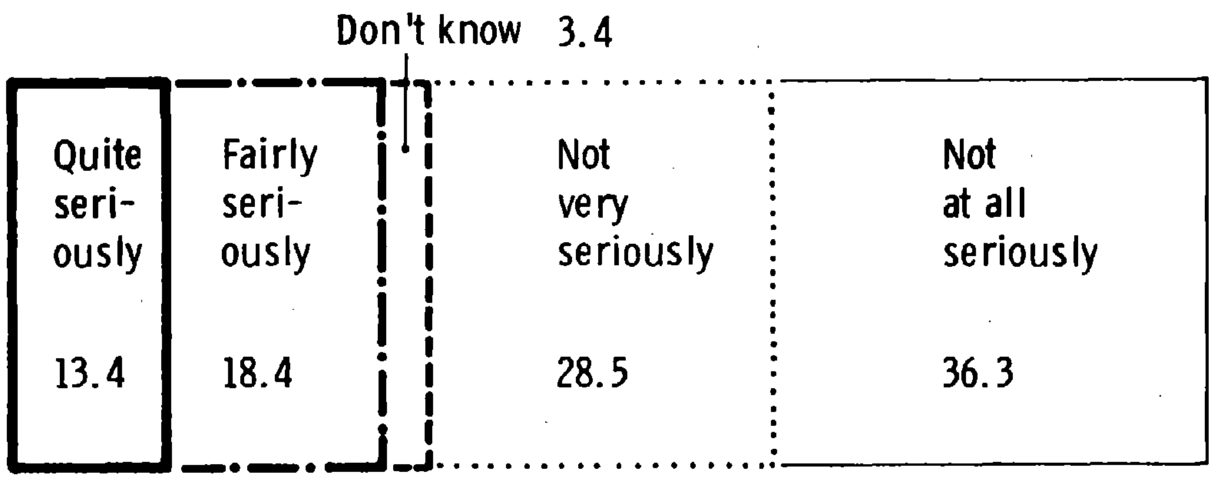
The question for this chapter is how seriously people take the earthquake premonitory announcements they have heard. Do people pay more serious attention to announcements with a credible scientific basis than they do to other forecasts?

In the course of questioning about each of the respondent's answers, interviewers asked:

> How seriously do or did you take this prediction? Quite seriously, Fairly seriously, Not very seriously, or Not seriously at all?

As Figure 1 indicates, most of the announcements were not taken seriously. Just under a third were taken fairly seriously or quite seriously.

In order to gain a refined impression of the awareness of earthquake predictions, forecasts, and cautions, we have tabulated separately the number of announcements that people heard <u>and</u> took seriously (Table 1). To facilitate comparison we have repeated the percentages from the earlier table. While 86.6 percent had heard one or more announcements, only 31.9 percent had heard



HOW SERIOUSLY EARTHQUAKE ANNOUNCEMENTS ARE TAKEN

FIGURE 1

and taken seriously one or more announcements. And only 5.8 percent had heard and taken seriously two or more. Over half of the people (54.7%) had heard one or more announcements but did not take any of them seriously.

People might fail to take an earthquake forecast seriously, not because they don't believe it is likely to come true, but because they don't expect the earthquake to be unusually severe. We attempted to secure an approximate idea of the intensity of the anticipated earthquake for each announcement. Respondents were presented with a card specifying four broad degrees of intensity, and asked the following question:

> Please look at this card and tell me how strong the earthquake is supposed to be. (Destroy many buildings and take many lives; Destroy some buildings and take a few lives; Do some damage, but no widespread destruction; Do little or no damage; or Didn't they say?)

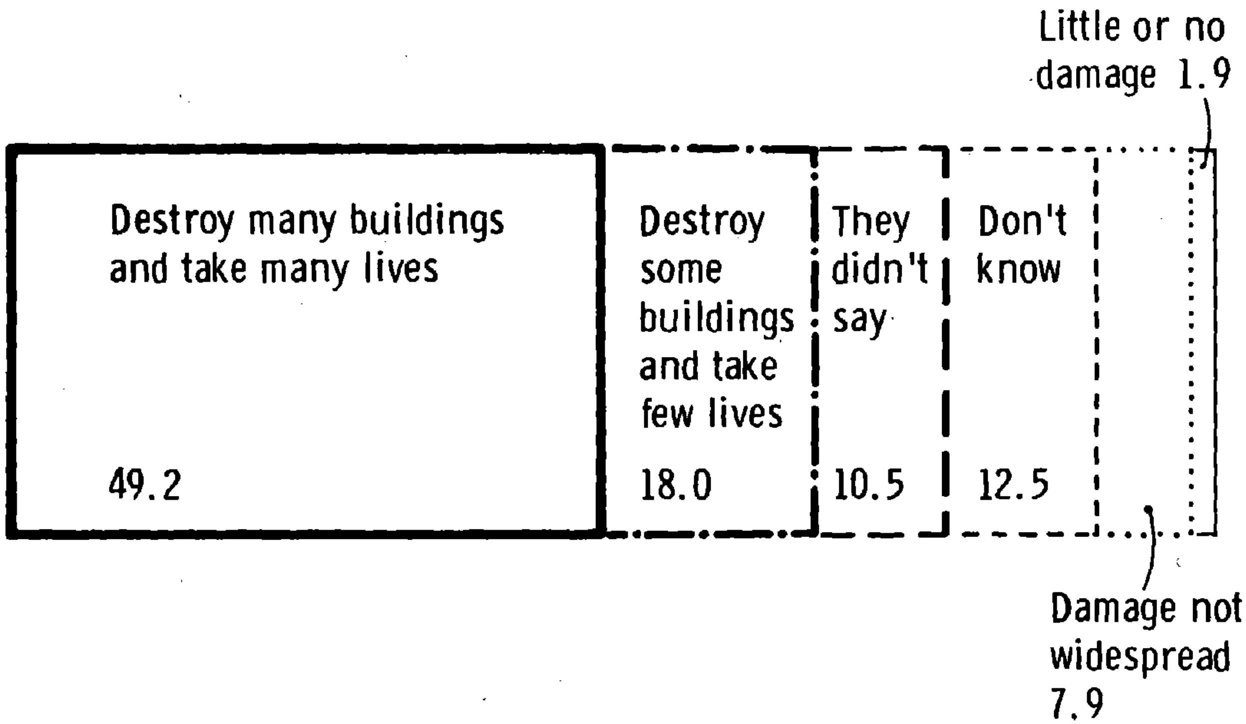
From Figure 2 it is plain that it is not the forecasting of innocuous earthquakes that explains the failure to take announcements seriously. More than three-fourths of the announcements were thought to refer to destructive quakes that would take some lives, and more than half to severe quakes that would "destroy many buildings and take many lives." The forecasts "in the air" in southern California convey the prospect of devastating quakes. Many are not taken seriously in spite of the anticipated high earthquake intensity rather than because of expected low intensity.

We look once again at the number of earthquake predictions, forecasts, and cautions that people could name or describe, but this time including only those that are supposed to destroy some or many buildings and take some or many lives. Sixty-four percent of the people have heard at least one announcement concerning an earthquake that is expected to destroy buildings and take lives (see the third column in the preceding table). But few can think of more than one.

TABLE 1

NUMBER OF EARTHQUAKE PREDICTIONS, FORECASTS AND CAUTIONS HEARD, TAKEN SERIOUSLY, AND INVOLVING CASUALTIES

Number of announcements	Heard	Taken seriously	Involving casualties	Taken seriously and casualties
		Percent		
None heard	13.4	13.4	13.4	13.4
None	--	54.7	23.0	56.9
One	57.4	26.1	47.0	24.5
Two	23.2	4.8	14.5	4.4
Three or more	6.0	1.0	2.1	0.8
Total	100.0	100.0	100.0	100.0
Total number	1450	1450	1450	1450
		Cumulative Percent		
One or more	86.6	31.9	63.6	29.7
Two or more	29.2	5.8	16.6	5.2
Three or more	6.0	1.0	2.1	0.8



EXPECTED DAMAGE FROM ANNOUNCEMENTS HEARD

FIGURE 2

The final column in the same table may give the best indication of public awareness of earthquake forecasts and cautions that people see as causes for concern. Here we have included only those announcements that forecast the destruction of buildings and loss of life and are taken seriously by the respondents. About 30 percent of the people in our sample could identify one or more such announcements. Only about five percent could identify more than one.

After starting with an amazing array of earthquake forebodings, we have arrived by a series of carefully considered steps at the conclusion that less than a third of the people can identify even one forecast or caution that is a cause for serious concern. And only one in twenty can identify more than one. If forebodings of earthquake are in the air, they remain ethereal for the majority and are simplified to a single forecast for most of the remaining minority.

Explaining Announcements Taken Seriously

Disaster research demonstrates a relationship between warning confirmation and interpretation of the warning message. Danzig, Thayer, and Galanter (1958) note that when a threat is ambiguous, there is a tendency to seek verification of the warning message. Drabek (1969) states that this process of confirmation, primarily for purposes of defining some aspect of the ambiguous situation, frequently takes place through direct and indirect appeals to authorities. Mileti (1975) states that the response of official sources to questions which call for validation, corroboration, or refutation help determine warning believability. This formalized activity, in conjunction with interpersonal discussion, occurs when media sources fail to provide sufficient information. Rosenthal (1971) contends that the potential for verification of a message enhances its credibility by enpowering the receiver with the ability to confirm or deny the message. The opportunity to verify the message continually reinforces the receiver's confidence that the "truth will win out." The capacity of negation is a primary force for sustaining affirmative credibility (1971:399).

Another factor which may affect how seriously announcements are taken is communication mode. Following a disaster warning, informal networks often emerge to interpret and disseminate information about changes in the environment (Williams, 1964). Williams states that consultation with informal sources can change people's interpretation of warning signals and can move people to action even though they are not convinced of the imminent danger. Danzig, Thayer and Galanter found that residents who had heard or discussed the consequences of a dam break were more likely to report fleeing the area upon hearing a rumor to this effect than residents who had not discussed a dam break. The researchers explain that discussion of the issue helped to predefine the situation so as to necessitate flight.

Conflicting evidence by Clifford (1956) demonstrates how verification of warning messages in informal groups can be counter-productive. Clifford found a tendency to ignore warnings among those who resist disturbances to the established social order. The greater reliance on family decision making in Piedras Negras produced resistance to the rational arguments disseminated by the mass media. In a study of social movement participants, Festinger et al (1956) bring further support to this finding. Individuals who were heavily committed to the group remained unshaken by the disconfirmation of a belief. Festinger demonstrates that in the face of disconfirming evidence, support for a belief can be maintained within a supportive circle of believers. Group discussion may lead to downgrading of the earthquake threat, despite media publicity to the contrary. In either case we expect to find a relationship between the mode of communication and announcements taken seriously.

The credibility of the source of information also tends to have an effect on interpretation of messages. Hovland, Janis, and Kelley (1953) postulate that when the communicator is perceived as having definite intentions to persuade the audience, information is perceived as less credible. We expect that peoples' trust in scientists, public officials, and other types of people who issue prediction announcements is likely to affect whether the announcements are taken seriously.

Literature in the field of disaster research also indicates that prior disaster experience has a significant effect on present concerns and methods for handling future disasters. Lachman, Tatswoka, and Bonk (1961) found that prior disaster experience increased the likelihood that the warning message would be interpreted as a sign of danger. On the other hand, Moore (1964) postulates that individuals "living at risk" develop means to cope with disasters which allow them to define the situation as non-threatening. In either case we expect that decisions about the seriousness of earthquake announcements will be directly affected by past disaster experience.

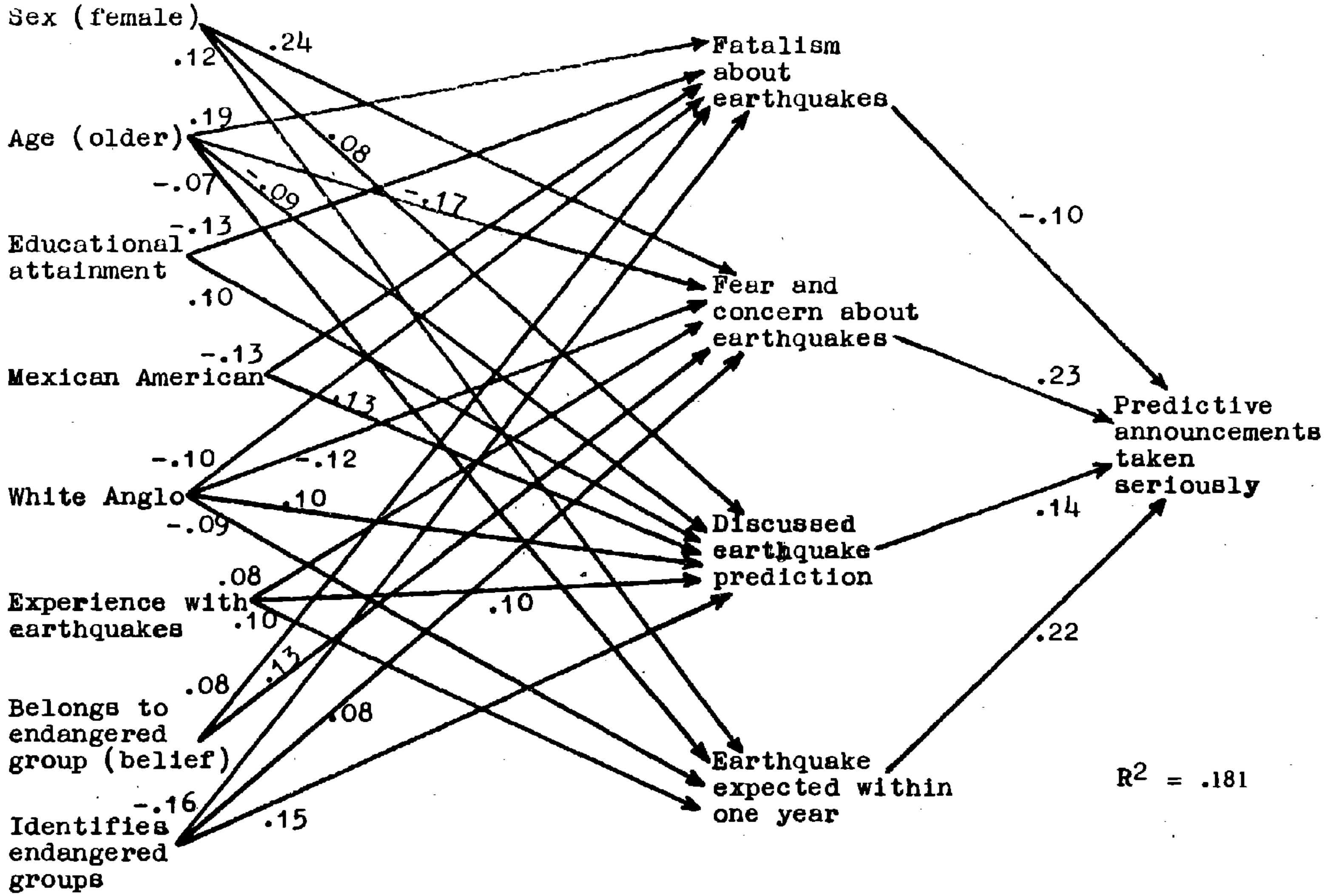
A model was developed to examine the effects of some of these factors on how seriously prediction announcements are taken. For the dependent measure we constructed an index which simply counts the number of prediction announcements taken "quite seriously" or "fairly seriously." The index scores range from zero, indicating that the respondent heard announcements but did not take any seriously, to five, if the respondent mentioned five predictions and took them all seriously.

We hypothesized that how seriously earthquake announcements are taken will be a function of individual background characteristics, prior disaster experience, and vulnerability. The same individual and household characteristics included in the model for the number of prediction announcements heard were included in the present model as independent variables. Both objective and subjective measures of vulnerability were also included in the model at this stage. Objective measures included the four special earthquake risk zones, vulnerability of the workplace, and residential vulnerability. Subjective vulnerability included respondents' awareness of vulnerable groups, membership in vulnerable groups, and proximity to an earthquake fault.

We also believed that how seriously earthquake announcements are taken is a function of the communication process and significant orientations. The eleven communication variables used in the previous model were included as intervening variables. Eight significant orientation variables included in our earlier model were also entered into the regression equation. Since we also assumed that current perceptions of the earthquake threat would have an effect on announcements taken seriously, two additional variables were included. These variables are the extent of fear and concern about earthquakes, and the probability of a damaging earthquake occurring within a year.

Variables were subsequently eliminated from the model if they did not have a direct effect on the dependent variable or they were not theoretically meaningful. Our discussion of the regression results will focus upon the variables that were significant predictors of the number of prediction announcements taken seriously.

Significant orientations and communication mode are the strongest predictors of announcements taken seriously. The extent of concern over earthquakes, the probability of a damaging earthquake occurring within a year, fatalism about earthquakes, and discussion of prediction announcements with a range of partners, account for 17.9 percent of the explained variance. When



MODEL FOR NUMBER OF PREDICTIVE ANNOUNCEMENTS TAKEN SERIOUSLY

Figure 3

the independent variables are entered into the equation, the explained variance increases to 18.1 percent, a nonsignificant increment. This finding leads us to conclude that individual characteristics, vulnerability, and prior disaster experience have little direct effect on whether announcements are taken seriously, and that communication mode and current perceptions of the earthquake threat are more significant determinants. The regression coefficients appear in Figure 3.

The extent of concern over earthquakes is the strongest predictor of announcements taken seriously. The higher the level of concern, the more prediction announcements are likely to be taken seriously. The belief in the probability of an earthquake occurring within a year is the second strongest predictor of announcements taken seriously. In this case the greater the belief that an earthquake is likely to occur within a year, the more announcements are likely to be taken seriously. People who express concern over the earthquake threat and people who believe that a damaging earthquake is likely to occur in the near future are more likely to take predictions, forecasts, and warnings seriously than people for whom the earthquake threat is not relevant. (Of course, a reversal of the direction of causality would make equal if not greater sense in a different model.)

Fatalism about earthquakes has a significant inverse relationship to announcements taken seriously. Restated as a positive relationship, this finding suggests that people who are confident that something can be done to alleviate the earthquake danger are more likely to take warnings of an impending quake seriously than individuals who doubt that anything can be done.

As predicted, communication mode is significantly related to announcements taken seriously. However, only discussion of prediction announcements with a range of partners has a significant impact on announcements taken seriously. Individuals who hear predictions or seek confirmation of predictions from informal sources are more likely to take announcements seriously than people who have not discussed predictions in informal networks. This finding lends further support to Williams (1964) and Mileti and Beck (1975) and others who contend that media communicated messages alone are inadequate to stimulate adaptive responses. People who seek warning confirmation through informal channels are more likely to accept the credibility of warning messages than individuals who do not utilize these channels. The relationship between discussion of prediction announcements and how seriously announcements are taken further suggests that if media-communicated forecasts are followed by confirmation within informal networks they are more likely to be taken seriously.

While the independent variables have little direct effect on announcements taken seriously, they do have significant effects on the intervening variables.

The data in the accompanying Table indicate that the extent of past experience in earthquakes has effects on several of the intervening variables. The extent of past experience in earthquakes has significant effects on the extent of concern over earthquakes, the belief in the probability of an earthquake occurring within a year, and discussion of prediction announcements with a range of partners. The fact that the coefficients are in the positive direction indicates that the greater the extent of past experience in a damaging earthquake, the higher the level of concern about future earthquakes, the greater the belief in the likelihood of an earthquake occurring within a year, and the more extended the discussion of earthquake announcements in informal networks, the more seriously announcements are taken. These findings suggest that firsthand experience in a damaging earthquake heightens people's concern, expectations, and information seeking behavior surrounding the threat of a future damaging earthquake.

Awareness of vulnerable groups and vulnerable group membership do not affect the intervening variables in any consistent way. Individuals who are aware of groups that would be especially endangered in a damaging earthquake are more likely to have a higher level of concern over earthquakes and to discuss prediction announcements with a variety of partners than individuals who are less socially aware. The association between awareness of vulnerable groups and fatalism about earthquakes is in the negative direction. This suggests that individuals who are socially aware are more apt to feel they can effectively institute measures to alleviate earthquake danger than people who are less socially aware.

When we examine the relationship between vulnerable group membership and the intervening variables a different pattern emerges. Vulnerable group membership contributes significantly to concern over earthquakes and fatalism about earthquakes. In this case individuals who claim membership in groups especially vulnerable to earthquake hazards are likely to have a higher level of concern about earthquakes and to be more fatalistic about the earthquake threat than individuals who do not perceive themselves to be highly vulnerable to earthquake danger. Thus while both measures of subjective vulnerability increase the individuals concern about the earthquake threat, actual membership in an endangered group may leave individuals feeling less able to cope effectively with earthquake hazards.

Sex, age, and ethnicity are among the most powerful predictors of the intervening variables. Sex is significantly associated with concern over earthquakes, the belief in the probability of an earthquake occurring within a year, and discussion of prediction announcements with a range of partners. The results indicate that women are more likely than men to have a higher level of concern over earthquakes, to expect an earthquake within a year, and to discuss earthquake predictions with a range of partners.

There is an inverse relationship between age and concern over earthquakes, the probability of an earthquake occurring within a year, and discussion of prediction announcements with a range of partners. Older people are less likely to have a high level of concern over future earthquakes, are less likely to believe an earthquake will occur within a year, and are less likely to discuss predictions with a range of partners than younger people. This pattern, demonstrating a lack of concern, may be due to the fact that older people have learned to normalize the threat. Moore (1964) explains that people living at risk develop means of coping with disaster which enable them to define the situation as nonthreatening. Because older residents may have learned this coping mechanism they are less likely to express concern over earthquakes and to perceive the inevitability of a future quake than younger residents. It is also plausible to assume that older people consider the earthquake threat in relation to their own briefer future time frame, and are less concerned because the quake is less likely to occur in their lifetimes. However, the positive relationship between age and fatalism indicates that older people are more fatalistic about earthquake than younger residents. The fact that older people are less apt to believe that anything can be done to alleviate earthquake danger might also partially explain their lack of concern and anticipation of a future quake.

Our results indicate that there are significant ethnic differences with regard to concern, fatalism, the probability of an earthquake occurring, and discussion of prediction announcements. White Anglos show less concern over earthquakes and are less likely to expect an earthquake within a year than members of other ethnic groups. Anglos and Mexican Americans are similar in that they are less fatalistic about earthquakes than Blacks. In addition, Anglos and Mexican Americans are more likely to discuss prediction announcements with a variety of partners than Blacks.

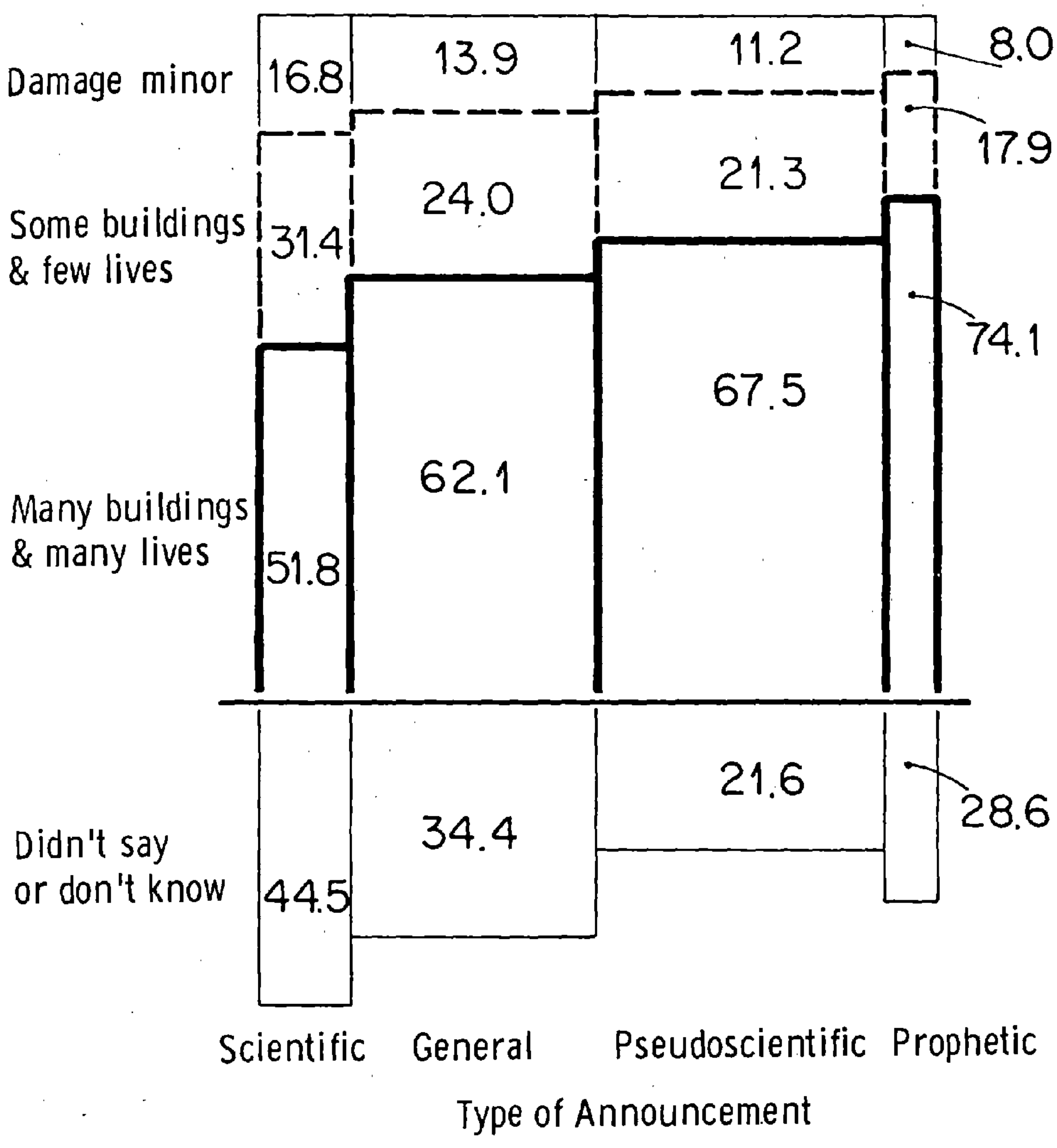
The decision-making process with regard to near predictions of earthquakes may be different from that applying to other types of disaster warnings. In contrast to published findings for other types of disaster warnings, prior disaster experience, environmental vulnerability, and individual characteristics have little effect on whether people will take prediction announcements seriously.

Instead, present concern over the earthquake threat, the belief that an earthquake is likely to occur in the near future, and a low degree of fatalism about earthquakes enhance the credibility of prediction announcements. Discussion of prediction announcements within informal groups further underscores the seriousness of these announcements. These four factors most adequately explain the decision to take prediction announcements seriously.

Comparing Scientific and Nonscientific Announcements

The predictions, forecasts, and cautions circulating in southern California differ greatly in scientific merit. As we noted, relatively few people think of an identifiable scientific announcement when answering a general question. And most of the announcements are not taken very seriously. It remains to be seen whether there is a difference in the earthquakes expected on the basis of scientific and nonscientific near predictions, and whether the scientific announcements are taken more seriously.

We first compare the intensity ratings of earthquakes expected for each of the four types of announcement (Figure 4). The relationship is graphed in a slightly different way than previously, so as to convey two distinct



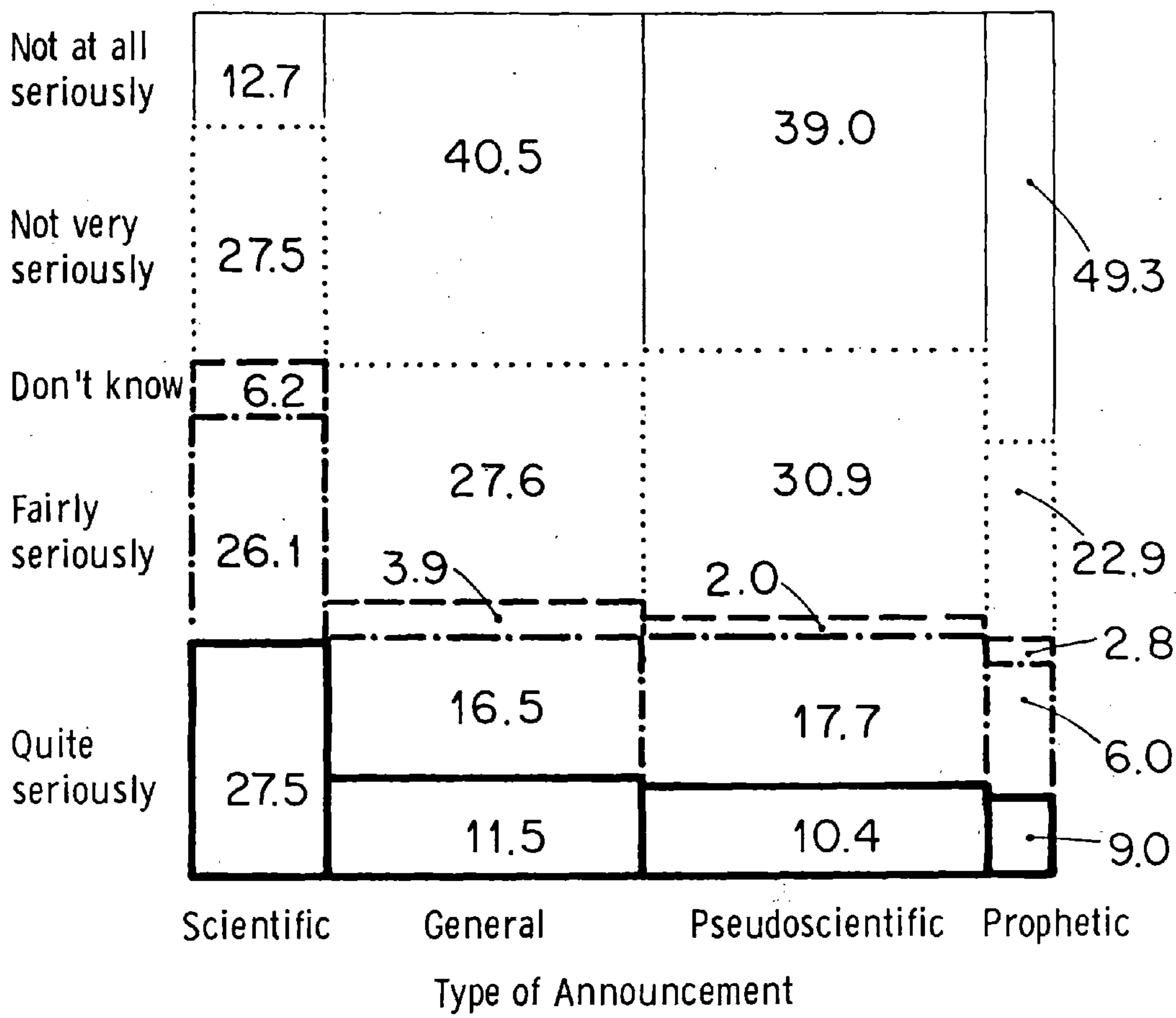
EXPECTED DAMAGE BY TYPE OF ANNOUNCEMENT

FIGURE 4

items of information. In the square area above the base line the graph shows the amounts of damage expected for each type of announcement in the usual fashion. The differences are not great, but they are significant by the usual statistical tests. On the average, when people think of scientific announcements, they think of less destructive earthquakes than when they think of prophetic forecasts. There is a steady progression in severity from scientific to general to pseudoscientific to prophetic forecasts and near predictions.

The figures above the base line apply only to announcements for which people were able to choose an intensity. Below the base line we have graphed the items to which people were unable to attach an intensity. These are the instances in which people have heard that there may or will be an earthquake, but can't say whether it will be mild or destructive. These figures vary considerably by type of announcement. People are least often definite about the intensity of the quake expected on the basis of a scientific announcement, and most definite in the case of pseudoscientific forecasts.

There may be something to be said about the relative potency of scientific and nonscientific announcements from this graph. When people remember scientific near predictions they are less likely to have a clear idea of how destructive an earthquake to expect. If they have a definite idea, it is less likely to be a highly destructive earthquake. The earthquakes associated with scientific announcements are vaguer and more benign than those associated with prophetic and pseudoscientific forecasts. These differences may come about because of the cautious and often reassuring manner in which the scientists announce their near predictions, compared to the sensational way in which seers and divines warn of impending doom. But the differences may tell us more about the perspectives of those people who remember hearing scientific announcements as compared to those who remember prophetic and pseudo-



HOW SERIOUSLY TAKEN BY TYPE OF ANNOUNCEMENT

FIGURE 5

scientific announcements. Most of the pseudoscientific references are to the Henry Minturn forecast for December 20, 1976. Minturn himself, in the days shortly before the forecast date, assured the community that the earthquake would not be a very big or destructive one. In spite of his assurances, most people who mentioned his forecast were convinced that a destructive earthquake had been predicted.

Whichever explanation is correct, there is reason for concern that scientific announcements may suffer reduced potency in stirring people to action because they are often vague and benign as they are remembered.

We have a different picture, however, when we ask how seriously people take different kinds of announcements. Considerably more people take seriously the announcements we have classified as scientific than take seriously other announcements (Figure 5). Prophetic forecasts are least often taken seriously. In spite of the weak character of scientific announcements as people remember them, they are still the ones most likely to be given serious public attention.

We must balance this conclusion, however, by remarking that the public is made up of the people who judge the same events quite differently. Fully a quarter of the references to pseudoscientific and prophetic forecasts were taken seriously.

Credibility and Relevance of Specific Announcements

Now we will look more closely at public perception of the Whitcomb announcement and Minturn's near prediction. We shall be concerned with both their credibility and their personal relevance.

Whitcomb's announcement. The two questions discussed earlier regarding the seriousness of the prediction and the intensity of the predicted quake, were used to determine public perception of the credibility and relevance of of Whitcomb's announcement. First, we will examine media reports of Whitcomb's announcement in order to help us interpret our respondents' perception of the expected damage and how seriously they took the announcement.

While Whitcomb did not state the amount of damage or casualties that would result, most of the media reports compared his predicted quake to the 1971 San Fernando quake. In drawing this parallel many papers mentioned that the quake would be a major one or speculated that its magnitude would be similar to the San Fernando quake which killed 65 people and caused millions of dollars in property damage. Whitcomb tried to reassure the public that the quake would not be very destructive and he even went so far to say that he would not hesitate to buy a home in the area where the quake might occur (LA Times, SGVT, 4-22-76, 4-23-76). Despite Whitcomb's effort to downplay the threat, a majority (63.8%) of respondents who mentioned his announcement expected some kind of property damage and loss of life if the quake should occur, as compared to only three people who expected little or no damage (Table 2).

Several circumstances may have made the few people who remembered Whitcomb's announcement take it seriously. First, most articles made reference to Whitcomb's affiliation with Caltech or identified him as a scientist. Second, reports of Whitcomb's past record of successful predictions may have made the current forecast more credible. Furthermore, the fact that Whitcomb's data were reviewed by an authoritative agency, the California Earthquake Prediction Evaluation Council, may have given some people the idea that the announcement should be taken seriously, even though the general tenor of the review was from qualified to negative. Finally, while Whitcomb stated that he was only testing a theory, the media continually referred to his announcement as a prediction, thereby giving the forecast greater credibility than may have been justified.

Other features of newspaper coverage could explain why people may not have taken the announcement seriously. First, several papers reported public apathy and relatively little concern over the latest announcement. Second, on April 30, CEPEC concluded that the probability of an earthquake occurring in the predicted area was not significantly higher than for other geological areas in California. Third, Whitcomb himself downplayed the seriousness of the threat when he stated, "I think the earthquake hazards for an individual in California certainly are less than the hazards one assumes driving on the freeway" (LA Times, 4-29-76). Finally in December 1976, although the new announcement was given very little media coverage or prominence, Whitcomb cancelled his forecast.

The data in Table 2 show how the respondents who mentioned Whitcomb's forecast weighed these conflicting reports. Respondents were split on whether to take the prediction seriously or not. Equal percentages took the announcement seriously (46.7%) and not seriously (46.8%). In certain respects the fact that almost half the respondents took the announcement seriously, in spite of skeptical treatment of the press and by CEPEC, indicates that the public places a great deal of confidence in scientific announcements--even more confidence perhaps than the announcements deserve. This observation is also consistent with our general finding that the public takes scientific predictions more seriously than other types of announcements. However, these findings also indicate that members of the public are selective in their use of information disseminated by the mass media and make up their minds independently of media reports.

Minturn's forecast. In examining newspaper articles on Minturn we find that few, if any, indicated the intensity of his predicted quake. However, shortly before the forecasted date, Minturn made it a point to assure the

TABLE 2

EXPECTED DAMAGE AND SERIOUSNESS FOR WHITCOMB AND MINTURN FORECASTS

Damage and Seriousness	Whitcomb forecast	Minturn forecast
Expected damage:		
Many buildings, many lives	36.2	50.4
Some buildings, few lives	27.6	19.6
Damage not widespread	11.4	9.0
Little or no damage	2.8	1.2
Didn't say, don't know	22.0	19.8
Total	100.0	100.0
Total number	105	619
How seriously taken:		
Quite Seriously	20.0	10.5
Fairly Seriously	27.6	20.2
Not Very Seriously	31.4	31.0
Not at All Seriously	15.2	35.4
Don't Know, No Answer	5.8	2.9
Total	100.0	100.0
Total number	105	619

community that the earthquake would not be very big or destructive. This appeared to be a timely announcement since many residents in the area were concerned about holiday plans during the month of December. However, in spite of his belated assurances, most people who subsequently mentioned Minturn's forecast were convinced that a destructive quake had been predicted. Half of the respondents believed there would be major damage involving many buildings and many lives, while an additional 20 percent believed some buildings and lives would be lost (Table 2). Again we find that the public perceived the predicted quake to be more destructive than Minturn intended. However, the media may have contributed to this interpretation by focusing a great deal of attention on Minturn's announcement, thereby heightening public concern about the proposed threat.

Did this interpretation make the public take Minturn's announcement seriously? A majority of respondents said they did <u>not</u> take Minturn's prediction seriously (65.5%). While this may not be surprising since our interview took place from one to three months after its disconfirmation, it seems quite contrary to media reports at the time.

In early December many newspapers reported that the media, government agencies, and universities in the area were receiving phone calls from anxious residents, many of whom talked about fleeing the area. Caltech alone was reported to have received over 1000 calls. Sociologist Robert Stallings was asked by one local newspaper to explain why the public seemed to take Minturn so seriously. However, if the respondents in our sample are any indication of public response to Minturn, the media greatly exaggerated public confidence in his prediction.

Attributed Sources of Announcements

The preceding discussion compares scientific and nonscientific announcements according to our classification of the information respondents gave us. For example, if a respondent mentioned the Palmdale bulge or an earthquake that was supposed to happen by April, 1977, we classified the statement as referring to a scientific announcement because we recognized the source. If a respondent mentioned an earthquake predicted for December, 1976, we classified the statement as pseudoscientific because we knew that the widely publicized prediction for December 20 was made by someone who laid false claim to scientific qualifications. But the respondent may have quite a different idea of the source of the announcement. The question naturally arises, do people generally distinguish correctly between announcements from scientific and nonscientific sources, or do they mix them up, ascribing nonscientific announcements to scientists and vice versa?

For each announcement they mentioned, respondents were asked the following question:

> Do you happen to remember who it was that originally made this prediction?

Interviewers were instructed to write down the name or other identification exactly as the respondent gave it. Then a second question was asked, as follows:

> Do you know whether this person was a: Scientist, Seer or Psychic, Religious Speaker, Amateur scientist, or Some other type of person (specify)?

In examining newspaper accounts of the Uplift and Whitcomb's announcement, we find that the media clearly identified the predictors as scientists. Nearly all articles referring to the Uplift mentioned that the discovery was made by scientists and often mentioned that these scientists were affiliated with USGS. Similarly, articles referring to Whitcomb identified him as a geophysicist, seismologist or scientist. The data indicate that the majority

TABLE 3

HOW PEOPLE IDENTIFY THE SOURCE OF SELECTED EARTHQUAKE PREDICTIONS, FORECASTS, AND CAUTIONS

Identified Source	General predictions and forecasts	Minturn forecast	California Breakoff	Whitcomb forecast	California Uplift
Scientist	37.7	38.0	15.4	79.0	84.6
Amateur Scientist	7.6	14.4	3.4	5.8	2.7
Secular or religious prophet	20.9	22.9	49.6	6.6	0
Other	8.5	6.1	6.0	2.0	2.7
Don't know, not answered	25.3	18.6	25.6	6.6	10.0
Total	100.0	100.0	100.0	100.0	100.0
Total number	660	619	117	105	110

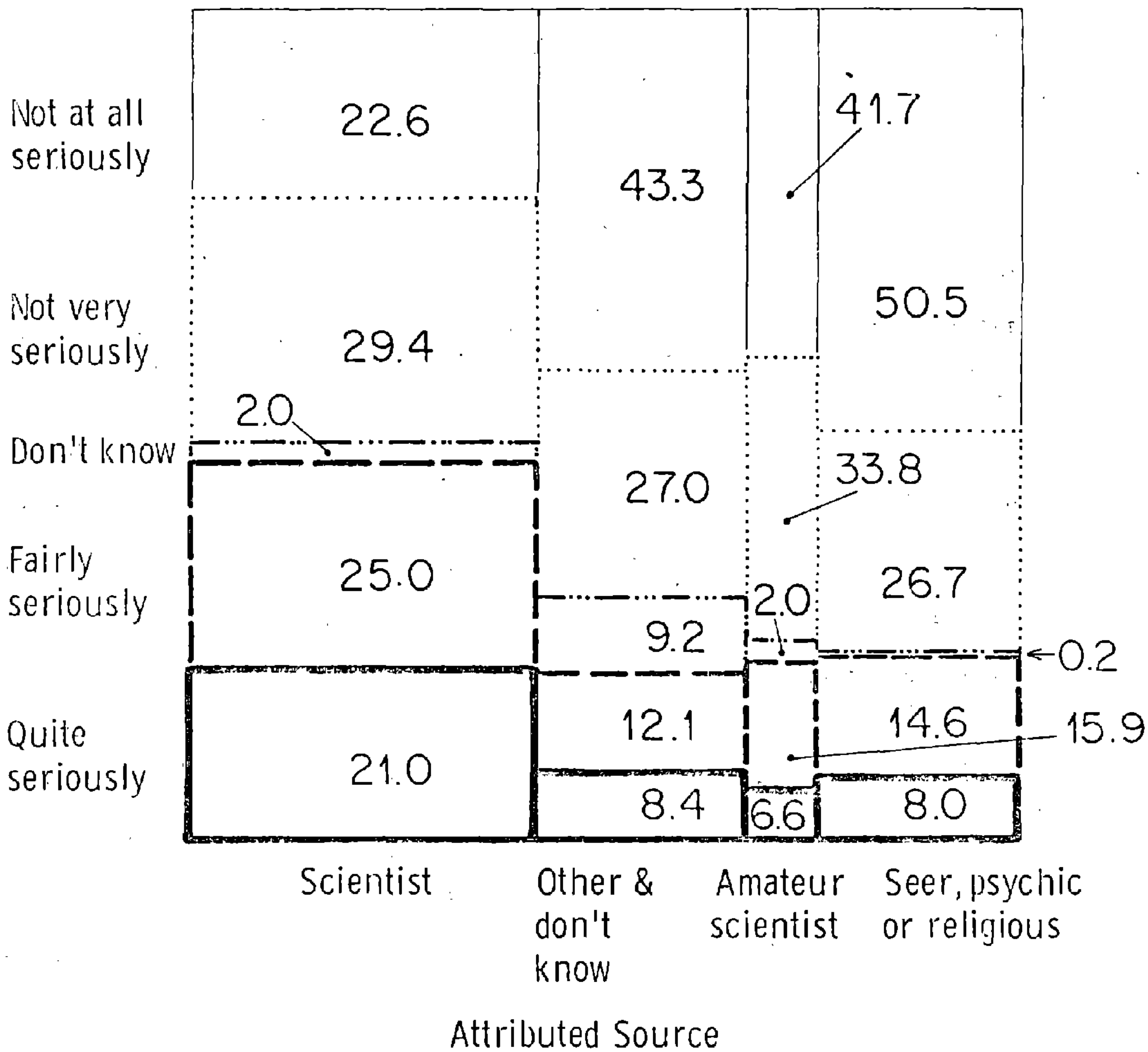
of respondents remember this fact. Nearly 85 percent of those mentioning the Uplift associated the prediction with scientists while 79 percent remembered that Whitcomb was a scientist (Table 3).

Three-quarters of the people who referred to quite vague and general predictions and cautions thought they knew the source. Most frequently they attributed the announcements to scientists, but quite frequently the general alarms were attributed to prophets. The southern California public finds general forebodings of earthquake disaster coming from both scientific and nonscientific sources.

The Henry Minturn prediction is of special interest because it received such extensive media coverage and because so many people remembered it. The percentages in the table show that there was much confusion over what kind of person made the December 20, 1976, prediction for Los Angeles. Nearly two out of every five who mentioned this announcement thought that it was issued by a scientist. Although Minturn publicly claimed to be a scientist, about 23 percent called him a seer, psychic, or religious speaker. The mass media may have been largely at fault for fostering this confusion.

The idea that California would some day break off from the North American continent and slide into the Pacific Ocean following a great earthquake gained currency from a popularly written book in 1968. By the time of our survey, it was most commonly attributed to seers and psychics. But a small though substantial minority attributed this forecast to scientists.

We are led by these data to the observation that members of the public are generally correct in recognizing a scientific announcement as scientific. But they also often attribute nonscientific announcements to scientists. Scientists are credited or blamed for more than their proper share of the earthquake predictions, forecasts, and cautions to which southern Californians



HOW SERIOUSLY ANNOUNCEMENTS ARE TAKEN
BY ATTRIBUTED SOURCE

FIGURE 6

are exposed.

If nonscientific announcements are frequently erroneously attributed to scientists, do people then take them especially seriously? We found earlier that scientific announcements are more often taken seriously than nonscientific announcements. Is it equally true that people take more seriously the announcements that they attribute to scientists, regardless of whether the true source of the announcements is scientific?

Figure 6 shows principally that the scientific and prophetic categories, formerly the narrower columns, are now the wider columns. The public tends to attribute earthquake predictions, forecasts, and cautions either to scientists or to seers. By casting the "scientist" net more widely, people now include more notices that they do not take so seriously. Enlarging the category of secular and religious seers does not make so much difference. Announcements attributed to scientists are still taken more seriously than other announcements, but we now find that over half the announcements attributed to scientists are not taken particularly seriously.

Types of Earthquake Predictors, Amount of Damage, and How Seriously Predictions Are Taken

We hypothesized that how seriously respondents take predictions is a function both of how much damage is expected and of the credibility of the type of person making the prediction. In addition, we were interested in assessing the extent to which amount of damage and type of predictor operate independently, and further, whether their interaction has an additional effect on seriousness. To assess the above, four regressions were run.

Included in the analysis are all predictions mentioned by respondents that were attributed to scientists, psychics, religious leaders, amateur scientists, and "others." Predictions attributed to friends and neighbors, crackpots, phonies, or combinations of types were eliminated because they were too few to be of interest. Predictions on which information was missing about the amount of damage or seriousness were also eliminated. The analysis thus includes 1550 announcements.

Because type of predictor is a five-category nominal variable, four dummy variables were entered in the regression equation. The dummy variable for "other" was excluded. Accordingly, if a respondent named scientist as type of predictor, he or she was assigned a score of one on the variable scientist and zero on all other dummy variables. The procedure was followed by respondents who named psychics, religious leaders, or amateur scientists. Respondents who named "other" scored 0's on all four variables.

The four interaction terms for amount of damage and type of predictor were computed by multiplying each respondent's score on the amount of damage by his or her score on all dummy variables.

First, how seriously each announcement was taken was regressed only on how much damage was expected (Model 1). From Table 4 it can be seen that predicted damage by itself has very little effect on how seriously the prediction is taken ($r^2 = .002$). The attributed source of the announcement (Model 2) is a better means of determining how seriously a prediction will be taken ($r^2 = .084$). The relationship is still small, but significant. Of the regression coefficients, however, only the one for scientist is significant ($F = 75.49$, 4 and 1545 df), indicating that only the difference between scientist and nonscientist is predictive of how seriously a prediction will be taken. Although it is not significant, the coefficient for psychics is negative, indicating a possible slight tendency for their predictions to be taken less seriously than others.

TABLE 4

COEFFICIENTS FOR THREE MODELS OF HOW SERIOUSLY PREDICTIONS ARE TAKEN

Independent Variables	Model 1	Model 2	Model 3
		Metric Coefficients	
Amount of Damage	.037		.058
	(.020)		(.019)
Scientist		.567	.574
		(.066)	(.066)
Psychic		-.108	-.135
		(.076)	(.076)
Religious Leader		.034	-.013
		(.190)	(.191)
Amateur Scientist		.025	.014
		(.103)	(.102)
Intercept	1.976	1.901	1.674
r^2	.002	.084*	.088*
		Standardized Coefficients	
Amount of Damage	.047		.073*
Scientist		.269*	.267*
Psychic		-.043	-.053*
Religious Leader		.005	-.002
Amateur Scientist		.007	.004

*$p < .01$. Standard errors are in parentheses.

When both the attributed source of the announcement and the accompanying amount of damage are used to predict how seriously announcements are taken (Model 3), r^2 increases to .089. The increment in r^2 from adding damage to the equation is small but significant ($F = 8.86$, 1 and 1544 df). Though damage by itself has no significant effect ($r^2 = .002$), the explained variance in seriousness increases by .005 when damage is included in the equation with types of earthquake predictors. This indicates a slight interaction effect. Both the coefficients for damage and for scientist are significant. In addition, when amount of damage is taken into account, the coefficient for psychics becomes significant, indicating that predictions made by psychics seem to be systematically taken less seriously than announcements by other types of people.

Finally, four interaction terms were added to the equation. These variables were included to assess whether or not amount of damage and type of person making the announcement have a multiplicative effect on how seriously predictions are taken. When these variables were included, r^2 was slightly over .09, but the increment in explained variance over Model 2 was not significant. This seems to indicate that seriousness increases fairly uniformly with amount of damage for each type of prediction, though seriousness varies more strongly, depending on what type of person made the prediction. Predictions by scientists are taken more seriously than those of all others. Predictions by psychics are assigned the least credibility, while amateur scientists, religious leaders, and others fall somewhere in between. However, for the last three groups, there seems to be too much variation in seriousness to assign any effect due to credibility of prediction source.

Altogether, the source attribution and the expected amount of damage still account for only a small fraction of the total variance in the seriousness with which people take different announcements.

These findings concerning the relative credibility of different prediction sources are generally consistent with those reported in Chapter Four. In Chapter Four we were reporting people's estimates of how seriously they would take predictions that they knew had come from designated sources. In the present chapter we have been examining reports of various kinds of announcements that our respondents remembered, confirming independently that they do actually assign greater credibility to announcements from scientific sources and announcements that they attribute to scientific sources than to other announcements.

A comparison between the effects of type of prediction as we classified it and the effects of the respondents' own attributions on the seriousness with which announcements were taken was made, using the method of multiple standardization. From this analysis, the following interpretations appear to be justified. First, whether or not people themselves identify the source of an announcement as scientific has little more effect on how seriously they take it than whether the source is scientific according to our classification. Accordingly, the media can foster a discriminating public response if they attempt to make unmistakably clear which announcements are scientifically based and which are not. However, the type of prediction as we have classified it also makes a difference, in addition to how people themselves classify the announcements. One plausible interpretation of this additional effect is that announcements are taken more seriously when they are more definite, more specific, and better identified, regardless of the source to which they are attributed. Another plausible interpretation is that the credibility and attention given an announcement by the media--especially television, radio, and newspapers--also affects the seriousness with which it is taken. In addition, as our earlier analyses have shown, confirmation of earthquake announcements through informal channels tends to raise the credibility of announcements in spite of the attributed source.

The Credibility of Sources of Information

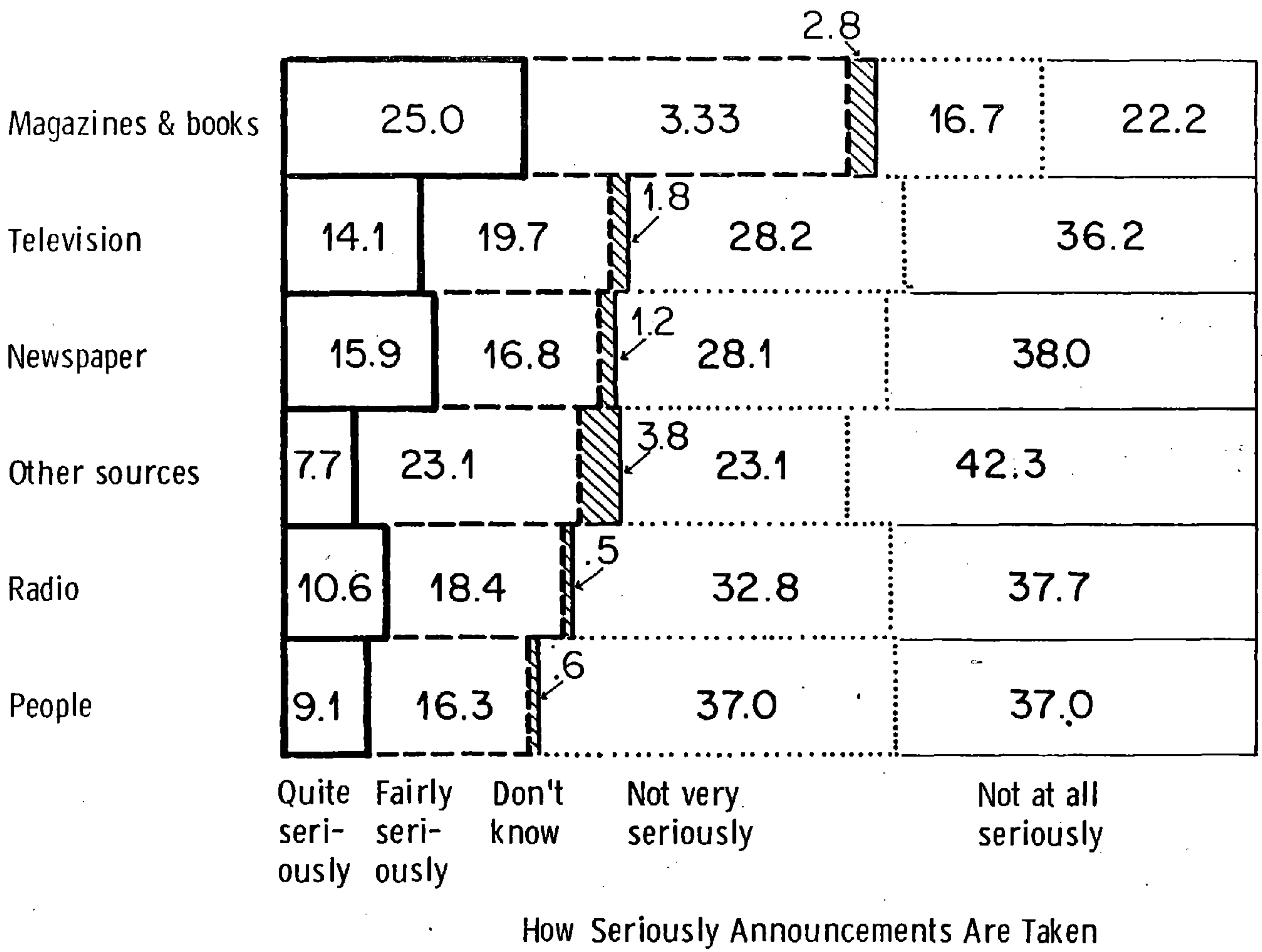
In Chapter Five we examined the media and informal discussion as sources of information about earthquake hazard. We established the dominance at the time of our initial survey of television as a source of information on earthquake-related topics, modified by some affinity between particular types of near predictions and particular media. In the current chapter we have shown that some predictions, forecasts, and cautions were taken more seriously than others. But we have yet to ask whether the media differ in their credibility. Are predictions, forecasts, and cautions received through one medium given higher credibility than announcements received through other media?

The reader will recall from Chapter Five that for each announcement the respondent remembered we asked:

> Do you remember what your chief source of information about this prediction was?

It is a straightforward matter to compare the seriousness with which announcements attributed to different media are taken. This comparison is presented graphically (Figure 7).

The most striking finding is that magazines and books are given much higher credibility than the other sources. From the infrequency with which magazines and books were identified as the chief sources for predictions and near predictions, we might have prematurely discounted their importance in communication for earthquake preparedness. But with more than half of the announcements being taken seriously, the importance of magazines and books is greater than the frequency with which they are cited would suggest. Perhaps, too, prophetic announcements would have been taken seriously less often if they were not disproportionately reported in magazines and books.



HOW SERIOUSLY PREDICTIONS, FORECASTS, AND CAUTIONS ARE TAKEN
BY CHIEF SOURCE OF INFORMATION

FIGURE 7

The differences among the other sources are not striking. Television and newspapers are about equally credible, coming next after magazines and books. Radio falls below television and newspapers, having about half the credibility of magazines and books. The variable mixture of "other sources" falls between radio and the leading media in average credibility.

Although the difference is slight, "people" have the least credibility as sources of information about predictions, forecasts, and cautions. This observation confirms the impression formed earlier that "people" as information sources are distinctively associated with rumor. The low level of credibility suggests that many people recognize the difference between rumor and more carefully substantiated information. This finding also underlines the power of the mass media. Although discussion with family, friends, and co-workers undoubtedly contributes to the interpretation of earthquake announcements, attention by the media is more effective than word-of-mouth dissemination in leading people to take an earthquake forecast or prediction seriously.

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CHAPTER NINE

WILL THERE BE AN EARTHQUAKE SOON?

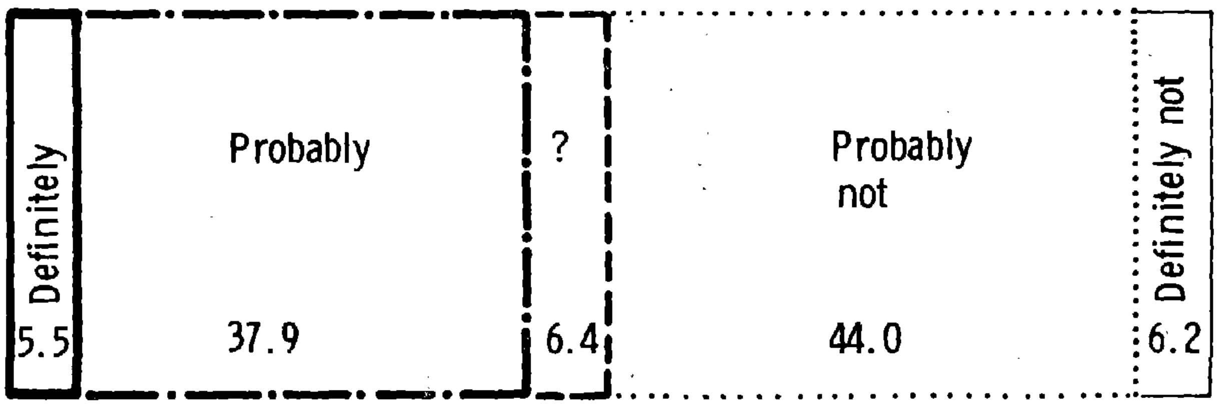
Earthquake Prospect

The discussion of awareness of earthquake predictions and near predictions during the bumper year from February, 1976, to February, 1977, appropriately culminates in the question whether people expect a damaging earthquake soon. Respondents were asked quite directly:

> How likely do you think it is that there will be a damaging earthquake in southern California within the next year?

Respondents could choose from "definitely," "probably," "probably not," and "definitely not." Again the results are graphed (Figure 1). By only a small majority the respondents vote against the occurrence of a damaging earthquake within the next year. In light of the relatively short lead time of one year, which few scientists would likely have endorsed, the size of the positive vote is striking. Since the question specifically asks about a "damaging" earthquake, the positive expectation is all the more striking.

By the time of this writing the 43.4 percent who answered positively have been shown wrong by events. There may be some basis for concern here. If confidence in the ability of scientists to predict earthquakes has led some of the public to take the warnings from scientists more seriously than scientists do themselves, with the result that their expectations have not been confirmed, will their confidence in future warnings be diminished? We provide a partial answer to this question in Part Nine of this report.



PROBABILITY OF A DAMAGING EARTHQUAKE
WITHIN THE NEXT YEAR

FIGURE 1

Prior Experience, Communication and the Earthquake Prospect

Why do some people confidently expect a damaging earthquake and others not expect one? We might anticipate that people's expectations are based, in part, upon their past experience in southern California. On one hand, people who have lived in earthquake country for a long time may be more likely to expect an earthquake soon since they know that a damaging earthquake is inevitable. On the other hand, since southern Californians have not experienced a damaging earthquake since 1971 despite warnings to the contrary, people may have no reason to anticipate a damaging earthquake in the near future. We shall explore the relationship between people's experience in southern California and their expectations of a future quake by examining some simple relationships between the two.

The relationship between length of residence and expectation of a damaging quake is presented in Table 1. The data reveal that long time residents of southern California are less likely to anticipate an earthquake within a year than relative newcomers to the area. People who have lived in southern California for more than eleven years are less likely to say that there definitely will be or probably will be a damaging earthquake within a year than people who are relative newcomers to the area. However, long time residents are also more likely to admit they do not know if an earthquake is coming. This is particularly striking among people who have lived in southern California for more than 33 years, of whom ten percent say they do not know if a quake will occur within a year.

Perhaps an indicator of more relevant experience in southern California is whether or not people have experienced a damaging earthquake. Is past experience in a damaging earthquake related to future expectation of a damaging

TABLE 1

LIKELIHOOD OF A DAMAGING EARTHQUAKE WITHIN A YEAR
BY LENGTH OF RESIDENCE IN SOUTHERN CALIFORNIA

Likelihood of earthquake	Less than 11 years	11-22 years	23-32 years	More than 33 years
Definitely not	6.9	8.0	3.9	5.8
Probably not	40.9	42.2	50.4	44.6
Don't know	2.9	4.5	5.1	10.4
Probably will	45.0	38.9	34.4	34.0
Definitely will	4.3	6.4	6.2	5.2
Total	100.0	100.0	100.0	100.0
Total number	347	424	337	327

$X^2 = 37.765$, df = 12, $p < .001$.

TABLE 2

LIKELIHOOD OF A DAMAGING EARTHQUAKE WITHIN A
YEAR BY NUMBER OF DAMAGING EARTHQUAKES EXPERIENCED

Likelihood of earthquake	None	One	Two	Three or more
Definitely not	10.5	6.1	2.6	4.6
Probably not	45.1	43.5	49.1	38.9
Don't know	3.6	5.1	8.2	8.3
Probably will	37.8	39.0	34.2	41.7
Definitely will	3.0	6.3	5.9	6.4
Total	100.0	100.0	100.0	100.0
Total number	304	741	269	108

$X^2 = 30.699$, df = 12, $p < .01$

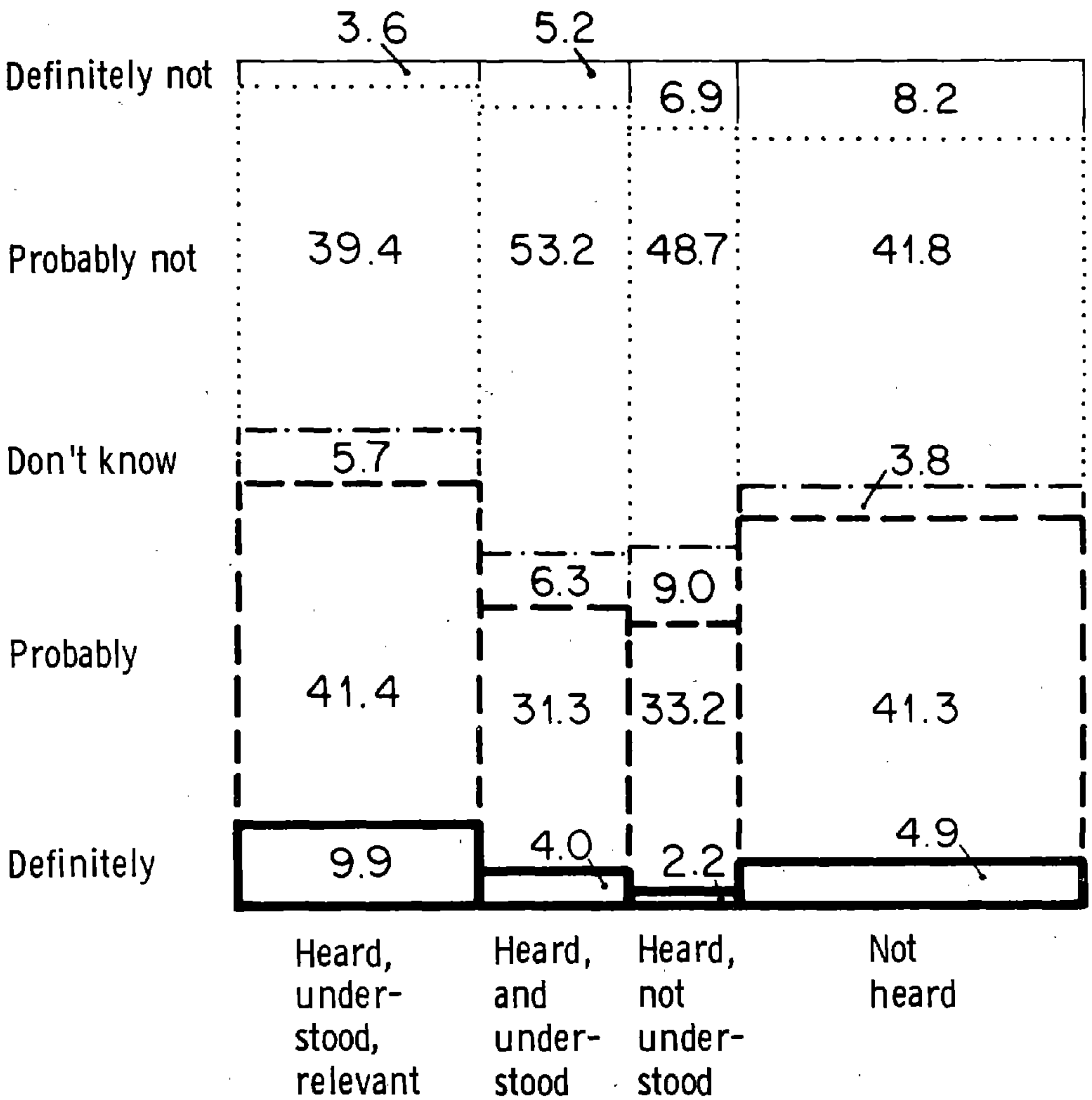
quake? The relationship between the number of damaging earthquakes experienced and anticipation of a future quake while not entirely consistent, is generally positive (Table 2). People who have never experienced a damaging earthquake are least likely to believe that a quake will occur within a year. The relationship is opposite to what might be inferred from the effect of mere length of residence.

Awareness of Earthquake Announcements and Earthquake Prospect

An obvious reason for people to expect a damaging earthquake is the various forecasts and cautions they may have heard during 1976. In this section we will attempt to relate people's convictions to the predictions and near predictions they have heard. Are the people who have heard and remembered the various announcements of earthquake danger the ones who conclude that an earthquake is coming? Or does knowing about the Uplift and other near predictions have nothing to do with whether people expect an earthquake or not?

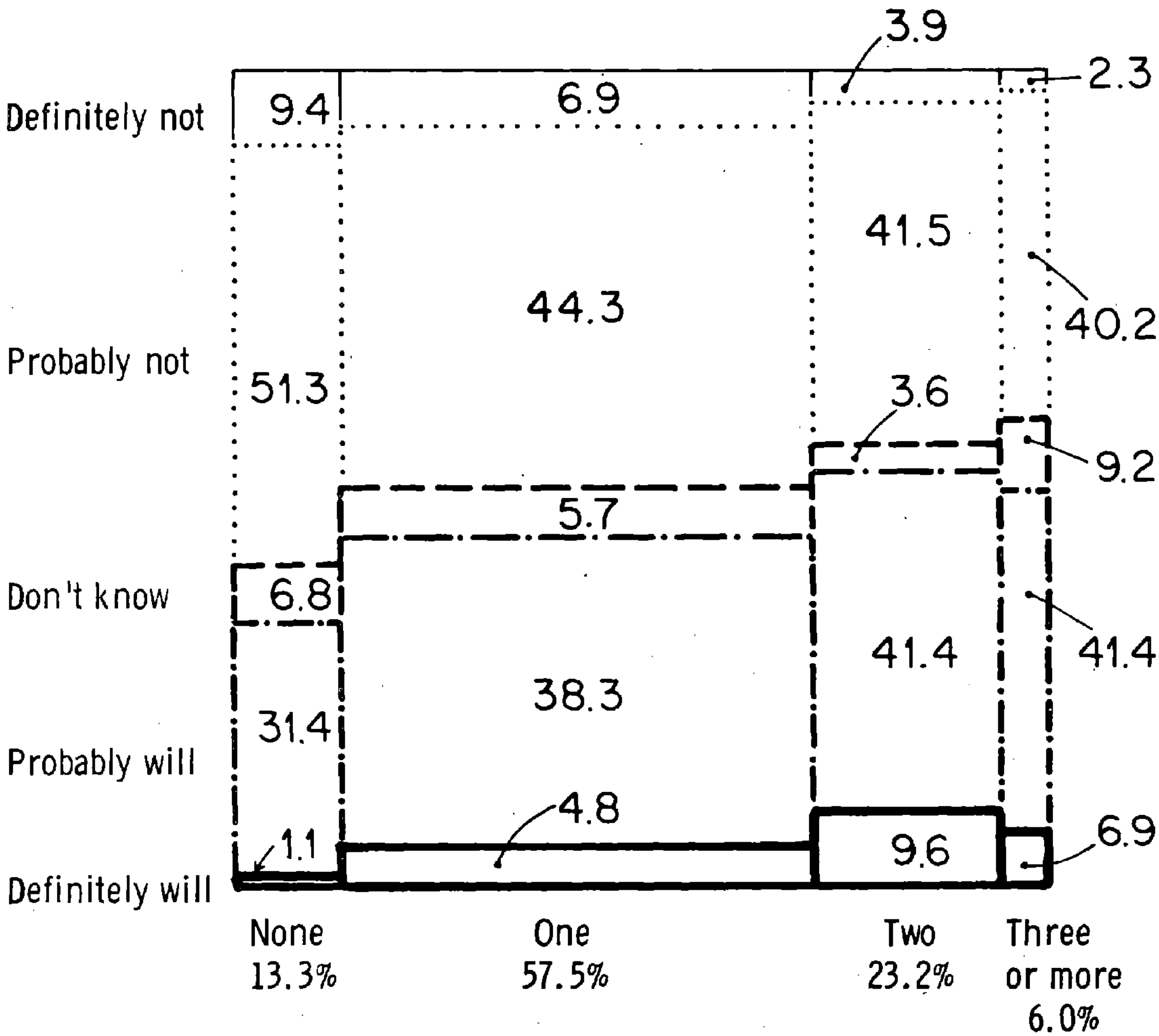
Figure 2 shows the relationship between awareness of the Uplift and expectation of a damaging earthquake. Among those who have heard of the Uplift, there is a definite relationship. People who appreciated the relevance of the Uplift most frequently expected an earthquake. The more clearly the message of the Uplift has been understood and applied, the more likely people are to anticipate a damaging earthquake soon.

However, there are two important qualifications to this finding. First, those who have not heard of the Uplift at all fall between the respondents who have heard and understood and the respondents who see the Uplift as personally relevant. As we shall see later, people who haven't heard of the Uplift after a year of news and discussion are not immune to other sources of concern over earthquakes. Second, the relationship between awareness of the Uplift and



LIKELIHOOD OF A DAMAGING EARTHQUAKE WITHIN THE NEXT YEAR BY AWARENESS OF UPLIFT

FIGURE 2



PROBABILITY OF DAMAGING EARTHQUAKE BY
NUMBER OF ANNOUNCEMENTS HEARD

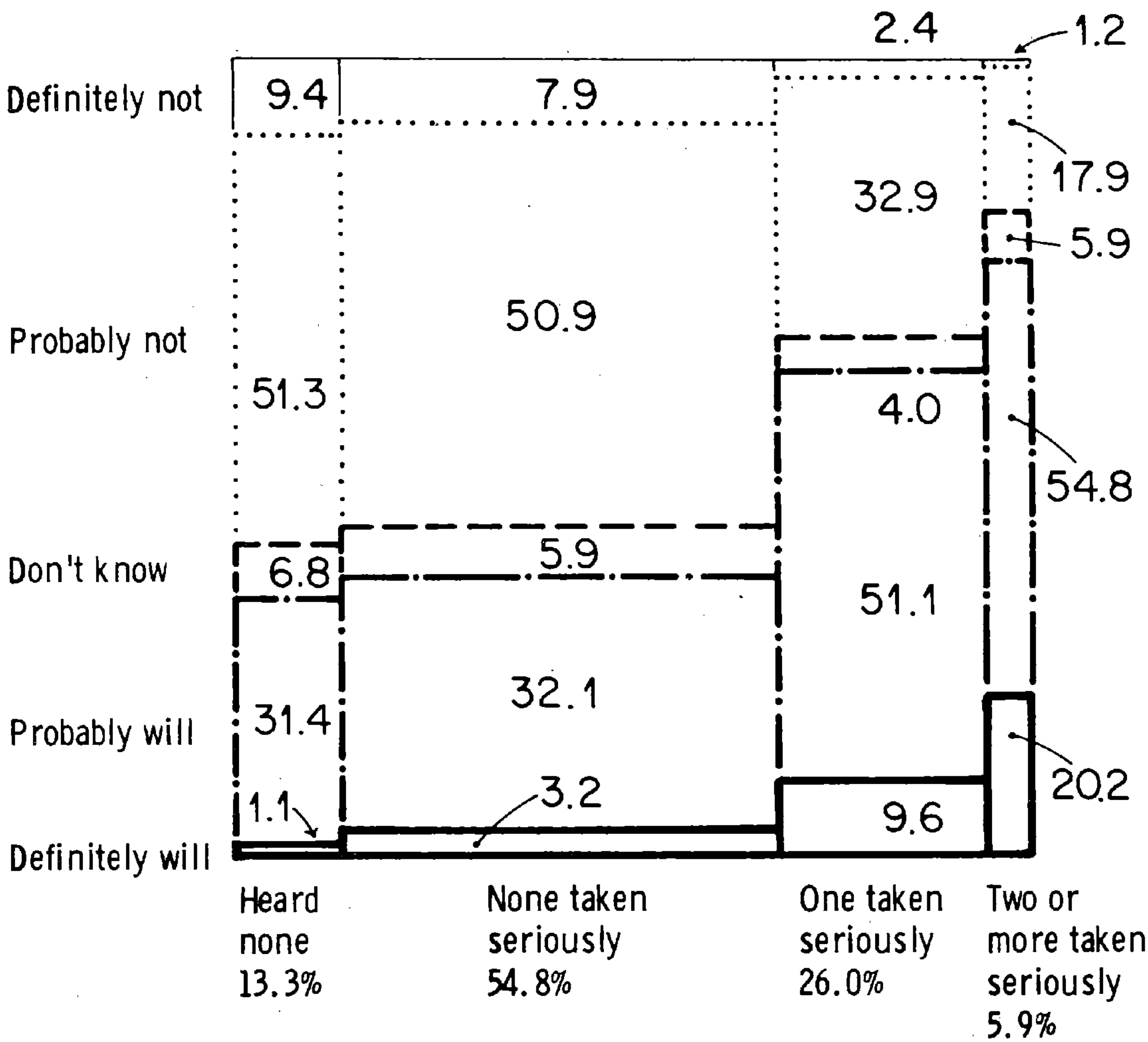
FIGURE 3

expecting a damaging earthquake is not a strong one. Fully a third of the people who have heard of the Uplift but don't relate it to a possible earthquake nevertheless say there will probably or definitely be a damaging earthquake within a year. And 43.0 percent of those who expect damage where they live in case of an Uplift-connected earthquake do not expect an earthquake within a year. It would be fair to say that understanding and appreciating the Uplift make a small contribution to people's convictions about the earthquake prospect, but not a decisive one.

What of the many announcements, both scientific and nonscientific, warning of an impending earthquake? Are people's expectations related to the number of these announcements they recall under questioning? Figure 3 shows that they are. People who remember two announcements are more likely than people who remember only one to expect an earthquake; people who remember one are more likely than people who remember no announcements to expect a damaging earthquake. The relationship is fairly similar to the relationship between awareness of the Uplift and expecting an earthquake.

Since most of the announcements are not taken seriously, the number of announcements that people have heard <u>and</u> taken seriously might be more important in shaping people's expectations. Indeed, as Figure 4 shows, the number of announcements people take seriously is more strongly related to expecting an earthquake than whether they have merely heard none, one, or more announcements. The more announcements people take seriously the more likely people are to expect a damaging earthquake soon.

As always, we must be careful not to claim that our data tell us what is cause and what is effect. But there is a relationship between people's awareness of predictions, near predictions, and cautions and their estimate of the probability of a damaging earthquake soon. It is plausible to assume



PROBABILITY OF DAMAGING EARTHQUAKE BY NUMBER OF ANNOUNCEMENTS TAKEN SERIOUSLY

FIGURE 4

that people who hear and are impressed by the various announcements concerning impending earthquakes are influenced to expect an earthquake soon. At the same time, awareness of earthquake danger is so general in southern California that many people who do not recall any of these announcements nevertheless expect a damaging earthquake soon.

The last point is accented by comparing the number of people who said there will probably or definitely be a damaging earthquake within a year to the number who were able to identify one or more forecasts of a destructive earthquake that they took seriously. The 43.4 percent who expected an earthquake include many more than the 29.7 percent who remembered a prediction, forecast, or caution meriting serious concern (see Chapter 8). Whatever the source of people's convictions about a coming earthquake, the convictions persist when the source can no longer be recalled easily.

Does it make any difference where people receive information about the earthquake threat? Table 3 illustrates the relationship between people's expectation of an earthquake within a year and patterns of communication use. People who rely exclusively on the mass media and people who rely disproportionately on discussion are less likely to expect an earthquake within a year than people who use discussion to supplement the media. Over half the people who do not seek verification of information through complementary channels state there definitely will not or probably will not be an earthquake within a year. This lends some support to other research concerning decision-making under uncertainty (Katz and Lazarsfeld, 1955; Rogers, 1962; Coleman, Katz and Menzel, 1966) which has found that most people are introduced to information through the mass media; however, before people take a firm stand or act on what they have heard, they seek confirmation through interpersonal channels. While we must be careful not to claim that the data

TABLE 3

PROBABILITY OF DAMAGING EARTHQUAKE
BY PATTERNS OF COMMUNICATION USE

Likelihood of earthquake	Exclusively media	Discussion supplementing media	Disproportionate reliance on discussion
Definitely not	9.7	5.2	4.0
Probably not	46.9	42.6	50.4
Don't know	7.4	4.9	3.9
Probably will	31.7	41.1	37.0
Definitely will	4.3	6.2	4.7
Total	100.0	100.0	100.0
Total number	350	945	127

indicate cause and effect, these findings suggest that people who seek confirmation of reports through interpersonal channels are more likely to perceive the earthquake threat as a relevant concern than individuals who do not seek verification of information from the media and interpersonal channels.

The data also suggest that exclusive reliance on the media is unlikely to convince people that an earthquake is coming. This is illustrated by the fact that a greater proportion of people who rely exclusively on the media do not believe an earthquake is likely to occur or admit they don't know how likely it is that a quake will strike within a year.

A more complete answer to the question why some people anticipate a quake is provided by a model which examines sets of demographic variables, prior earthquake experience, earthquake vulnerability, earthquake orientations, and sources of information, in relationship to expectation of a damaging earthquake.

A Model of Belief in a Quake Within the Near Future

As with knowledge about the Uplift and the awareness of predictions, it was assumed that certain demographic variables would be influential in identifying people who believed that a damaging quake would occur within the next year (that is, by January or February of 1978) in southern California. It was hypothesized that higher status individuals--those with more income and those with better educations--would be more likely to expect a quake within the near future since they were the people who were more likely to be aware of the significance of the Uplift. For the same reason, age was also included, assuming that older people would be more likely to expect a quake (see Part 6). Sex was included because we found that women were more likely to believe in a damaging quake in the near future.

The past experience cluster of variables was not expected to have a particularly important direct effect because of the low zero-order correlations with the dependent variable. However, because past experience might be influential on the orientation variables (i.e., in its effect on attitudes and scientific orientations of those who had previously experienced damaging quakes), three variables in this cluster were included in the model: the extent of past experience in earthquakes, the amount of damage or injury sustained in those quakes, and the number of other natural disasters that one had experienced.

It was assumed that people who lived in more hazardous areas, including areas with greater concentrations of pre-1934 buildings and areas in danger of being inundated of dams collapsed during an earthquake, would be more fearful about a quake in the near future and would, therefore, be less likely to admit that such a quake was likely. Similarly, we hypothesized that people who live in the area damaged by the 1971 San Fernando quake and those who believed that they presently live near an earthquake fault would be less likely to think that a damaging quake could occur.

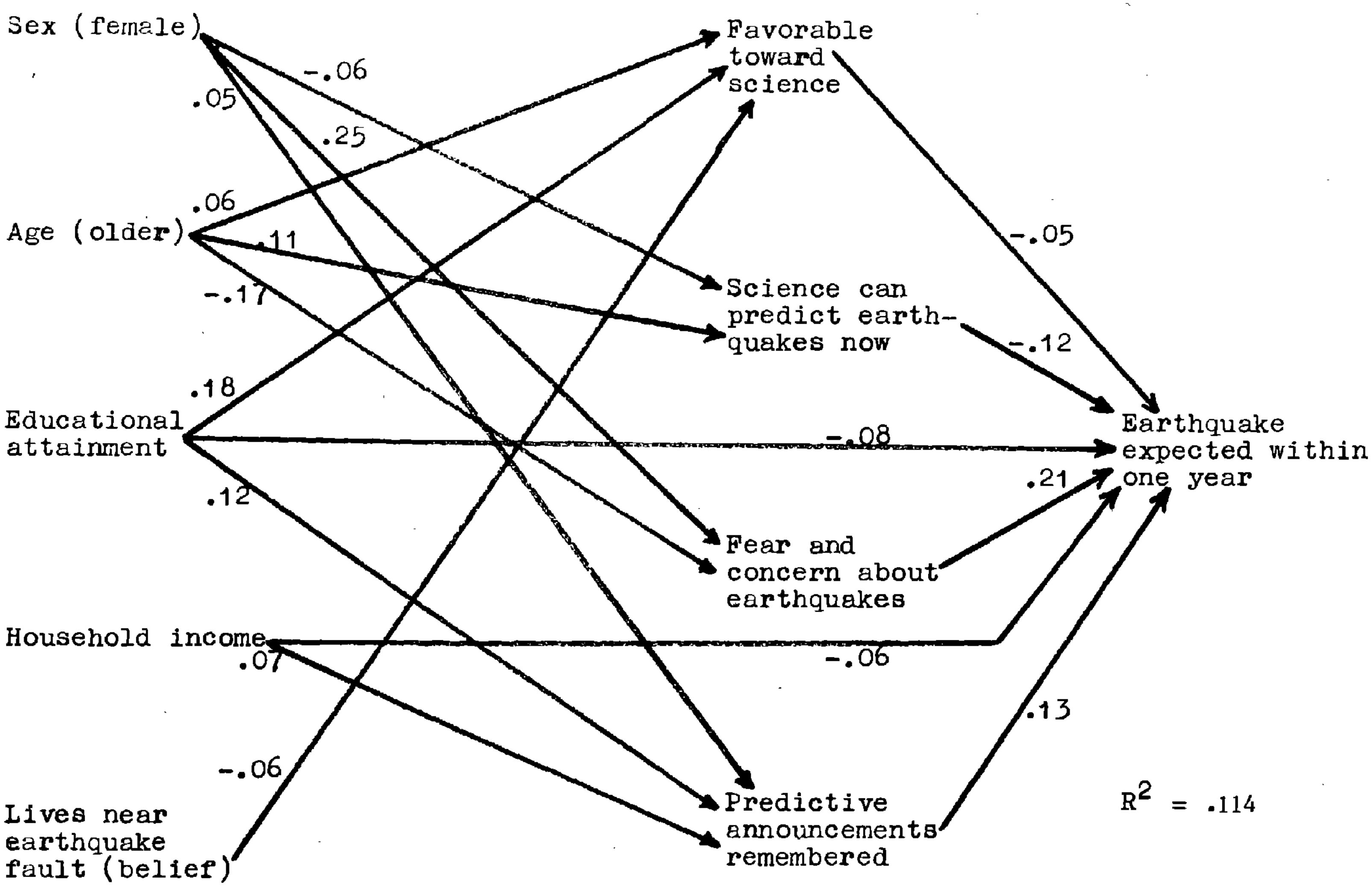
Indicators of a favorable attitude toward a prediction, including belief in the ability of scientists to predict earthquakes now, a high score on the favorability toward science index, and belief in scientists only as credible predictors were anticipated to be positively related to a belief in a coming quake. Also a high score on the prediction release index, an indication that more information on predictions was desired as soon as it was available, was also thought to be important for people to believe in the likelihood of a quake.

The number of predictions that a person had heard, indicating an awareness that several people were forecasting earthquake events, was hypothesized to be positively correlated with a coming quake belief.

Two attitudinal measures, the fatalism index and the fear index, were included in the model. We expected a high score on the fear index to be negatively related to imminent anticipation of a quake. People who are fearful about the prospect of a future quake should be less willing to admit that a damaging quake was in the immediate offing. A high score on the fatalism index was also expected to result in denial of imminence. If there is nothing one can do to prepare for a quake, it would be difficult to admit that a quake was likely in the near future.

Communication was assumed to constitute an important cluster of variables. Assuming that people who used the media for information on earthquakes would be exposed to the reports that earthquakes may be anticipated in the not-too-distant future or that forecasts of quake events had been made, variables measuring the extent to which formal channels of communication were used and added to the model. Specific variables included were: the number of earthquake-related issues discussed, the number of groups with whom the prospect of a damaging quake was discussed, the number of earthquake-oriented group meetings the respondent had attended, the number of formal media sources from which quake information was acquired, and the number of newspapers the respondent read on a regular basis.

About eleven percent of the variance in the dependent variable was explained by the final model (R^2 = .114, Figure 5). Two background variables had direct effects on belief that a damaging earthquake would strike within a year, namely household income and education. Wealthier people and the better educated were less likely to expect a damaging quake within a year. Perhaps



MODEL FOR EXPECTATION OF DAMAGING EARTHQUAKE WITHIN ONE YEAR

FIGURE 5

people with greater wealth feel they have a great deal to lose, in terms of real property investments, if a quake were to occur and be less inclined to admit that a quake in the near future is a real possibility.

A positive orientation toward science resulted in surprising correlations with the dependent variable. People who were generally favorable toward science and those who believed that scientists could accurately predict quakes now were less likely to believe that a quake would occur within a year. Apparently, people who hold these positive orientations toward science (even though with respect to earthquake forecasting, they are overly optimistic) do not believe that a damaging quake is in the immediate offing. Perhaps they believe that if a quake were imminent, the scientists would already have announced such a prediction. People who are generally favorable toward science are those with higher educational attainment, older, and those who didn't think they lived near a fault. Those who believe that scientists can now accurately predict quakes tend to be older people and men.

In reconsidering the findings concerning education, household income, and appreciation of earthquake prediction, we note that scientists generally would probably not set the date for a damaging earthquake so early as one year. It has often been stated that people of higher socioeconomic status and education tend to orient themselves to the world in a longer time frame than people in the lower levels of society. In the absence of definite indications from authorities concerning the time of the expected quake, it is plausible to conclude that people establish their own subjective time spans based on their customary time perspective.

The number of predictions that one had heard was positively related to belief in a quake within a year. After controlling for other variables in the model, those who had heard more predictions were better educated, had higher incomes, and were women.

One quite surprising result in the model was the relationship between fear and the dependent variable. Fear, the strongest variable in the model, was positively related to belief in a coming quake. People who were most fearful about the general prospect of experiencing a damaging quake were the most likely to believe in the certainty of a coming quake. Fear, then, does not appear to result in a denial of the possibility of an imminent quake. This finding is especially interesting when we consider that fatalism, the other variable which is assumed to be an indicator of denial, was not even included in the final model because of its insignificant effects. Respondents who admitted being more fearful tended to be women and younger people.

Another unexpected finding was that none of the communication variables remained in the final regression model. Although all of these variables had significant zero-order correlations with the dependent variable, they became weak explanatory variables when all other variables were controlled. This observation lends support to the developing impression from our research that the effects of both mass communication and informal communication are far from automatic, and that people deal quite selectively with what they receive.

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CHAPTER TEN

HOW FEARFUL AND CONCERNED ARE PEOPLE OVER THE EARTHQUAKE THREAT?

In the preceding chapters we learned that most southern Californians are at least vaguely aware of some of the predictions, forecasts, and cautions that a damaging earthquake may strike the region in the near future, that many believe the earthquake is likely to strike within a year, and that few rule out the possibility of imminent disaster. If people are aware of the earthquake threat, are they also concerned and fearful about it, or do they simply disregard it? Are they impassive, indifferent, and apathetic in the face of possible danger as many writers have said? Are they, at the other extreme, frightened and anxious to the point that a more definite prediction or warning would be upsetting and disorienting?

When examining awareness of the southern California Uplift we found it useful to distinguish between awareness and salience. We find it useful to make a similar distinction between simple concern or fear over the earthquake threat and salience of the earthquake threat. Salient concerns are those that are constantly on our minds, that constantly command our attention, that preoccupy us. We are sometimes preoccupied with concerns over which we do not feel very deeply, simply because we are constantly reminded of them. On the other hand, we can be deeply fearful and concerned over some matters, yet seldom think of them because we are preoccupied with other problems.

Salience

In order to discover just how salient the earthquake threat was to southern California residents, we initially avoided telling respondents that we were interested in their feelings about earthquakes. Once the topic of earthquakes was brought up in the interview, we could expect people to become increasingly preoccupied with the topic until the close of the interview. Hence it was essential to introduce the investigation without mentioning earthquakes, and to ask questions from which we could infer salience. The respondents were first informed that we were interested in studying people's attitudes and opinions about problems facing their local communities and the greater Los Angeles area. We then asked a short series of open-ended questions which gave respondents ample opportunity to mention earthquakes if earthquakes were at the forefront of their attention.

The interview opened with the question,

> First, we would like to know what, in your opinion, are the three most important problems facing the residents of southern California today?

Interviewers were instructed to record the first three problems the respondent mentioned. All but 41 of the 1450 respondents named one or more problems, and most of them named three problems. Even with three chances, only 35 people, or 2.4 percent of the people in the sample, mentioned earthquakes.

Next, respondents were asked,

> If a friend was moving to southern California in the near future, is there any particular problem you might warn him or her of before making the decision to move here?

About 64 percent answered "Yes." These 904 respondents were then asked,

> What particular problem about southern California would you point out?

Interviewers were instructed to record only the first answer to this question. Only 26 people mentioned earthquakes.

Finally, we asked what we thought would be a more pointed question sequence to bring out preoccupation with earthquakes. Respondents were asked,

> Compared to other sections of the United States, do you think southern California is a more or less hazardous place to live in?

The largest number of respondents (42.1%) answered that it was about the same as other places. Almost a third (30.0%) said it was less hazardous, and 19.6 percent felt it was more hazardous. If people thought southern California was either more hazardous or less hazardous, they were asked,

> Why do you think southern California is (more/less) hazardous?

Again interviewers recorded only the first answer. Of the 287 who thought southern California was a more hazardous place to live, only 21 gave earthquakes as the reason. Of the 433 who found southern California less hazardous, 25 mentioned earthquakes, saying that the earthquake threat is less severe than the threat from such hazards as tornadoes, hurricanes, winter storms, and floods that are common to other areas.

If we look at the answers to all of these questions together, 95 people, or 6.6 percent of the entire sample, mentioned earthquakes one or more times. For only one person was the earthquake concern so salient that earthquakes were mentioned in answer to each of the three questions. Only 10 people mentioned earthquakes in answer to two of the questions.

Plainly, even after a year of news about the Uplift and other earthquake harbingers, very few people living in earthquake country are preoccupied with the threat to their safety. Problems such as crime, cost of living, taxes, unemployment, smog and pollution, transportation, crowding, and education and busing come to people's minds before they think of earthquake danger. Even those few who find southern California a relatively hazardous place to live more often think of climatic conditions and high population density as the principal hazards.

Fear and Concern

The very low salience of earthquakes might indicate very little fear and concern over earthquakes, or "apathy," as many popular writers would say. Or earthquakes might have little salience in spite of genuine concern because other problems demand more frequent and immediate attention. Fear and concern were measured by a set of three questions, asked after the respondent had been informed that the rest of the interview dealt with earthquakes.

Respondents were first asked,

> Which of the following best describes your own feelings about the possibility of experiencing a damaging earthquake? Would you say you are very frightened, somewhat frightened, not very frightened, or not not at all frightened?

As indicated in Figure 1, over 60 percent acknowledged being substantially frightened. This figure includes 27 percent who admitted being very frightened and 35 percent who said they were somewhat frightened. Only 14 percent said they were not frightened. These figures are in sharp contrast to the mere 6.6 percent for whom earthquake danger is a salient concern. Since the word "frightened" is quite unambiguous, these figures represent an impressive admission of fear of earthquakes.

In a second question respondents were asked,

> How worried are you about the possibility of a damaging earthquake striking southern California?

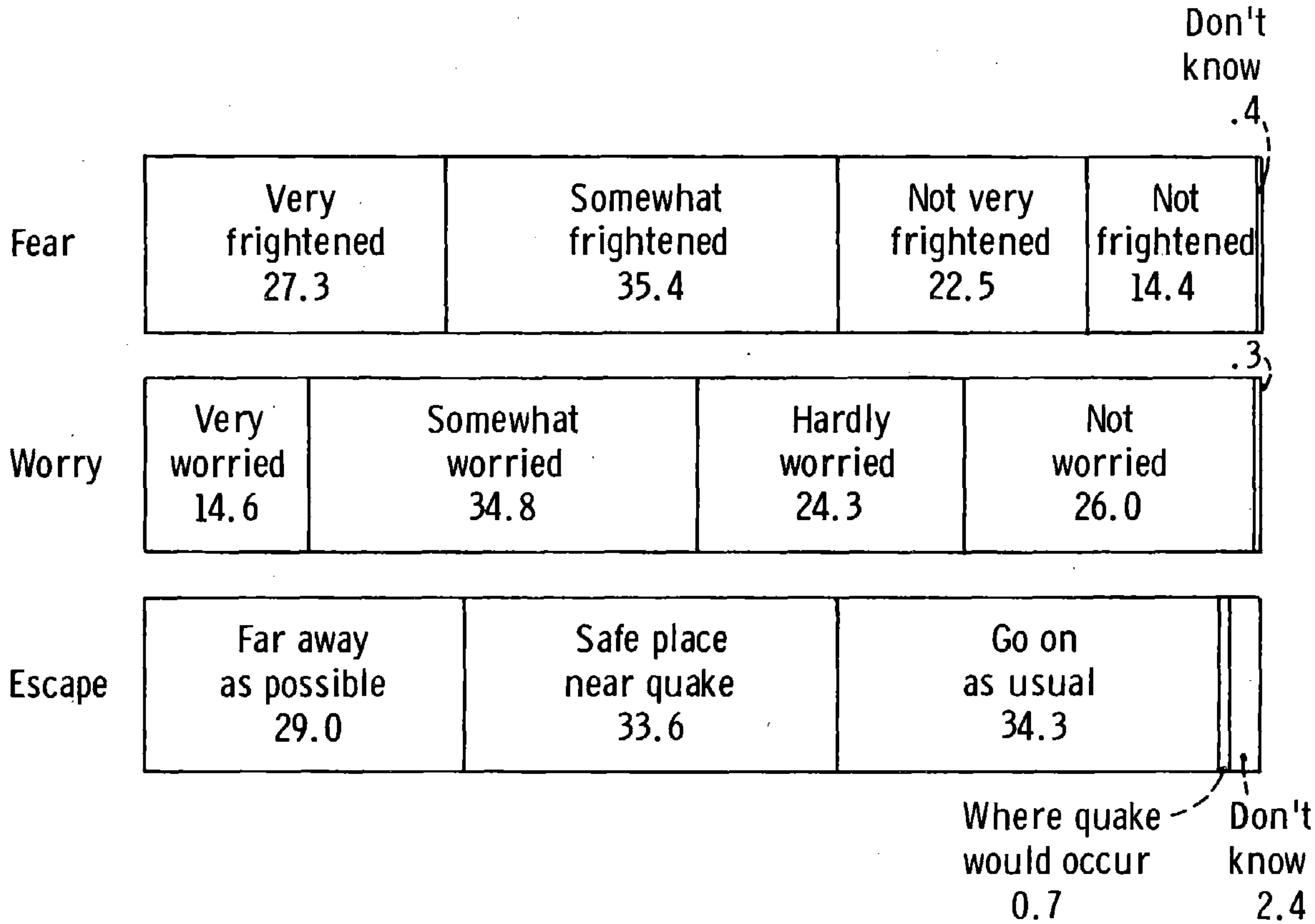
Respondents chose from the usual four answers, from "not worried" to "very worried." If we accept the answers at face value, being worried is a little less prevalent than being frightened. If 63 percent admitted being substantially frightened, only 49 percent said they were substantially worried. These worriers include only 15 percent who were very worried, compared with 27?who were very frightened. The number who claimed they were not worried at all (26%) is correspondingly greater than the 14 percent who said they were not frightened. Worry has a greater connotation of persisting concern than fright, which can be momentary, and therefore is a little closer to salience. A substantial number of people, while being frightened of earthquakes, do not let the prospect of an earthquake worry them to a corresponding degree. Nevertheless, about half of our respondents admit that they are substantially worried over the prospect of an earthquake.

Another way to find out how people feel about earthquakes is to ask what they would do in case of a quake. We cannot take literally what people say they would do when asked in hypothetical terms about a situation they have never actually experienced. But we can take the answers as indications of the extent of feeling people have. If people said they were very frightened of earthquakes, but would go on with life as usual if they knew that an earthquake were coming, we should have reason to doubt the seriousness of their fear.

The question was posed,

> 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?

Only eleven people were so rash as to choose the first answer, with the bulk of the people dividing fairly evenly among the three remaining answers. A substantial 34 percent said they would go on as usual. These are the people who are often labelled apathetic or fatalistic. Another 34 percent accepted the course most often proposed in disaster mitigation plans, and followed in the People's Republic of China, to find a relatively safe location without trying to leave the immediate earthquake area. Fully 29 percent said that they would try to get as far away as possible. The latter figure is larger than the number who said either that they were very frightened or very worried.



THREE MEASURES OF CONCERN OVER EARTHQUAKE THREAT

FIGURE 1

Again it is important not to assume from these answers that 29 percent would actually try to get out of Los Angeles on the freeways, or that a third of the people would actually go on as if nothing out of the ordinary were happening. What people actually do in a crisis situation will depend much more on the kind of leadership and instructions they receive, the amount of advance warning, the opportunities practically available to them, and other considerations. But these answers confirm our impression from the two preceding questions. The majority of the people are actively concerned about the earthquake danger and not only admit fear and even worry, but feel that they would interrupt their normal routines to some extent in order to minimize personal danger, if they were confident there was to be an earthquake.

Answers to the three questions are summarized in Figure 1. By viewing the three graphically it is possible to see how closely the number who are very frightened and the number who would try to get as far away as possible correspond. Likewise the number who are somewhat frightened and the number who would seek a safe place near the quake are very similar. And the number who are hardly frightened or not frightened and the number who would go on as usual correspond closely. Worry, on the other hand, with its implication of preoccupation, is consistently reported by smaller numbers of people.

Are people who admit being frightened about the possibility of an earthquake the same people who would try to get as far away as possible? The answer to this question can be secured by crosstabulating the responses to the fear and escape questions. The data in Table 1 reveal that people who are very frightened over the prospect of a future damaging earthquake are substantially more likely to say they would try to get as far away as possible than other respondents. People who are somewhat frightened or not very frightened are more likely to say they would find a safe place near the quake.

TABLE 1

WHAT RESPONDENT WOULD DO IN CASE OF A QUAKE BY EXTENT OF CONCERN OVER EARTHQUAKES

Where respondent would be	Very frightened	Somewhat frightened	Not Very frightened	Not frightened
Far away as possible	42.3	28.2	23.1	15.0
Safe place near quake	29.2	37.0	36.3	31.6
Go on as usual	26.9	32.2	38.8	47.1
Where quake would occur	1.0	.6	.3	1.5
Don't know	.6	2.0	1.5	4.8
Total	100.0	100.0	100.0	100.0
Total number	394	511	325	206

$X^2 = 82.176$, df $= 12$, $p < .01$.

Almost half of the people who said they are not frightened would go on as usual in the face of a damaging earthquake.

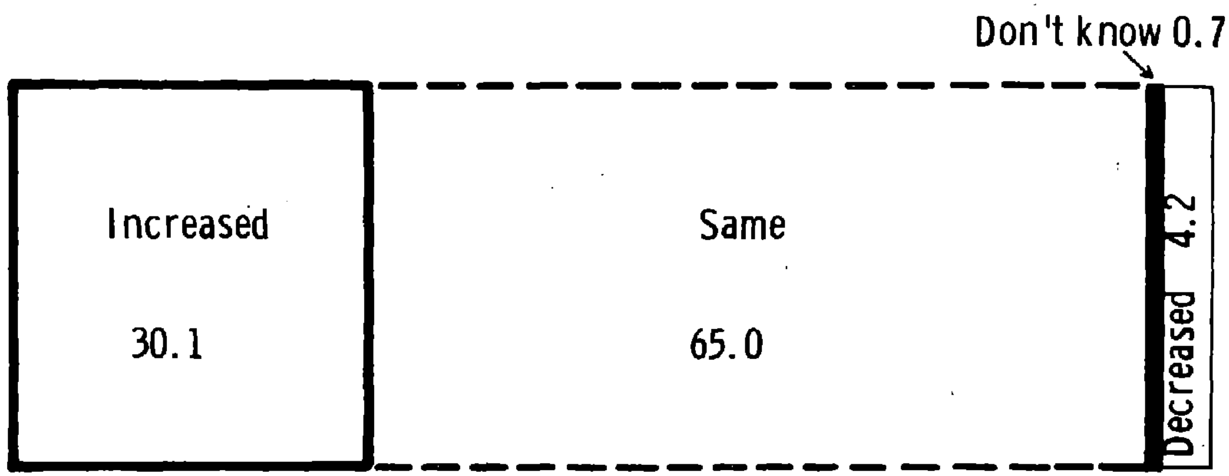
The data indicate that fear over the future earthquake prospect and the individual's projected course of action are substantially interrelated. As fear increases, the motivation to minimize danger is more likely to manifest itself in hypervigilant behavior in the form of flight. On the other hand, while individuals with low levels of fear are likely to anticipate vulnerability to danger, they are more discriminating in their reaction to a future damaging earthquake. Few people, no matter how fearless, are willing to try to be where the quake would occur. However, a higher percentage of the people who are not frightened by the earthquake prospect admit they do not know what they would do if they were certain a quake would occur.

Change in Earthquake Concern

Although we find much concern expressed over the earthquake danger, we have no way to know whether this concern is greater than it was before the announcement of the Uplift and the subsequent public attention to earthquake hazard. In order to be sure whether these events have affected concern about earthquakes or not we should need measures taken both before and after the announcements. In the absence of pre-announcement data we asked people whether their concern had changed. We do not take the results as an accurate indication of the amount of change, but as a measure of how many people think of the "first year of the Uplift" as a time when they became more or less concerned over the earthquake threat.

Respondents were asked,

> During the past year, would you say your concern about a damaging earthquake striking southern California has increased, decreased, or remained about the same?



CHANGED CONCERN ABOUT A DAMAGING EARTHQUAKE
DURING THE PAST YEAR

FIGURE 2

The majority (65.0%) said their concern had not changed. Slightly fewer than one third (30.1%) acknowledged an increase in concern, while 4.2 percent said their concern had decreased. Most of the people do not think of the first year of the Uplift as a period in which they have been stirred to greater concern over earthquakes than heretofore. Nevertheless, a substantial minority do remember that year as one of increased concern. The people who reported increased concern are disproportionately the same ones who expressed higher degrees of fear and concern over earthquakes in the preceding three questions. There is a significant segment of the population who remember the first year of the Uplift as provoking a new sensitivity to the earthquake danger.

Correlates of Concern

Is there any relationship between people's past experience in an earthquake and the amount of fear and concern they have about a future damaging quake? One may assume that people who felt frightened during a previous earthquake may be fearful of a future earthquake as well. On the other hand, people who felt frightened during past experiences in earthquakes may have learned to cope with the threat, thereby reducing their fear of a future damaging earthquake. The relationship between people's feelings during past earthquakes and their feelings about experiencing a future damaging earthquake is discussed below.

First, the three questions dealing with fear and concern were grouped together to form an index. The three questions should provide a more reliable indicator of concern when taken together than each does separately. Accordingly, answers to each question were given scores from one to four with four indicating the highest degree of concern. The three scores were added together to produce a simple fear or concern index for each person. For convenience

TABLE 2

EXTENT OF CONCERN OVER FUTURE EARTHQUAKES
BY FEELINGS DUIRNG PAST EARTHQUAKES

Level of fear and concern	Very frightened	Somewhat frightened	Not Very frightened	Not frightened	Enjoyed experience
Low concern	6.6	17.1	33.7	57.7	36.1
Low medium concern	25.8	32.5	41.3	26.8	38.9
High medium concern	17.8	25.5	14.4	7.1	16.7
High concern	49.8	24.9	10.6	8.4	8.3
Total	100.0	100.0	100.0	100.0	100.0
Total number	427	357	264	239	36

$X^2 = 371.631$, df = 12, $p < .001$.

these scores were divided into four categories which are identified as "low concern," "low medium concern," "high medium concern," and "high concern."

The relationship between the extent of concern over the prospect of a future damaging earthquake and the feelings people report during past earthquakes is one of the few quite strong ones we encounter in the investigation. Reported fear during past earthquakes signifies fear and concern over future earthquakes. There is nothing here to support the supposition that fear of earthquakes typically decreases with time and experience (Table 2).

Since fear of past experience is likely to affect future expectations it seems logical to examine the relationship between the extent of damage people experienced and their present concern over the earthquake threat. The data in Table 3 provide only modest support for the assumption that people who suffered little or no damage in previous earthquakes are likely to be less apprehensive about a future earthquake. The less extensive the damage experienced, the less concern over a future damaging earthquake. Nearly thirty percent of the people who have not experienced an earthquake in the vital sense express a low level of concern, while only 19.5 percent of the people who experienced extensive damage are unconcerned over a future quake. A third of the respondents who suffered extensive or moderate damage in a previous quake express the highest level of concern over the future earthquake prospect. While there is a relationship between damage experienced and people's concern over a future damaging earthquake, nearly a quarter of the respondents who suffered little or no damage express a high level of concern over the earthquake prospect.

Since fear during past earthquakes is so highly correlated with fear and concern over future quakes, one might expect an even stronger relationship between the experience of injury or damage in a past earthquake and fear

TABLE 3

EXTENT OF CONCERN OVER FUTURE EARTHQUAKES
BY EARTHQUAKE DAMAGE EXPERIENCED

Level of fear and concern	None	Little	Moderate	Extensive
Low concern	29.1	21.7	21.2	19.5
Low medium concern	29.2	33.7	31.1	36.2
High medium concern	18.1	18.4	18.0	14.1
High concern	23.6	26.2	29.7	30.2
Total	100.0	100.0	100.0	100.0
Total number	719	359	222	149

$X^2 = 17.244$, df = 9, $p < .05$.

and concern over future quakes. But Table 3 provides only modest support for this assumption. The index of damage and injury experienced personally or by a close friend or relative was crosstabulated with the fear and concern index. The relationship is in the predicted direction, but it is a weak one and is only marginally significant ($p < .05$).

The striking difference between the weak and the strong relationship calls attention to the extent to which fear and concern vary independently of the experiences that might justify them. For the most part, fear of earthquakes is a characteristic personal response that does not appear to be greatly affected by the outcome of previous earthquake experiences. The fear is linked to the experience and anticipation of quaking and the awareness of what earthquakes can do rather than to what has happened to people in the quakes they have experienced, except to a slight degree.

Is there a relationship between the level of fear and concern people express and where they receive their information about earthquakes? We would expect that people who rely more heavily on interpersonal discussion for information would have a higher level of concern over a future damaging earthquake because of their susceptibility to rumor activity. The data reveal that this is the case; however, people who filter media information through interpersonal channels are equally concerned about the earthquake prospect (Table 4). People who rely exclusively on the media are least concerned over the possibility of a future damaging earthquake. Since people who use interpersonal discussion either as a substitute or as a supplement to the media express a higher level of concern than people who rely exclusively on the media, it appears that interpersonal discussion is an important factor in raising the level of concern about the earthquake threat. The importance of interpersonal discussion in raising the salience of the earthquake threat

TABLE 4

EXTENT OF CONCERN OVER EARTHQUAKES
BY PATTERNS OF COMMUNICATION USE

Level of fear and concern	Exclusively media	Discussion supplementing media	Disproportionate reliance on discussion
Low concern	35.1	22.2	17.2
Low medium concern	32.6	30.8	31.3
High medium concern	13.6	19.1	20.1
High concern	18.7	27.9	31.3
Total	100.0	100.0	100.0
Total number	353	952	128

$X^2 = 35.862$, df = 6, $p < .001$.

was also brought to our attention in the preceding chapter. We found that people who relied exclusively on the media were less likely to expect an earthquake within a year than people who used discussion as a supplement or as a substitute to the mass media.

As always, it is important to remember that causal flow may be in the opposite direction. The level of concern may determine the amount of informal discussion.

Concern in Relation to Awareness of Prediction Announcements

Is the amount of fear and concern people feel related to their awareness of announcements that a damaging earthquake may occur in the near future? Does knowledge contribute to peace of mind, lack of concern, and apathy? Or is ignorance bliss? To answer this question we examined the relationship between the number of prediction announcements heard and extent of concern.

While the relationship between concern and the number of announcements heard is significant, the relationship is weak (Table 5). The majority of people who could not recall any announcements of future earthquakes express little concern over a future damaging earthquake. However, the same lack of concern is expressed by people who remember hearing three or more announcements during the year. People who remember hearing one or two announcements are the ones who are most concerned about a coming quake.

When we examine the relationship between fear and concern and the number of announcements taken seriously the relationship between awareness and concern becomes much clearer (Table 6). There is a substantial relationship between how seriously announcements are taken and concern over future earthquakes. Thirty-two percent of the people who did not take any prediction

TABLE 5

EXTENT OF CONCERN OVER EARTHQUAKES BY
NUMBER OF PREDICTION ANNOUNCEMENTS HEARD

Extent of concern	Number of announcements heard			
	None	One	Two	Three or more
Low concern	26.9	25.6	25.3	15.0
Low medium concern	34.2	31.2	27.7	40.2
High medium concern	19.7	16.1	19.3	23.0
High cocern	19.2	27.1	27.7	21.8
Total	100.0	100.0	100.0	100.0
Total number	193	833	336	87

X^2 = 16.427, df = 9, not significant.

TABLE 6

EXTENT OF CONCERN OVER EARTHQUAKES
BY NUMBER OF ANNOUNCEMENTS TAKEN SERIOUSLY

Level of concern	None	One	Two or more
Low concern	31.9	14.5	3.6
Low medium concern	34.6	24.8	23.8
High medium concern	15.5	20.3	22.6
High concern	18.0	40.4	50.0
Total	100.0	100.0	100.0
Total number	793	379	84

Tau = .258, $p < .001$.

TABLE 7

CHANGED CONCERN OVER EARTHQUAKES
BY NUMBER OF ANNOUNCEMENTS HEARD

Changed concern	None	One	Two	Three or more
Increased	21.9	28.2	35.7	47.2
Same	73.4	67.9	59.2	49.4
Decreased	4.7	3.9	5.1	3.4
Total	100.0	100.0	100.0	100.0
Total number	192	825	336	87

$X^2 = 26.062$, df = 6, $p < .001$.

announcements seriously expressed little concern over earthquakes. Only 14.5 percent of those who took one announcement seriously and 3.6 percent of those who took two or more announcements seriously expressed low levels of concern. On the other hand, half the people who took two or more announcements seriously expressed a high degree of concern over a future damaging earthquake. As the number of announcements taken seriously increases, so does fear and concern over the earthquake prospect. It is not primarily awareness of prediction announcements that may increase the extent of concern, but the fact that these announcements are taken seriously. Once again we find that subjective reactions are more strongly intercorrelated than subjective reactions are to the more objective experiences that make them understandable and are often thought to cause them.

By examining the relationship between prediction awareness and changed concern we hoped to determine whether a sense of increased concern could be attributed to awareness of prediction announcements. Again the relationship is clear. People who have heard announcements of future quakes are more likely to say that their concern has increased during the year (Table 7). Increased concern is particularly evident among people who heard three or more announcements.

The relationship between announcements taken seriously and changed concern is even more telling (Table 8). Only about a fifth of the people who did not take any announcements seriously say that their concern has increased. However, forty-five percent of the people who took one announcement seriously and 63 percent of those who took more than one announcement seriously say their concern increased.

The data leave no question in our minds that awareness of prediction announcements does not leave the public indifferent to the possibility of a

TABLE 8

CHANGED CONCERN OVER EARTHQUAKES BY NUMBER OF ANNOUNCEMENTS TAKEN SERIOUSLY

Changed concern	None	One	Two or more
Increased	21.5	45.4	63.1
Same	74.0	50.9	33.3
Decreased	4.5	3.7	3.6
Total	100.0	100.0	100.0
Total number	785	379	84

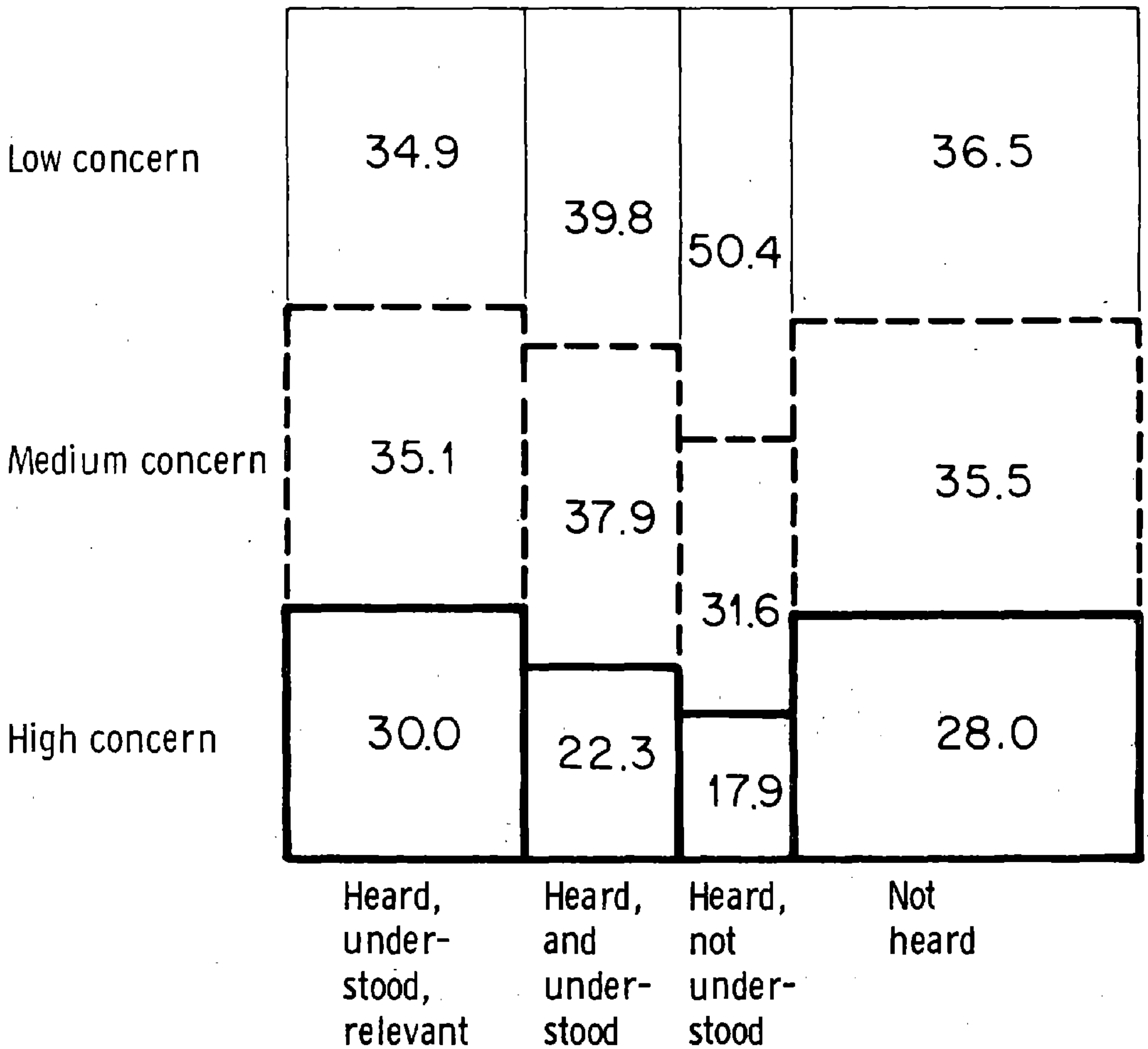
$X^2 = 109.464$, df = 4, $p < .001$.

future damaging earthquake. Awareness of these announcements has contributed to an increase in public concern over the earthquake threat and even more to a sense of recently aroused concern. And these relationships are most evident among people who took the announcements most seriously.

Finally, we wanted to know whether there was any connection between awareness and understanding of the Uplift and the amount of fear and concern people felt. The result is summarized in Figure 3.

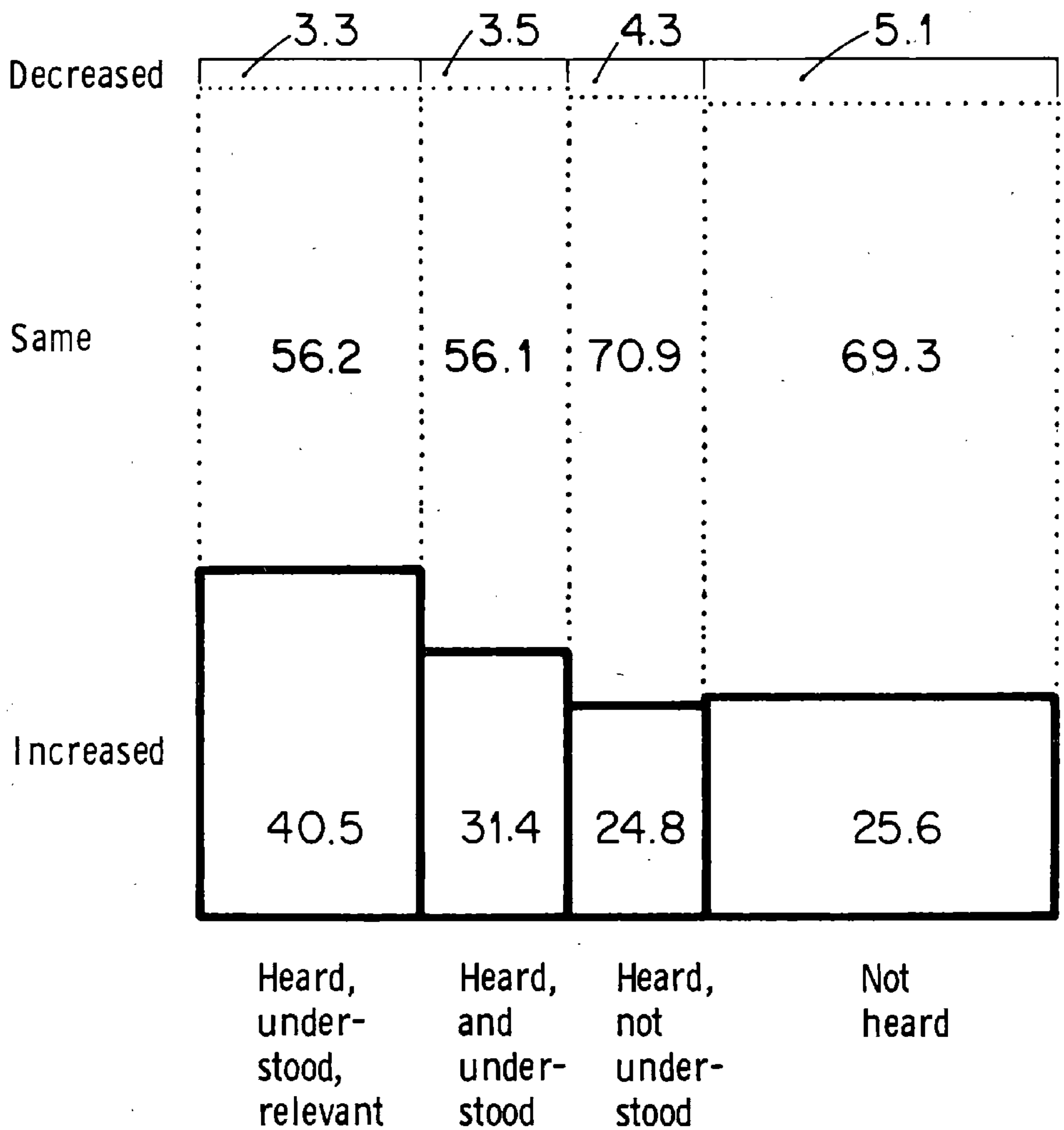
Although the relationship is not what statisticians would call a strong one, it is very clear. Among those who have heard about the Uplift, concern increases with understanding and relevance. Those who have not even heard of the Uplift seem to be a special group. Perhaps they are people for whom facts and information are unimportant, but who respond according to feelings that they cannot relate to specific information. Or perhaps they are "denyers," people who deal with their fear of earthquakes by forgetting or denying information that might reawaken their fears. At this point we can only speculate about this group. But among those who have heard of the Uplift, understanding and the sense of relevance go with greater concern rather than with unconcern.

A similar relationship can be explored between awareness of the Uplift and sense of changed concern during the past year. This relationship is summarized in Figure 4. Again the relationship is clear except for people who have not heard of the Uplift. The people who understand the connection between the Uplift and a possible earthquake and anticipate damage where they live in case of an earthquake are most likely to remember the first year of the Uplift as a year in which their concern increased. People who have heard of the Uplift but don't understand that it may signify a coming earthquake are most likely to say their concern has been unchanged during the year.



EXTENT OF CONCERN OVER EARTHQUAKES
BY AWARENESS OF UPLIFT

FIGURE 3



CHANGED CONCERN
OVER EARTHQUAKES BY AWARENESS OF UPLIFT

FIGURE 4

People who have not heard of the Uplift are more likely than those who have heard and not understood to say that their concern has increased. They are also more likely than any of the other groups to say their concern has decreased.

It would be convenient if we could say that understanding the significance and relevance of the Uplift contributes to concern over the earthquake threat. But unfortunately there is no way to decide which is cause and which is effect. It is also plausible to suppose that fear and concern sensitize people so that they are more likely to grasp the significance and relevance of the Uplift than unsensitized people. Perhaps it is more difficult to make a plausible case that a feeling of recently increased concern gives people a fuller appreciation of the significance of the Uplift. While we cannot claim to have demonstrated a cause-and-effect relationship, the interpretation that fuller appreciation of the Uplift contributes to increased concern seems more plausible.

Moving Away from Earthquake Danger

Perhaps the most tangible expression of intense fear stimulated by recent earthquake predictions, forecasts, and cautions would be the decision by many people to pack up their belongings and move away from southern California. Cursory review of population estimates and district data on real estate listings, as well as the Los Angeles City Attorney's inquiries about San Fernando Valley property values in the wake of Professor Whitcomb's near prediction, fail to reveal a net exodus from the area. We also have evidence from our survey that bears on this issue.

In a series of questions (outlined in detail in Chapter Five) we asked respondents which of several earthquake topics they had discussed informally with family members, friends, neighbors, and co-workers. One of the topics was listed simply as "moving out." A total of 22.3 percent of the respondents said that they had discussed moving out at some time during the last year. "Moving out" may refer to a permanent move or only a brief evacuation, and discussions may have been serious or casual. The fact that most of the discussion about moving took place between respondents and their friends, neighbors, and co-workers, rather than within the family, further suggests that moving was not a very serious consideration. The number who seriously debated the wisdom of moving away from southern California must be much smaller.

Evidence of more serious intentions is supplied by another question. After the main portion of the interview dealing with earthquakes was completed, interviewers announced:

> The following questions are about yourself, your household and your community. These questions help provide the information necessary to define the types of households we collect our opinions from.

After several questions about the local community in which the respondent lived, the interviewer asked:

> Now, thinking ahead to the next five years, how likely is it that you will move from (. . . name of the local community . . .) or beyond a three-mile radius from your present home? Would you say you will: Definitely move, Probably move, Probably not move, or Definitely not move?

Respondents who said they would definitely or probably move were then asked

> Why do you think you will move?

Our interest was in ascertaining how many people were seriously contemplating moving because of the fear of earthquakes.

Out of the entire sample of 1450 people, only ten people mentioned earthquakes in answering the follow-up question. Of these ten, seven said they would definitely move and three said they would probably move. Some of these ten also probably had other reasons besides earthquakes for moving.

In a model developed to explain people's decisions to move based on their perceptions of earthquake hazards, Kiecolt and Nigg (1978) found no evidence to suggest that factors such as past earthquake experience, ecological vulnerability, or prediction awareness increased the likelihood that people would consider moving due to the earthquake threat in southern California. There is little evidence to support the idea that people are seriously enough disturbed over the earthquake prospect that they plan to move away.

A skeptic may well retort that the people who feared earthquakes most intensely had already moved before our interviewers arrived and are not included in the sample. This is a superficially plausible argument, but one that cannot stand the test of careful examination. Human attitudes are almost universally distributed among populations in continuous series. If there were a great many people who feared earthquakes so intensely that they moved away within the year after announcement of the southern California Uplift, there would also have been a great many whose fear had not quite carried them past the threshold for moving, but who were close enough that they were still seriously contemplating a move. In the absence of contradictory evidence, the most reasonable interpretation of our data is that only an inconsequential number of people have moved or are likely to move away from the local community because of the earthquake predictions, forecasts, and cautions of 1976.

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CHAPTER ELEVEN

DO SOUTHERN CALIFORNIANS WANT TO HEAR ABOUT EARTHQUAKES?

A favorite theme in popular magazines is the head-in-the-sand mentality of Californians about earthquakes. According to a typical interpretation, residents of earthquake country would rather not hear about earthquake danger. Fearing the "big earthquake" and knowing that one is bound to come sooner or later, they prefer to ignore the risk and live in a comfortable fantasy of invulnerability. According to this view, people ignore and even resent media attention to the earthquake danger because they find it harder not to worry when they are reminded of the real situation. And they would rather be surprised by an earthquake and deal with whatever happens at the time than to be forewarned and foreworried and still have to cope with the actual disaster. As one southern Californian said, speaking of the Uplift and Whitcomb announcements, "I don't know why they tell us these things when there is nothing we can do about them anyway."

In the last chapter we noted the contrary evidence that few people are willing to claim invulnerability to earthquake disaster. Yet the combination of high fear and low saliency for earthquakes seems consistent with this popular account of southern Californians' attitudes. But the question of whether people really want to know or want to be sheltered from the "bad news" is too important to be answered only by indirection. Hence we have asked people directly about news coverage of earthquake topics and the public release of earthquake predictions. We should be able to say whether this popular theme is correct or a serious distortion.

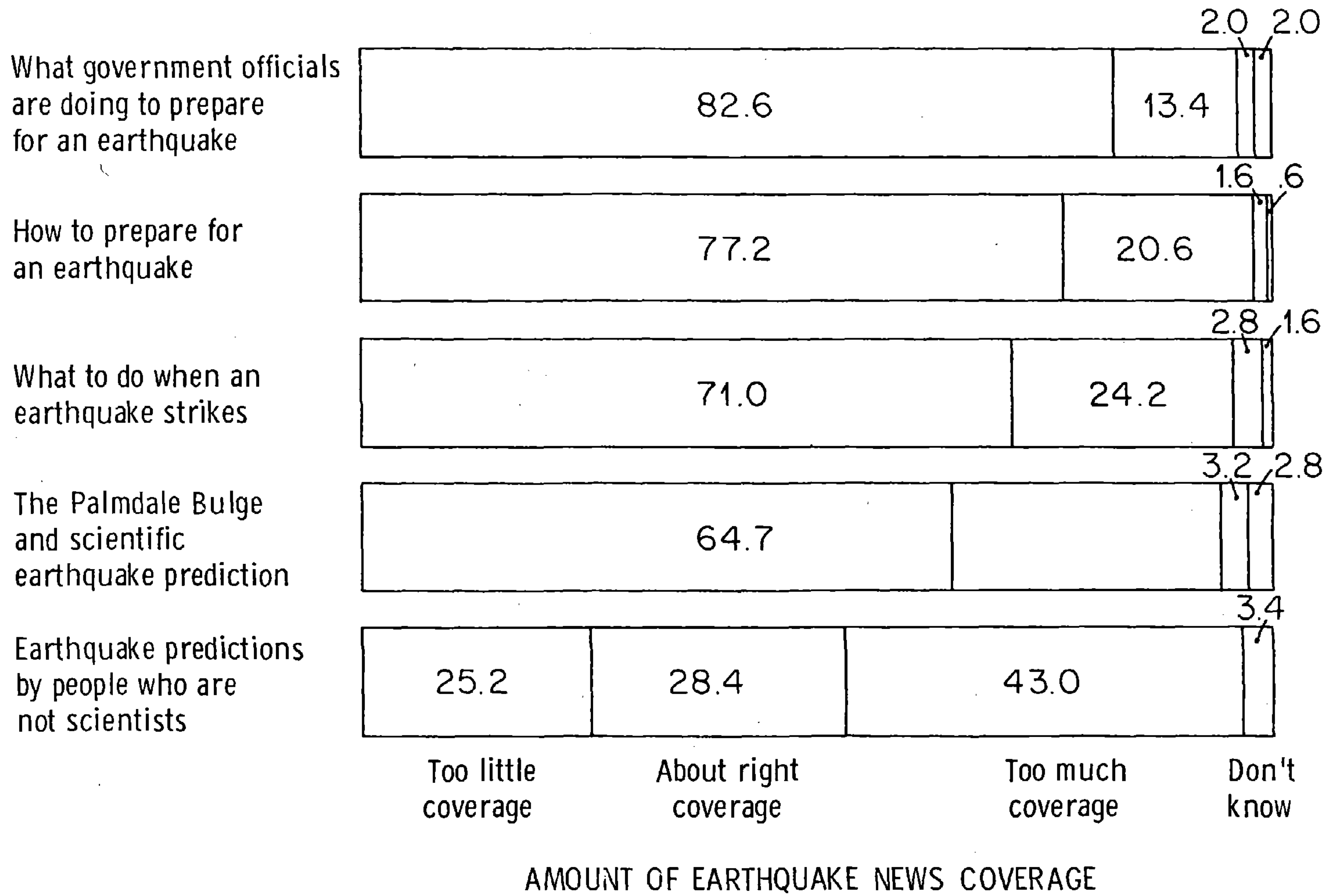
Media Coverage of Earthquake News

After the extensive media coverage given Henry Minturn's earthquake forecasts during December of 1976, the media were often more careful about airing earthquake news. One often heard it said that the people were "fed up" with hearing about the earthquake threat. After being agitated twice, once by Whitcomb's "hypothesis test" that was subsequently withdrawn, and again by Minturn's forecast of a December 20 earthquake that didn't happen, people didn't want to hear any more on the subject of earthquakes. It was said that earthquake news had reached a point of saturation--people simply couldn't cope with any more. It was also said that the absence of a damaging earthquake in spite of the Uplift, Whitcomb, and Minturn, had undermined the credibility of all efforts to forecast and prepare for an earthquake. According to this view, the desire to hear less rather than more earthquake news became especially strong after the first year of the Uplift.

Unfortunately we did not include a question on the general desire for earthquake coverage in the field survey of early 1977. But we remedied this defect a year later by including a battery of five questions in our February, 1978, telephone survey of a new sample of 500 Los Angeles County residents. Residents were asked:

> Now here are some questions about television, radio, and newspaper coverage during the last six months. We want your personal opinion on each of these questions. 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:
>
> A. Coverage on what to do when an earthquake strikes?
> B. Coverage on how to prepare for an earthquake?
> C. Coverage on the Palmdale bulge and scientific earthquake prediction?
> D. Coverage on earthquake predictions by people who are not scientists?
> E. Coverage on what government officials are doing to prepare for an earthquake.

The five specific items are given in the accompanying graph.



What government officials are doing to prepare for an earthquake
82.6
13.4
2.0
2.0
How to prepare for an earthquake
77.2
20.6
1.6
.6
What to do when an earthquake strikes
71.0
24.2
2.8
1.6
The Palmdale Bulge and scientific earthquake prediction
64.7
3.2
2.8
Earthquake predictions by people who are not scientists
25.2
28.4
43.0
3.4
Too little coverage
About right coverage
Too much coverage
Don't know
AMOUNT OF EARTHQUAKE NEWS COVERAGE

FIGURE 1

The findings are overwhelmingly one-sided, and the message is surprisingly unambiguous. From 65 to 83 percent of the respondents want more coverage of the "Palmdale bulge and scientific earthquake prediction," "what to do when an earthquake strikes," "how to prepare for an earthquake," and "what government officials are doing to prepare for an earthquake." The consensus that too little is reported about preparations by government officials is particularly striking. No more than three percent feel there has been too much coverage on any of these topics.

Only on the topic of "predictions by people who are not scientists" do a substantial number feel that the coverage has been excessive. But even on this topic, somewhat less than a majority (43%) say the coverage has been excessive, and fully 25 percent would like more coverage.

The same questions were asked of the two samples of reinterviewed respondents during the same survey. Their responses are not significantly different from those in Figure 1. The combined total sample comes to 1367 people, reducing the probability of meaningful sampling error to a trivial figure.

Although we found earlier that earthquake predictions and earthquakes around the world were the most widely discussed topics among family and friends, with family preparedness lower on the list, the more immediately practical topics rank highest when it comes to wishing for more media coverage. An evaluation of this sort always melds two considerations, namely, the priority people assign to having certain kinds of information and the extent to which the media have failed to provide sufficient coverage. The rank ordering of the first four topics probably correlates inversely with the extent of earthquake coverage, as reported in Part Two. There had been a fairly steady flow of information about predictions and the Uplift, providing grist for the mill of informal discussion. But there was considerably less treatment of personal and household preparedness. And there was very little in the news about government actions to protect the public.

There is plainly no evidence here to support the fear that well-conceived earthquake news and features will be rejected by a "saturated" public. Most of the public were ready for more extensive treatment of earthquake prediction than they had received in preceding months. This is not to say that they will necessarily welcome "warmed over" news and repetitions of what they already know. But it certainly appears that popular writers have been purveying at the very least a misinterpretation of attitudes in earthquake country. Only a surprisingly miniscule number of people seem to have their heads in the sand.

But the demand for more information to clarify a situation made confusing by vague forecasts and by an absence of visible public leadership for coping with the earthquake prospect may be different from the attitude toward publicly announcing a specific scientifically based earthquake prediction. Questions dealing with release of predictions were included in the initial field survey.

Releasing Earthquake Predictions to the Public

Although it is fairly generally accepted policy in the United States that credible earthquake predictions should not be withheld from the public, there is continuing discussion about the optimal time and circumstances for releasing predictions. Scientific predictions are based on the gradual accumulation of data and step-by-step analysis. The evidence at first merely suggests the possibility of an earthquake, and then provides increasingly firm grounds for making a prediction. It is unlikely that confidence in the grounds for a prediction will ever reach 100 percent certainty.

Scientists must therefore decide at some stage in their research that the earthquake indications, though still fallible, are strong enough that the public should be notified. In deciding how certain they should be before making a public announcement, scientists are called upon to weigh the anticipated disruptions of life and the loss of future credibility if the prediction turns out to be false. These "costs" must be weighed against the possible benefits from taking safety precautions on the basis of the prediction. In addition there is argument about the best time to issue a prediction, irrespective of scientific confidence in the prediction. There is concern that a prediction of an earthquake in the too remote future will be ignored by the public and by agencies responsible for disaster preparedness, but will allow time for financial agencies to transfer their assets out of the threatened area and thus provoke a business recession. On the other hand, there are many hazard-reducing steps that could be taken with a fairly long lead time that could not be taken on shorter notice.

Although most people would probably want these issues resolved by informed analysis rather than popular vote, it should be of interest to public officials and scientists to know what popular thinking on these matters is. In addition, public opinion on these issues tells us something about the confidence people have in earthquake prediction as an instrument for advancing the community welfare.

The following question was read to the respondents:

> If there is information indicating that there will be a damaging earthquake in the near future, please look at this card and tell me how certain you think this prediction should be before a public announcement is made.

Simultaneously, respondents were handed a card containing the following choices:

90-100%	Definitely sure the earthquake will occur
60-80%	Quite sure the earthquake will occur
40-50%	A fifty/fifty chance the earthquake will occur
20-30%	Somewhat sure the earthquake will occur
0-10%	Not very sure the earthquake will occur

In reading Table 1, it is important to remember that answers are always biased to some degree by the choices people are given. We did not include in this question the option of not releasing the prediction at all, so we must assume that some of the people who said predictions should be released when scientists are 90 to 100 percent certain and some of those who were recorded under "don't know" might have said "never" if given the option. Furthermore, answers to ensuing questions will show that closeness to the predicted time of occurrence as well as degree of certainty affect people's judgments about releasing predictions.

The easiest way to understand the accompanying table is from the cumulative percentages, reading down the table. Very few people favor the release of predictions about which the scientists themselves are quite unsure. Only 13.4 percent would have scientists publish predictions when they are no more than 30 percent confident that they are correct. Just over a third would have scientists publish predictions when the odds of being right are even. When the odds are solidly in favor of the prediction (60 to 80 percent certain), about two thirds of the people favor publishing the prediction. And if scientists can reach the magic 90 to 100 percent range of certainty, nearly everyone favors releasing the information. We can summarize by saying that once scientists are relatively confident of a prediction the public wants to be told. But most of the public do not want to be told every time there are signs leading scientists to feel that there is a remote possibility of an earthquake.

TABLE 1

HOW CERTAIN SHOULD A PREDICTION BE BEFORE A PUBLIC ANNOUNCEMENT IS MADE

Degree of certainty	Percent	Cumul. Percent
Don't Know or Not Answered	3.5	--
Not very sure (0-10%)	4.3	4.3
Somewhat sure (20-30%)	9.1	13.4
Fifty-fifty chance (40-50%)	23.2	36.6
Quite sure (60-80%)	29.5	66.1
Definitely sure (90-100%)	30.4	96.5
Total percent	100.0	
Total number	1450	

The question of how soon to issue a prediction has been examined in conjunction with the degree of confidence scientists have in their predictions. Respondents were asked the same question twice, once for a prediction of which scientists were 50 percent certain, and once for a prediction with 90 to 100 percent certainty. The first question was worded as follows:

> Now let's imagine a situation in which scientists have information indicating that there is a 50-50 chance that a damaging earthquake will occur one year from now. Should this prediction be made public; Immediately, Held back until six months before the quake is to occur, Held back until 2-3 weeks before, Held back until 24-28 hours before, or Not to announce the prediction at all?

The second question had similar wording, except that it began,

> Let's imagine that scientists are definitely sure, 90-100%, that a damaging earthquake will occur one year from now . . .

Again, Table 2 can be understood most easily by reading the cumulative percentages down the table. There is considerable reluctance to release any prediction as long as a year before the anticipated quake. Many people feel that six months or even two to three weeks is long enough to know about an earthquake prediction. Very few people would hold back the announcement until one or two days before the expected quake. But the reluctance is less when the prediction is more certain. More than half the people who favor eventually releasing a 50-50 prediction would not favor releasing it as long as a year before the expected quake. But only 31 percent of those who favor eventual release of a 90-100 percent prediction would object to releasing it a year ahead.

In these two questions the respondents were given the option of saying that they would not favor releasing the prediction at all. Fifteen percent elected this answer for the 50-50 prediction and only 4.2 percent for the 90-100 percent prediction. Surprisingly few people would suppress even the more uncertain prediction altogether. Rather than withholding information entirely, people favor delay in releasing uncertain predictions. The greater

TABLE 2

HOW SOON SHOULD PREDICTION OF AN EARTHQUAKE ONE YEAR IN THE FUTURE BE MADE PUBLIC

	Percent		Cumulative Percent	
How soon prediction should be made public	If 50-50 chance	If 90-100% sure	If 50-50 chance	If 90-100% sure
Immediately	40.4	65.5	40.4	65.5
Six months before quake	19.1	14.2	59.5	79.7
2-3 weeks before quake	17.4	11.0	76.9	90.7
24-48 hours before quake	6.1	4.1	83.0	94.8
Don't announce at all	15.0	4.2	--	--
Don't know or Not answered	2.0	1.0	--	--
Total percent	100.0	100.0		
Total number	1450	1450		

the uncertainty, the longer they would wait before going public.

Answers to these three questions on the public announcement of predictions require that we modify the impression gained from the five questions on media coverage. The demand for news is not without reservation when it comes to anything so specific as a scientifically grounded earthquake prediction. A similar concern for the quality of information seems to be expressed in both sets of information. Many people are less than enthusiastic about cluttering the news with reports of earthquake forecasts by nonscientists and with scientifically grounded predictions about which scientists are not relatively confident.

Apparently people also want to weigh the <u>effects</u> of releasing information. While the majority of people wanted to hear more about "the Palmdale bulge and scientific earthquake prediction," the majority was notably smaller than for the more obviously practical questions of what the citizen could do and what government leaders were doing. Similarly, concern with the practical effects of releasing information probably explains why many wish to have predictions withheld until some optimal time before the anticipated quake. But the better the <u>quality</u> of the information, as measured by scientific confidence in a prediction, the fewer people want public announcements delayed. While there is disagreement over the kind of information that should be released and the timing of public announcements, the two sets of questions indicate overwhelming public agreement on the most essential point. When there is highly credible information available about the earthquake danger, most people want to be told.

Correlates of Favorability Toward Public Release of Predictions

Why do some people favor the release of predictions while others do not? First, we will attempt to answer this question by examining the relationship between general attitudes toward science and favorability toward public release of predictions.

The three questions dealing with releasing predictions were combined to form a general index to indicate the extent to which the people believe predictions should be made public. Answers to each question were given scores from one to four with four indicating the greatest degree of favorability. The three scores were added together to produce a simple favorability index for each person. For convenience these scores were divided into three approximately equal groups, which are identified as "high favorability," "medium favorability," and "low favorability."

Table 3 shows the relationship between favorability toward science and favorability toward public release of predictions. Favorability toward science was measured by the battery of questions assessing public attitudes toward science (Chapter Four). The data reveal that people who are less favorable toward science are less likely to favor the public release of predictions. As favorability toward science increases, so does favorability toward release of predictions.

We might also expect to find that people who are suspicious of scientists' motivations for releasing predictions would be less favorable toward the release of prediction announcements. A series of questions were combined to assess public trust in scientists. Respondents were first asked whether they thought scientists were giving the public all the information they have on predictions or whether they were holding back information. If the respondent mentioned scientists were holding back information, they were

TABLE 3

FAVORABILITY TOWARD RELEASE OF PREDICTIONS
BY FAVORABILITY TOWARD SCIENCE

Attitude toward release	Favorability toward science			
	Low favorability	Low medium	High medium	High favorability
Low favorability	40.2	37.2	34.0	29.2
Medium favoribility	28.4	30.8	32.3	29.5
High favorability	31.4	32.0	33.7	41.3
Total	100.0	100.0	100.0	100.0
Total number	341	164	412	264

$r = .080$, $p < .01$.

TABLE 4

FAVORABILITY TOWARD RELEASE OF
PREDICTIONS BY TRUST IN SCIENTISTS

Attitude toward release	Trust in scientists			
	Low	Low medium	High medium	High
Low favorability	41.0	36.6	35.5	32.8
Medium favorability	26.5	32.4	31.3	30.2
High favorability	32.5	31.0	33.2	37.0
Total	100.0	100.0	100.0	100.0
Total number	117	355	310	652

$r = .06$, $p < .05$.

asked whether it was because of concern for the public welfare or to protect their own interests. The index ranged from high trust, for people who believe scientists are giving all information to the public, to low trust, for people who believe scientists are holding back information to protect their own interests (cf. Chapter 4).

The data appear to reveal that people who believe scientists are holding back information for their own interests are less favorable toward the release of predictions than people who believe scientists are telling all or withholding information for the public good. While the relationship is marginally significant, it suggests that people who are suspicious of scientists' motivations for issuing predictions are often dubious about the public release of prediction announcements (Table 4).

Next we ask: are there differences with respect to favorability toward release of predictions between people who are concerned about a damaging earthquake occurring and those who are not concerned? We might expect people who have a great degree of fear and concern over the earthquake threat may not want scientists to release predictions for fear of increasing their anxiety. On the other hand, people who are concerned over a damaging earthquake occurring may want to know when a quake is predicted so that they can flee the area or take other protective action. The relationship between favorability toward release of predictions and fear and concern over the earthquake threat is statistically significant (Table 5). People who are less concerned about a damaging earthquake occurring are less favorable about public release of predictions. As concern increases, so does favorability toward public release. This finding emphasizes the general observation that people who are concerned about the earthquake threat want more information about earthquakes than those who are less concerned.

TABLE 5

FAVORABILITY TOWARD RELEASE OF PREDICTIONS
BY CONCERN OVER DAMAGING EARTHQUAKES

Attitude toward release	Fear and concern index			
	Low	Low medium	High medium	High
Low favorability	42.2	36.4	34.4	27.0
Medium favorability	26.5	31.9	29.3	34.2
High favorability	31.3	31.7	36.3	38.8
Total	100.0	100.0	100.0	100.0
Total number	355	448	256	374

$r = .102$, $p < .001$.

A similar relationship exists between favorability toward public release and expectation of a quake within a year. People who do not expect a quake are less favorable toward prediction release, while people who anticipate a quake favor scientists issuing predictions to the public (Table 6).

In Chapter Nine we asked whether the disconfirmation of many of the forecasts issued in 1976 caused segments of the public to lose confidence in the ability of scientists to predict earthquakes. If this were the case we should expect people to be less favorable toward scientists issuing their announcements publicly as a result of the 1976 experience. We would expect the public's reservation to be stronger among people who took some of these predictions seriously.

In order to see the relationship between how seriously people took predictions and favorability toward public release of predictions we will examine the relationship between how seriously people took the three near predictions of 1976, Minturn's prediction, Whitcomb's announcement, and the California Uplift, and public release. If the hypothesis is confirmed we would expect to find that people who took any of these announcements seriously are less likely to favor releasing predictions than people who did not take these announcements seriously.

The data do not confirm the hypothesis (Table 7). The relationship between taking specific predictions seriously and favorability toward release is the same whether for Minturn's prediction, Whitcomb's announcement or the Uplift. We find that people who took any of these announcements seriously are more likely to favor releasing predictions in the future than people who did not take any of these announcements seriously. This finding suggests that even though people who have embraced forecasts have been proven wrong by events, they are not discouraged enough to think that scientists should withhold

TABLE 6

FAVORABILITY TOWARD RELEASE OF PREDICTIONS BY EXPECTATION OF A QUAKE WITHIN A YEAR

Attitude toward release	Expectation of damaging quake within a year				
	Definitely not	Probably not	Don't know	Probably	Definitely
Low favorability	47.2	34.9	41.9	33.0	29.1
Medium favorability	29.2	31.8	19.8	29.9	40.5
High favorability	23.6	33.3	38.4	37.2	30.4
Total	100.0	100.0	100.0	100.0	100.0
Total number	89	633	86	546	79

$r = .056$, $p < .05$.

TABLE 7

FAVORABILITY TOWARD RELEASE OF PREDICTIONS BY HOW SERIOUSLY NEAR PREDICTIONS WERE TAKEN

Near prediction taken seriously?	Favorability toward release			Total	Total Number
	Low	Medium	High		
Uplift*					
Taken seriously	29.2	30.2	40.6	100.0	424
Not taken seriously	37.4	30.9	31.7	100.0	1010
Whitcomb					
Taken seriously	19.6	30.4	50.0	100.0	46
Not taken seriously	32.4	27.0	40.6	100.0	37
Minturn					
Taken seriously	29.1	34.4	36.5	100.0	189
Not taken seriously	37.4	30.1	32.5	100.0	412

*Differences are significant at .001 level.

TABLE 8

FAVORABILITY TOWARD RELEASE OF PREDICTIONS
BY NUMBER OF PREDICTIONS TAKEN SERIOUSLY

Attitude toward release	Number of announcements taken seriously		
	None	One	Two or more
Low favorability	38.1	27.5	31.6
Medium favorability	30.3	33.1	39.4
High favorability	31.6	26.2	39.3
Total	100.0	100.0	100.0
Total number	782	384	429

$r = .084$, $p < .01$.

TABLE 9

FAVORABILITY TOWARD RELEASE OF PREDICTIONS
BY AWARENESS OF THE UPLIFT

Attitude toward release	Awareness of the Uplift			
	Not heard	Heard but not understood	Heard and understood	Heard, understood and relevant
Low favorability	38.5	34.1	31.6	32.4
Medium favorability	29.7	34.9	30.4	29.7
High favorability	31.8	31.0	38.0	37.9
Total	100.0	100.0	100.0	100.0
Total number	582	232	253	367

$r = .07$, $p < .01$.

predictions in the future. On the other hand, people who did not have faith in the predictions of 1976 are also less likely to favor public release of future predictions.

The relationship between predictions taken seriously and favorability toward release is even stronger when we examine the number of predictions taken seriously (Table 8). People who have not taken any predictions seriously are less likely to favor releasing predictions to the public, while people who have taken seriously more than two announcements are highly favorable. The greater the number of predictions taken seriously, the more favorable the public is toward disclosure of prediction announcements. This emphasizes an earlier conclusion. When people find information highly credible, they want to hear more.

Is there any relationship between awareness and understanding of the Uplift and the extent of favorability toward release of predictions? Here again there is an apparent relationship that is not statistically significant (Table 9). People who have not heard of the Uplift are less favorable toward the release of predictions than those who have. Among those who have heard about the Uplift favorability increases with understanding and relevance. The data consistently suggest that people who are most aware and concerned about the earthquake threat want to keep abreast of the latest developments in the field of earthquake prediction.

Placing the Responsibility for Announcing Predictions

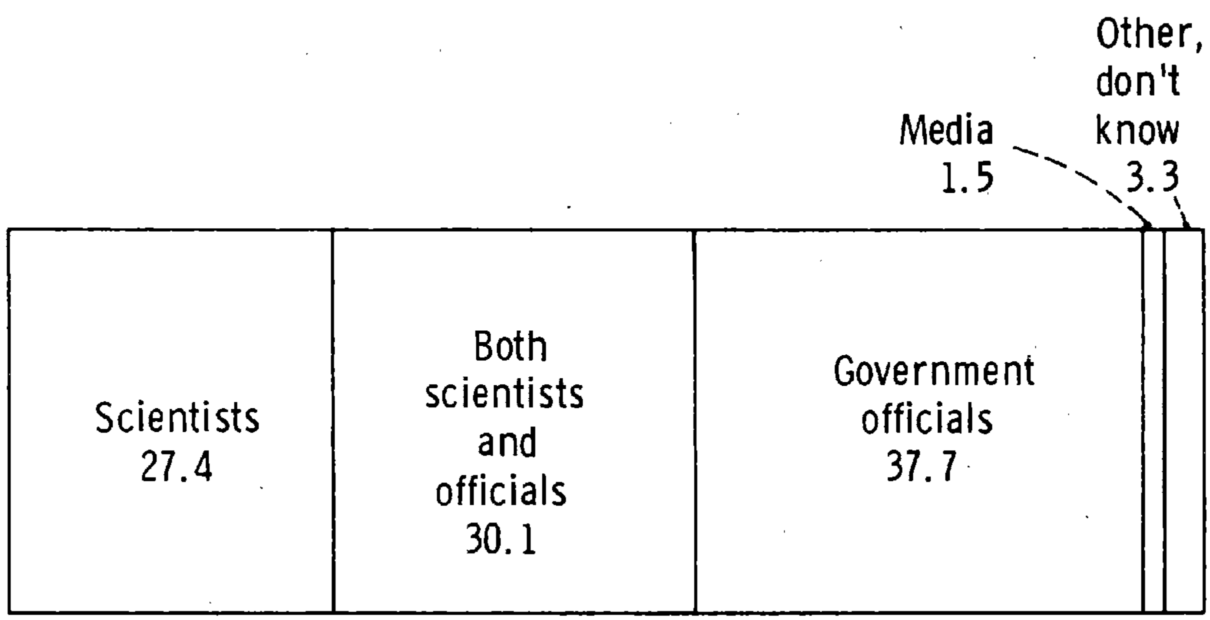
There has also been debate over who should release predictions. Again, current American policy leans in the direction of distinguishing between prediction and warning. According to this view, predictions should be released by the scientists who make them. On the basis of the prediction and other relevant information, public officials should then decide whether the prediction merits issuance of a public warning. But it is unlikely that the public have generally been apprised of this subtle distinction. There is also a reason to believe that in spite of negative popular attitudes toward politicians and the political process, the public looks to government officials for authoritative leadership and direction at times of potential crisis.

In order to ascertain public views on responsibility for issuing predictions, we asked:

> If the prediction that a damaging earthquake will occur one year from now were to be made, who do you think should be responsible for informing the public? Would you say: The scientists themselves, Government officials, or Someone else?

If respondents chose the third answer they were asked to specify who the "someone else" was. Although it was not read to the respondent, the reply, "Both scientists and government officials" was preprinted on the schedule for use by the interviewer when respondents gave that answer.

As summarized in Figure 2, just over one quarter of the respondents place the responsibility exclusively with scientists. More people see the release of earthquake predictions as a government responsibility, and another sizeable group want collaboration between scientists and government officials. There are well documented risks of unregulated information leakages, undue delay by public officials, and dissemination of misinformation in any plan which makes government officials responsible for releasing a prediction based on sophisticated scientific evidence. Nevertheless, the great majority of people expect government officials to assume principal or coordinate responsibility in a matter of such vital public concern as releasing an earthquake prediction.



WHO SHOULD RELEASE PREDICTIONS ?

FIGURE 2