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PEOPLE'S RESPONSES TO THE 1989 LOMA PRIETA EARTHQUAKE

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ABSTRACT

In order to investigate people's responses to the 1989 Loma Prieta Earthquake empirically, a telephone survey was conducted to the 300 randomly sampled residents in the four heavily damaged Counties in the Northern California (Alameda, Santa Cruz, Santa Clara, and San Francisco) about five weeks after the earthquake. We designed the survey so as to be able to compare its data with what we had obtained for the 1987 Whittier Narrows Earthquake in the United States and the 1987 Chiba Prefecture Toho-oki Earthquake in Japan.

From this survey it was found, first, that the psychological and behavioral responses to the Loma Prieta Earthquake were moderate and adequate on the whole. Second, most people used radio and evaluated it highly as the information source just after the earthquake. Third, personal assistances were actively given during and after the earthquake, particularly by the residents in the Santa Cruz County. Fourth, several significant cross-societal differences were found between the United States and Japan in psychological and behavioral responses to the earthquakes, which may reflect cultural and educational background.

1. INTRODUCTION

The Loma Prieta Earthquake occurred at 17:04 (P.D.T.) on October 14, 1989 about 16 km northeast of Santa Cruz, California (U.S.A.). It had an estimated Richter magnitude of 7.1, and caused severe damage in the San Francisco Bay area. Sixty-four persons died and an estimated 7 billion dollars of damage was done. News and newspapers, however, reported that there were few occasions of panic during the earthquake and that a great many volunteer activities were organized by citizens to help the people who suffered in the earthquake. The media reports showed that, althought the earthquake caused severe damage in the San Francisco Bay area, the immediate reactions of the residents on the whole were moderate and adaptive to the situation.

To investigate citizens' responses to the Loma Prieta Earthquake empirically and to compare them to responses to the two recent eqrthquakes (one in the United States and one in Japan) we made a telephone survey of residents aged from 20 to 69 living in the four counties in the San

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Francisco Bay area which were heavily damaged. We designed the survey so as to be able to compare its data with what we had obtained for the Whittier Narrows Earthquake (October 1, 1987, U.S.A.) and the Chiba Prefecture Toho-oki Earthquake (December 17, 1987, Japan). The Whittier Narrows Earthquake (magnitude 5.9) occurred at 7:52 (P.D.T.) on October 1, 1987 at Rosemead, about 20 km east of Los Angeles. Six persons died in this earthquake. Los Angeles county was markedly affected, especially Whittier, where about 2,000 houses and other buildings were damaged. We conducted a telephone survey of 300 citizens aged 20 to 69 in Whittier and El Monte, which were close to the epicenter, five weeks after the earthquake [1]. The Chiba Prefecture Toho-oki Earthquake (magnitude 6.7) occurred at 11:08 on December 17, 1987 off of the Boso Peninsula near the Tokyo metropolitan area. Two persons were killed and more than a hundred houses were severely damaged in Chibe Prefecture. We conducted a telephone survey of 300 citizens aged 20 to 69 living in the cities of Ichihara, Chonan and Chosei five weeks after the earthquake [2]. The research procedure, question items and wordings used in these two surveys were very similar to those used in the survey of the Loma Prieta Earthquake. Empirically it therefore is justifiable to compare these data and examine both the similarities and differences in people's responses to the three earthquakes.

2. OUTLINE OF THE SURVEY

We selected four counties in the San Francisco Bay area to provide the population for the survey, as those counties suffered relatively heavy economic and physical damage from the earthquake. Table 1 gives the damage statistics for the four counties reported by the Federal and State Disaster Assistance of FEMA one week after the earthquake. Three hundred citizens aged 20 to 69 were randomly sampled from the four counties in numbers proportionate to the population. The ratio of male and female samples drawn was almost unity. Population size, the number of households and the effective sample size for each county are shown in Table 2.

The survey was conducted by the telephone interview method. Based on the questionnaire

County	Fatalities	Injuries	Estimated Property Damage
Alameda	39	349	\$ 1.48 bil
San Francisco	12	300	\$ 2.00 bil
Santa Clara	5	1,300	\$ 728 mil
Santa Cruz	6	729	\$ 316 mil

Table 1 Damage statistics in the four Northern California counties

 Table 2
 Population, Household and sample sizes in the four Northern California counties

County	Population	Distribution Population Ratio	Number of Households	Effective Sample Size	Distribution of Sample Ratio
Alameda	1,180,203	33.0	459,964	98	32.7
San Francisco	251,612	6.9	96,780	21	7.0
Santa Clara	1,432,799	36.4	508,092	119	39.6
Santa Cruz	748,219	23.7	330,866	62	20.7
Total	3,612,833	100.0	1,395,902	300	100.0

sheet prepared by the authors, trained native interviewers from the PLOG Research Inc. called the respondents and asked questions. The interviews started on November 25, 1989, five weeks after the earthquake and finished on December 1.

The main questionnaire included questions on (1) immediate psychological and behavioral responses to the earthquake, (2) individual damage or loss caused by the earthquake, (3) communication behavior taken after the earthquake, (4) exposure to rumors and earthquake predictions, (5) assistance provided or recieved and (6) past experience of earthquakes. We kept the wordings of these questionnaires as close as possible to the wordings used in our two previous surveys in order to be able to compare the surveys [3].

In comparing the Loma Prieta data with the Whittier Narrows Earthquake and the Chiba Prefecture Toho-oki Earthquake, we used a sample of two Cities, Whittier and Chosei, because the seismic intensities and degrees of damage were similar in these cities. It should be noted, however, that the samples in the Loma Prieta Earthquake survey were drawn from wide region encompassing four counties in the Bay area and that the most severely affected residents might not have been included in the sample because they remained evacuated for weeks after the earthquake. Thus, the obtained data is to be evaluated taking into account these specific characteristics of the sample.

3. PSYCHOLOGICAL AND BEHAVIORAL RESPONSES TO THE EARTHQUAKES

3.1 Degree of fright

The Loma Prieta Earthquake occurred at 17:04 (P.D.T.). At that time, 43.3% of the respondents were at home, 20% were at their offices, and 11.3% were in cars. To the question, "How frightened were you by the earthquake?", 35% answered that they were "very frightned", and 32% answered that they were "somewhat frightened". The percentage of those who were "very frightened" was 46% in Whittier and 86% in Chosei, higher than the percentage in the Bay area (Figure 1). This shows that the Loma Prieta Earthquake did not produce extreme fear among the residents.

More women were tended to answer that they were "very frightened" then men, and those under 30 tended to be "very frightened" in comparison to the other age group (Figure 2). A comparison of the degree of fright according to the respondents' locations at the time of the earth-



Fig. 1 Degree of fright at the three earthquakes



Fig. 2 Degree of fright at the Loma Preita Earthquake/by sex and age

quake indicated that those in offices showed the highest degree of fright and those in cars showed the lowest.

3.2 Reactions during the earthquake

To measure the immediate reactions to the earthquake, we asked the respondents "What did you do during the earthquake?", having them choose among the following precoded twelve alternatives.

- (1) Kept perfectly still
- (2) Felt like you could neither move nor walk
- (3) Got under a table or desk ot protect yourself from falling objects
- (4) Stood in a doorway
- (5) Protected furniture or other objects you thought might break
- (6) Went to help infants, old, or sick people
- (7) Ran outside
- (8) If in your car, pulled over to the side of the road and stopped
- (9) Tried to calm family members or friends
- (10) Kept right on with what you were doing
- (11) Prayed
- (12) Other

The results of these interviews and equivalent data obtained in our previous two surveys (Whittier and Chosei) are shown in Fig.3. The most frequent response was "stood in a doorway" (28%). This percentage is a somewhat smaller than that for Whittier (31%), but was much higher than for Chosei (1%). This striking contrast may reflect differences in culture or education between the United States and Japan. In Japan, advice to stand in doorways during an earthquake has not been a popular oral tradition, nor is it recommended in schools or by public agencies. Instead, there is a wide belief that the small bathroom is structurally strong in Japanese wooden houses. In contrast, people in the United States are generally aware that doorways during an earthquake. For example, several years ago the American Red Cross published a brochure titled, "Family Disaster Plan and Personal Survival Guide", in which "bracing yourself in a strong doorway" was recommended as an immediate action to take during an earthquake, in addition to "getting under a desk or table and hanging on to it", and "staying clear of windows, fireplaces and heavy furniture or appliances".



Fig. 3 Immediate actions during the three earthquakes

Other reactions which showed remarkable contrast were "praying" and "trying to calm family members or friends". About 23% in the Bay area and 20% in Whittier tried to calm family members or friends". About 23% in the Bay area and 20% in Whittier tried to calm family members or friends, whereas only 2% of the respondents in Chosei took this cation. The percentage of those who prayed during the earthquake was 12.5% in the Bay area and 14.5% in Whittier, but there was not a single person in this category in Chosei. This contrast undoubtedly reflects cultural and religious differences.

Surveying the immediate reactions to the Loma Prieta Earthquake in comparison with the other earthquakes, we conclude that on the whole the citizens in the Bay Area made moderate and adaptive responses to the earthquake. For example, appropriate behavior such as "kept perfectly still" (24%), "tried to calm family members" (23%), or "went to help infants, old or sick

people" (14%) was taken by many persons. Also, the percentage of those who took such undesirable action as "running outside" was 14% in the Bay area, much lower than in Whittier (30%) or Chosei (23%).

Differences in the immediate reactions in the four counties are shown in Fig. 4. The percentage of those who "felt as if they could neither move nor walk" or "got under a table or desk" was particularly high in Santa Cruz, where the seismic intensity was the severest of all the counties. Helping infants, old or sick people also was an action taken by a much larger percentage of people in Santa Cruz than in the other counties. A significant sex difference was found for several items. Females were more likely to "stand in doorways", "help infants or others", "pray" or "get under a table or desk" than were males (Fig.5). Males were more likely to "protect furniture", run outside", "pull the car over to the side of the road", or "keep right on with what the person was doing" than were females. These tendencies may be related to differences in sex roles and location at the time of the earthquake.

A breakdown of the reactions by location during the earthquake is shown in Figure 6. Those



Fig. 4 Immediate actions during the Loma Prieta Earthquake/by counties



Fig. 5 Immediate actions during the Loma Prieta Earthquake/by sex

who were at home tended to "stand in doorways" (41.5%), "try to calm family members" (30%), or "go to help infants" (23%), whereas those who were in their offices tended to "stand in doorways" (40%), "try to calm friends" (28%), or "get under a table or desk" (25%). Although 43% of those who were in cars "pulled over to the roadside", 27% "kept right on with they were doing".

4. MEDIA USE AFTER THE EARTHQUAKE AND AN EVALUATION OF INFORMATION SOURCES

What was the media situation in the Bay Area on the day of the Loma Prieta Earthquake? Because of the World Series, which would have been held at 5 p.m. on that day, there was a high concentration of media representatives in the San Francisco Area. The communication-media generally were still intact after the earthquake, and in the early hours media attention focused on such visible and readily available targets as Candlestick Park, the Marina fire and the overpass collapse in Oakland. Largely because of damage to communication facilities, loss of power, ac-

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Fig. 6 Immediate actions during the Loma Prieta Earthquake/by location

cess, and the smallness of the media staffs, little was heard from the worst hit communities in the epicentral area: Santa Cruz, Watsonville, Hollister ,Los Gatos, and others. Only after several hours had passed was concern voiced about areas that had not been heard from. The concentrated coverage in the north contributed to misunderstandings about the full effect of the earthquake (See EERI Preliminary Report [4]).

Power failure did not cause direct interruption of TV broadcasting, except for a 30-minute suspension experienced by a few stations such as KRON; but, it did affect about 1.4 million customers. Many people received more information about the earthquake from the radio than from TV broadcasting. KNBR, KCBS and KGO in San Francisco, for example, provided continuous earthquake-related information for more than 48 hours without commercial breaks. The increase in telephone traffic in the hours immediately after the event overloaded the system, and many respondents answered that they lost telephone service (See Figure 7).

How did the respondents use the media? In the survey, we asked respondents what they did immediately after the earthquake in order to learn more about the situation. As shown in Figure



Fig. 7 Restoration of electricity and telephone service (Loma Prieta)



Fig. 8 Information behaviors immediately after the Loma Prieta Earthquake (M.A.)

8, most people took action to learn about the earthquake. Note that about 66% answered that they turned on the radio, as compared to 23% who turned on TV or 22% who made telephonecalls. The unusually high percentage using the radio is partly ascribable to the lack of TV because of the power failure. Another reason is that the careful and helpful information provided by the radio was favorably received by the listeners. The various pieces of useful information communicated, and the portability of the radio prompted the residents to use the radio as an information source just after the earthquake.

The most useful information sources about the earthquake, as evaluated by the respondents are shown in Fig. 9. The tendencies of the answers are the same in the Bay Area, Whittier and Chosei (in Chiba). More than half of the respondents answered that the radio was the most useful information source. This is explained by the characteristics of the radio stated previously (portability, careful provision of information, listener's need-oriented regionalism etc.). It should be noted that only 1% of the respondents recognized public officials as being a useful informa-

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Fig. 9 The most useful information sources

tion source.

5. RUMORS

Rumors often have spread widely in areas where large earthquakes have struck. Surveys conducted in the past by the Institute of Journalism and Communication Studies at the University of Tokyo, Japan show that 83% of those surveyed after the Izu-Oshima Kinkai Earthquake (1978), 70% after the Urakawa-oki Earthquake (1982), 70% after the Nihonkai Chubu Earthquake (1983), and 56% after theNagano Prefecture Seibu Earthquake (1984) heard rumors after the earthquakes.

The percentages of those who heard rumors after the Loma Prieta Earthquake, the Whittier Narrows Earthquake and the Chiba Prefecture Toho-oki earthquake are given in Fig. 10; 42% in the Bay Area and 50% in Whittier heard rumors. The percentage in Chosei (in Chiba) was exceptionally low, even when compared with other Japanese cases.

The tabulation of the after-coded open answers about the content of rumors is given in Table 3. Most of the rumors were about exaggerated damage, such as "The Bay Bridge collapsed" (40%), and a "high death toll" (30%). Our previous survey showed that many of the rumors that



Fig. 10 Spread of rumors

Table 3 Content of rumors (Loma Prieta)

	N	%
Bay Bridge Collapsed	50	40.3
High Death Toll	37	29.8
It Wasn't the "Big One"	21	16.9
Aftershocks to follow	16	12.9
Fires	15	12.1
Miscellaneous Damage	14	11.3
Freeway Collapse	12	9.7
Other	25	20.2
Total Respondents	124	100.0

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		Location				
	Total	at home	in a car	in an office	elsewhere	
Neighbors	50.0	53.2	50.0	35.5	61.5	
Radio	33.1	34.0	25.0	41.9	26.9	
Television	24.2	27.7	25.0	16.1	26.9	
Strangers	18.5	8.5	30.0	25.8	19.2	
Newspapers	12.1	6.4	30.0	9.7	11.2	
Family	8.9	8.5	15.0	6.5	7.7	
Others	5.6	4.3	5.0	9.7	3.8	







Fig. 12 Belief in rumors/the degree of fright (Loma Prieta)

spread immediately after the event were about a re-occurrence of the earthquake. But in the Loma Prieta Earthquake Survey the results were somewhat different; most rumors were about exaggerated or distorted images of damage. We think that this was indirectly caused by the TV news reports, which were exaggerated in the course of communicating by word of mouth. Table 4 shows the sources of rumors and their breakdown by people's location during the earthquake; 50% heard the rumors from neighbors or friends, 33% from the radio and 24% from TV.

The degree of belief in rumors shows an equivalent pattern between the Bay Area and Chosei. Of those who heard a rumor in the Bay Area, 16% believed it completely and 60% believed it to some degree; whereas in Chosei 28% believed it completely and 50% believed it to some degree (See Figure 11). The degree of belief is closely related to the degree of fright during the earthquake. The more severely the respondents were frightened, the more they tended to believe rumors (See Figure 12).

6. PERSONAL ASSISTANCE PROVIDED OR RECEIVED

TV, radio and the newspapers reported that a great many volunteer activities were undertaken by citizens in order to help victims in the disaster-stricken area. We asked the respondents whether they had provided or received any assistance after the earthquake. As Figure 13 in74

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Fig. 13 Personal assistance provided and received in the Loma Prieta Earthquake

dicates, about 38% of the entire sample and 57% of the respondents in Santa Cruz provided others with food, water, clothing or supplies. Moreover, 17.5% of the entire sample and 52% of those in Santa Cruz helped neighbors with clean-up or debris removal. This data shows that in the Bay area, in particular in Santa Cruz County, aid and assistance by citizens were widespread after the earthquake. Since comparable questionnaires had not been included in the other two surveys, it is difficult to evaluate the data in a cross-cultural setting. Anecdotal evidence suggests, however, that these types of helping behavior also are found in other countries although the degree and styles may differ depending on cultural and institutional conditions.

7. CONCLUDING REMARKS

We here have described citizens' responses to the Loma Prieta Earthquake of 1989 and compared them with equivalent data from two other earthquakes that recently occurred in the United States and Japan. The behavior of the residents during and after the earthquake was adaptive to

the situation on the whole, in marked contrast to the notion of a panicky or helpless population. Several significant cross-national similarities and differences were found in people's immediate responses, media use, and exposure to rumors. Some of these differences are ascribable to cultural or institutional differences. Others may be related to situational or environmental factors. Differences in people's experience of earthquake shaking (seismic intensity felt) may also contribute to the degree of fear and to people's immediate reactions. When designing future comparative surveys, it will be necessary to take these intervening variables into account.

This study was an initial attempt to test the validity and usefulness of measuring people's responses to earthquakes in different cultural settings. We hope this preliminary effort will lead to the development of more refined and organized continuing research projects, that will be carried out with cooperation of disaster researchers throughout the world.

REFERENCES

- [1] Mikami, S. and Hashimoto, Y. (1988)., A Survey to the residents of Whittier and El Monte on the Whittier Narrows Earthquake of 1987, A Research Report on the 1987 Whittier Narrows Earthquake: The Final Report to the Ministry of Education, Culture and Science, pp. 112–157.
- [2] Hiroi, O. (1989)., Dissemination of disaster-information and habitants' behavior on the 1987 Chiba Prefecture Toho-oki Earthquake. *The Bulletin of the Institute of Journalism and Communication Studies, University of Tokyo.* No. 38, pp. 125–218.
- [3] Mikami, S. and Hashimoto, Y. (1990)., A Sample Survey on the 1989 San Francisco Earthquake, Loma Prieta Earthquake of October 17, 1989 Reconnaissance Report, pp. 301-338.
- [4] Earthquake Engineering Research Institute (1989)., Loma Prieta Earthquake October 17, 1989: Preliminary Reconnaissance Report.