

AN INVESTIGATION INTO HUMAN PSYCHOLOGY AND BEHAVIOR DURING AN EARTHQUAKE

by

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ABSTRACT

By carrying out questionnaire surveys the human psychology and behaviors in relation to seismic intensities were investigated. Special concerns were paid on the people's general behaviors and mental attitudes, attentions to dealing with a fire source, and reactions of the people who happened to be driving a car. It was clearly confirmed that the human behaviors and psychological conditions are strongly correlated to seismic intensities, that is, people's responses go from bad to worse with increasing intensities.

INTRODUCTION

Investigations of human psychology and behavior during a large earthquake have frequently been carried out in Japan. However, most of the investigations in the past are limited to elucidate their qualitative characteristics, that is, they lack a view point of understanding human responses as a function of earthquake strength(=seismic intensity). Usually the earthquake damage is characterized by ground shakings and other mechanical forces, but is generally enlarged with the secondary disasters such as fire, traffic accident and sometimes panic fair. To know the human psychological conditions and behaviors at the earthquake are supposed to take a great part for diminishing these secondary disasters. For this, however, the data should be accumulated in a quantitative way in relation to the seismic intensity.

In recent several years we have been carrying out questionnaire surveys of earthquake intensities for the purpose to make seismic zoning maps. In this questionnaire sheet a few questions on the human responses are included. So, by an accessory product of intensity analyses the data on these matters has been stored. And a data processing was done while paying attention to the human responses during earthquakes. This provides a preliminary report in this direction.

The covered intensity range by our surveys was II-V (Intensity Scale by Japan Meteorological Agency), but through one case study for a recent earthquake it was extended to nearly VII.

METHOD OF INVESTIGATION

A questionnaire sheet contains 34 questions for describing the replier's location and circumstances, and for estimating a seismic intensity. These questions are made to be more sensitive imperceptible difference of the quake than those developed in the past. Among them we prepared a few questions to know human behaviors and mental conditions during an earthquake. They are the questions on the general behaviors of human beings, grades of frightening, mental attitude for fire prevention, response of the people who was driving a car and so on. Soon after a moderate-to-large earthquake occurs, thousands of the questionnaire sheets are delivered to several shocked areas. The earthquakes investigated until now are 7, the surveyed cities are at least 10, and the total number of the sheets received are about 24000, made up as in Table 1. The latest survey shown

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in the table is for a recent inland earthquake attacked the northern part of Kyushu district, in which an elaborated investigation was performed in a wide area surrounding its source region.

An analysis to estimate an intensity by a questionnaire sheet was done by means of a kind of weighted summation of responses for each question, considering a correction due to the replier's circumstances. Estimated values were finally referred to the JMA Intensity Scale.

Main items and their categories of the questions concerned with the human psychological conditions and behaviors are as follows.

1. How did you behave yourself when you felt the quake?
 1. No special reaction was necessary
 2. Consciously I looked to my own safety
 3. Consciously I got off outdoors
 4. It was unconscious that I ran away to outdoors
 5. No convincing memory is remained because of deep confusion.
2. How did you deal with fire sources as gas heater and oil burner?
 1. Fire was out of use at the time
 2. I felt no necessity to put out the fire
 3. I felt danger and put out the fire
 4. It was unconscious that I put out the fire
 5. I could not afford putting out the fire at the instance.
3. Please answer if you happened to be driving a car. How did you go through then?
 1. No special effort was needed
 2. I felt a slight trouble
 3. Driving a car was fairly difficult
 4. I felt impossibility of driving and brought to a car to a halt
 5. An accident (slipping off the road, collision of cars) has happened.

Besides these a few questions on the people's astonishment and frightfulness are included. A brief static analysis was done relating to these questions.

RESULT AND DISCUSSION

[1] Human behaviors at the intensities less than VI.

(A) The first question is for the general behaviors of human beings during an earthquake. In Fig.1 (a) we see the three grades of replier's responses. The abscissa is the seismic intensities by means of the JMA Scale (for reader's convenience the MM Scale is also cited). Looking into this figure we notice a remarkable contrast among the three grades of responses from no effect to unconscious condition. At lower intensities almost all the people naturally pay no attention to the earthquake. But, at increasing intensities many people tend to behave consciously and to be unconscious conditions. At intensity V nearly a 30% of the people are confused to be unconscious or instinctive. People who can control oneself decreases less than 10%. Extrapolating this trend it is very practical to anticipate that at a higher intensity as VI unconsciously behaving people will go up to 50% or more.

(B) Fig.1 (b) illustrates how the people pay attentions to put out a fire during the earthquake. A curve corresponding to upper solid circles shows changes of the responses possible to put out the fire, and a middle curve indicates percentages of the people who replied impossible. A curve going down right-wards shows the responses unnecessary to put out the fire. The people who responded impossible increases with increasing intensities, and amounts to 10% at intensity V. It is favorable that the people who

replied possible to put out the fire keeps a large percentage as is seen in this figure. However, considering the results shown in Fig.1 (a) we can not expect that this favorable tendency will be true even at higher intensities.

(C) Here is a question to the people who happened to be driving a car at the time of the quake (Fig.1 (c)). A 50% driver tells us that at intensity IV they could continue driving without any troubles. Nevertheless, at intensity V the people who had no effect goes down to only 10%, but the people who replied impossible to keep driving comes up to 30%. After all a 90% driver seems to be subjected to some kinds of troubles at intensity V. This teaches us that at higher intensities there might be many traffic accidents if an earthquake will attack an urban area.

There are a few interesting results concerning the differences in psychology and behavior between male and female. Those are summarized in Fig. 2 (a), (b) and (c). Hence, ordinates indicate response grades. Females are in general more astonished and frightened in their minds by the earthquake than males. However in the lowest graph each curve is close together. This suggests that the actual behaviors of females during the earthquake are not so disconcerted as inferred from the upper two graphs.

[II] Human responses at higher intensities.

For the earthquake occurred at northern part of Kyushu district an elaborated questionnaire survey has been done covering an area with its seismic source region, and the widely distributed intensities were described. Specially in the fault region of a 7 km x 17 km rectangular shape the intensity was above VI. Thus a case study of human responses in the extremely awful situation as attacked by a destructive earth movement was partially performed. The questions meaningful for our object are general behaviors of human beings, fearfulness to quake and preparation for fire prevention. For car driving no useful data was obtained because the earthquake occurrence was in the midst of the night (2h 17m).

Results are illustrated in Fig.3 (a), (b) and (c). At first, we can recognize that the responses to each question are very sensitive to the ascending order of categories, in other words, that the questionnaire texts are very perceptive to intensities. Next, it is understood that the human responses up to intensity V are very similar to those discussed in the preceding section. So, special concerns were paid to those in higher intensities. The number of the people who behaved unconsciously or instinctively, though around 50% at intensity V, increases abruptly with a slight increase of the intensity and almost 100% of people were brought to despair before arriving at the intensity of VII. These are naturally related to the response for the question about how the people dealt with fire sources. Almost all the people at intensity VI answered impossible to put out the fire. This suggests that the favorite tendency mentioned about the fire prevention is broken down in the worst situation. It was one consolation in sadness that the fire sources on use were very scarce.

In this short report we presented a few interesting data regarding the human responses during the earthquake. These surveys are still half a way because of shortage in data. Nevertheless, we would like to believe that these results obtained in relation to seismic intensity will be valuable and these are basic materials for the adequate disaster prevention programs against a large earthquake which may occur in future. Hereafter we will accumulate such data at every chance, after having a further revision of the questionnaire texts so as to improve the sensitivity to seismic intensities.

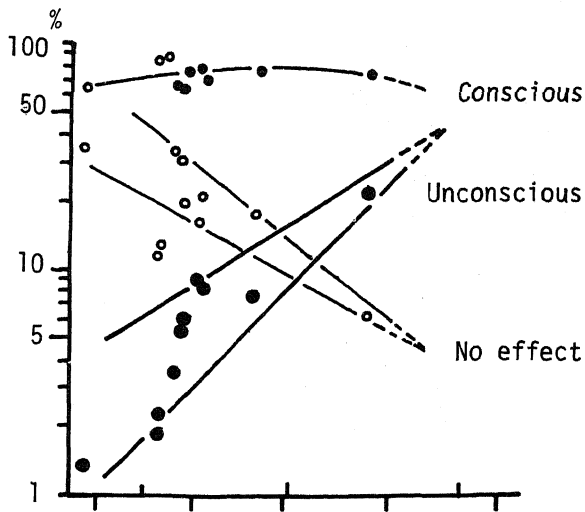


Fig.1(a) Response to a question of human behavior at an earthquake and its relation to seismic intensity. Intensities adopted are Japan Meteorological Agency (JMA) and Modified Mercalli (MM) scales. Ordinate indicates percentage to each category in the question.

No effect means that no special reaction was necessary. Conscious is that I looked to my own safety. Then Unconscious corresponds to I ran away or no convincing memory was remain because of deep confusion.

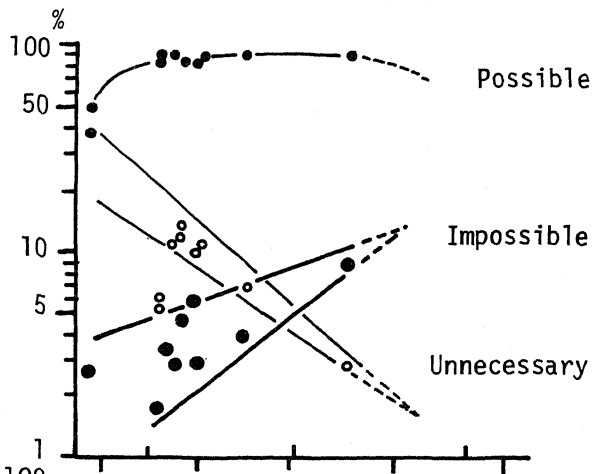


Fig.1(b) Response to a question about people's attention to put out a fire during an earthquake.

The uppermost curve with small solid circles shows the response of Possible to put out the fire, and a middle curve indicates change of percentage of the people who replied Impossible. A curve going down to right is Unnecessary to put out the fire.

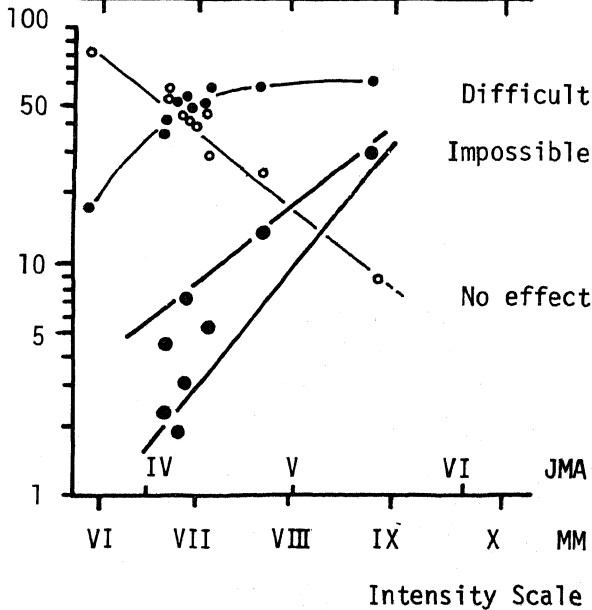


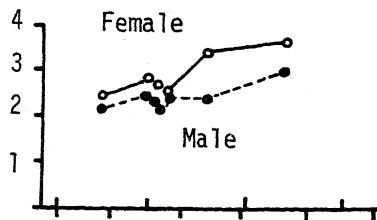
Fig.1(c) Response of the people who happened to be driving a car at the time of earthquake occurrence.

Difficult means that it was difficult to keep driving. Impossible indicates that they had no other way to stop the car or they were about to meet car accidents. And the percentage of impossible increases at higher intensities. In contrast No effect, which means that drivers were in usual ways regardless of the earthquake, decreases with increasing intensities. After all a 90% of drivers was subjected to some kind of troubles at intensity V (JMA).

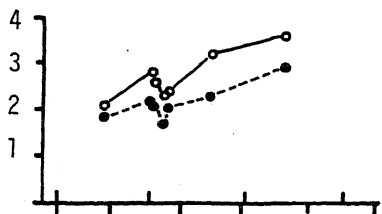
Table 1
Earthquake and surveyed areas by a questionnaire method

Earthquake	Date	Magunitude	Questionnaires	Surveyed area
Near Ohtsuki	1972.1.27	4.8	2212	Kawasaki
Off Hachijyo	1972.2.29	7.2	2739	Kawasaki
Off East of Hachijyo	1972.12.4	7.3	2720	Kawasaki
Off Nemuro Peninsula	1973.6.17	7.4	4059	Nemuro, Kushiro, Obihiro, Hiroo, Urakawa
Aftershock	1773.6.17	5.7	1169	Kushiro
Aftershock	1773.6.24	7.1	1237	Kushiro
Northern Kyushu	1975.4.21	6.4	10192	Kyushu district

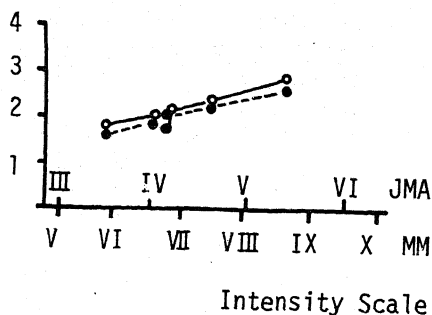
Total : 24328



(a) Astonishment at the earthquake. This indicates that the grade of astonishment is clearly increased as a function of seismic intensities, and the response of female is more conspicuous than that of male.



(b) Frightfulness of male and female. The very similar relation to (a) is obtained in this figure. Again the females seem to be more sensitive to the earthquake.



(c) General behavior of human at the earthquake. This figure shows that people's behaviors are very indistinguishable between the male and female, contrasting with the results shown in the figures of (a) and (b).

Fig.2 Differences in mentality and behavior for male and female during an earthquake. Digits in ordinates show, in an ascending order, grades of human response.

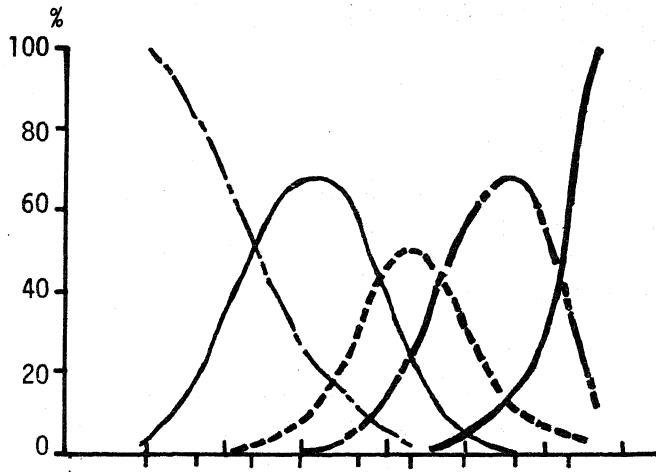


Fig.3(a) Frightfulness in relation to intensity

- No effect
- Frightened a little
- Frightened fairly
- · - · - Frightened heavily
- Driven to despair

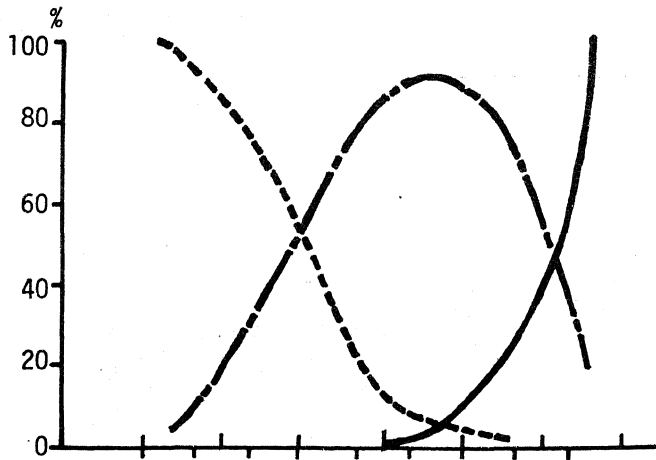


Fig.3(b) General behavior

- No effect
- · - · - Behaved consciously
- Behaved unconsciously or instinctively

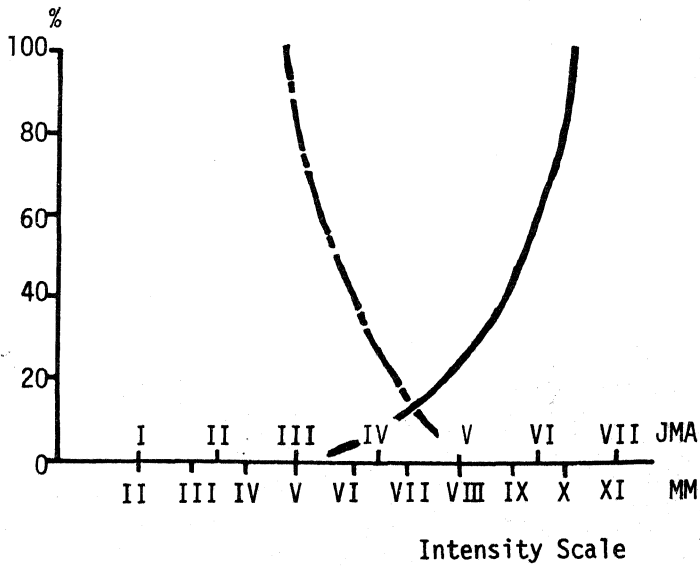


Fig.3(c) Attention to put out the fire

- Unnecessary
- Impossible

DISCUSSION

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In your analysis of psychological response to ground shaking did you consider personality variables ?

Is the frightfulness scale an ordinal scale ?

How did you establish your scale ?

What was your age distribution in the population sampled? Do you think your distribution of ages had anything to do with your results ?

Author's Closure

Not received.