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The Role of Media and ICT to Motivate People to Take Post-Quake Recovery Action: An Evidence of the “Pythagorean Effect”

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The Role of Media and ICT to Motivate People to Take Post-Quake Recovery Action: An Evidence of the “Pythagorean Effect”

1. Introduction

This paper aims to show empirical evidence of how media and ICT (Information and Communication Technology) motivate people to take after-quake initiatives such as collecting information, preparing for another disaster and participating in volunteer activities and making donations. Assuming that information provided by media and ICT is purely rational and influential because irrelevant information is discarded, the impact of the media information is to be analyzed in conjunction with direct and indirect influences of the disaster and the existence of communities.

The Great East Japan Earthquake hit the northern part of Japan on March 11, 2011 (see Fig. 1 for its seismic intensity). Some sixteen thousand lives were lost and three thousand people are still missing (as of May 23, 2012). One of the distinct features of the earthquake with respect to the role of ICT and media is that television and other image media provided plentiful high-resolution visual images of the earthquake and the subsequent tsunami to other people. Actually, what modern society could do was to film and record the forces of nature, and convey them to areas across Japan except for the severely damaged areas and then to the rest of the world. In addition, social networking services performed an important role providing and exchanging information among people by complementing the role of mass media. In contrast, voice calls on mobile phones, the most popular communication means, were pretty much useless in terms of establishing communication due to heavy traffic on telephone lines.

In this paper, the rationality of media information is defined as the “Pythagorean Effect” as it can be compared to his addiction to “rational numbers”. People faced with such information are assumed to be more motivated to take immediate action after the disaster. This kind of effect was initially discussed in terms of recognition of words and pictures (see, for example, Shepherd, 1967 and Nelson et al., 1974). Major reactions are to collect information, to take countermeasures against possible earthquake aftermath and to be altruistic to others. The existence of a similar phenomenon was found in medical education (Shapiro and Rucker, 2004), indicating that physicians feel more emotionally moved when viewing a movie about a patient than when treating a similar patient in an actual situation.

The result suggests that media information has a different contribution to post-quake behavior as compared to real experience in that it triggers information gathering while damages from the earthquake provoke countermeasures against

possible aftermath. They both have the same influence on altruism. In addition, real communities motivate people to collect information. In contrast, virtual communities induce altruistic behavior.

2. The Pythagorean Effect

Any media information is not genuinely real in the sense that it is provided through some sort of media and is not acquired by experience. However, its potential is enormous because it can be delivered anytime and anywhere to anyone in the world with almost no delay if he/she has an access to it. In most cases, information provided by media and ICT is more rational and influential because irrelevant information is discarded. In that sense, it creates the “sense of reality” or “virtual reality”. Since media and ICT are indispensable in our daily lives, we could say that we live in the two worlds, i.e., the “real” and the “reality”¹. The latter is not necessarily the genuine truth but representing the essence of a thing.

As technology advances, communications through ICT has become more real-time, interactive and effective, and even creates a space to share communication. Video is provided in a higher resolution such as through the high definition TV technology, which contributes to increasing the reality. This technological advancement will bring about the same awareness and sensation as in the real. Even without real experience, people can regard them as real with empathy and compassion. In most cases, the reality expresses the essence of the real since they are usually produced based on the information collected and edited under some intension of information providers². Media have succeeded in delivering the reality more effectively and efficiently and contributed to creating the sense for the real among their receivers

Besides an enormous benefit from media information, as it becomes more realistic, people are apt to fall in a misconception that they have experienced something without experiencing it. While real experience accompanies difficulties, risks, troubles, inconsistencies etc., the created reality has discarded those inconvenient factors. Furthermore, they may tend to believe that the reality provided by media is the real. What they believe is not the real but the reality created by media.

The relationship between the real and reality could be compared to that between rational and irrational numbers in the era of the Pythagorean philosophy. In his

¹ The real and reality are often confused but not the same. For example, one will feel loneliness or isolation if he/she lives alone. However, he/she may feel the similar sensations even if he/she live with others. This is just the senses but not real loneliness or isolation.

² For example, news information is provided under the control of news editors and issues are sometimes exaggerated to draw attention.

doctrines, it is believed that numbers are “rational”³. A disciple of Pythagoras found the existence of an irrational number when investigating the so-called Pythagorean Theorem. However, Pythagoras didn’t accept the existence of irrational numbers since he thought that numbers should be rational and composed of integers and the ratios of integers.

This story suggests a lot to the role of media information. The Pythagorean Effect of the digital age can be defined as: an emotional belief that the real (=irrational) is expressed by reality or virtual reality (=rational), just in the same way as Pythagoras believed in the world of rational numbers. The effect includes both positive and negative aspects. As the positive aspects, i) media information can convey the essence of information and ii) people can take effective and efficient measures in response to the information conveyed. On the other hand, as the negative aspects, i) people believe that reality or virtual reality is more essential than the real and are satisfied with a virtual world, ii) by accepting the reality, people seem to understand the real without watching it, and iii) people tend to take countermeasures without watching the real.

Media information is rational in that it is more essential and easy to understand the essence since complexities are eliminated, necessary information is easy to retrieve and many other factors are discarded. From these advantages of media information, it is natural to assume that it motivates people to take action without experience. It can be assumed that the effect of media information will not be affected by the distance and not be decreased even if people live further away. This means the impact of media information will be stronger as people’s location gets further away compared to real experience. This paper examines the positive effect of the rationality of media information in terms of people’s contribution to and participation in the post-quake recovery process after the Great East Japan Earthquake.

3. Analytical Approaches

Two approaches can be considered. Firstly, a structure of cause-effect relationship is hypothesized and given *a priori*. This deterministic approach examines whether a hypothesized structure is statistically significant and represents the real structure. Secondly, a more heuristic approach is applied, in which an exploratory factor analysis is adopted.

1) A Deterministic Approach

In order to express a comprehensive cause-effect relationship among factors and to

³ Rational numbers are integers or expressed by the ratio of integers. Nowadays, it is found that almost all numbers are irrational numbers.

express the consequences of the impact of media information on the earthquake in contrast to real damages, structural equation modeling was applied. In the model, two major factors are considered in terms of the contrast between real and virtual, i.e., the source of information and communities which people belong to. Latent variables adopted are: (1) suffering damage from the earthquake, (2) media information, (3) real communities, (4) virtual communities, (5) collecting information, (6) countermeasures against possible aftermath events and (7) altruistic action. The first two represent the source of information, the next two communities, and the last three people's response as the consequences of people's decision. The relationship between the latent variables based on the hypothesis is constructed as given in Figure 2. The idea behind the structure is as follows: i) People know the fact about the consequence of the Great East Japan Earthquake by experiencing it; ii) At the same time, they acquire information through media and ICT; iii) They also collect information in their community from their relatives, friends and acquaintances and are influenced by them; iv) Some people belong to virtual communities such as communities created by social networking services and exchange information through them.

Each potential variable is composed of some relevant observable variables. For example, the variable "suffering damage from the earthquake" is composed of four observable variables as shown in Figure 3. All the variables are linked appropriately to show causalities among them. The whole structure of the model is represented in Figure 4.

2) An Exploratory Approach

In addition, a cluster analysis based on the factors derived from an exploratory factor analysis was applied to identify the consequence of exposure to media information. More concretely, their responses upon experiencing the shock of the earthquake and being exposed to the media information were grouped into several behavioral patterns. This analysis helps understanding how people typically behaved after the earthquake. More concretely, it demonstrates how their reactions were related to the types of response after exposed to the shock of the earthquake and the media information.

3) The Data

An online questionnaire survey was carried out over sample panels pre-registered in a survey research company. The data were collected in February 2012 from across Japan excluding the three heavily-damaged prefectures and included more than two thousand samples aged from in their teens to over their sixties. The percentage of the samples collected from each region is shown in Table 1. The largest number of samples

were collected from the Kanto Region which includes Tokyo while the least number from the Tohoku Region which does heavily damaged areas by the earthquake. Age and gender compositions are listed in Tables 2 and 3. The questionnaire survey was intended to collect the same number of samples from each age group. However, there are some variations in the numbers of samples collected.

4. The Results

1) A Deterministic Approach

The structural equation modeling was solved by using the SPSS/AMOS software. The result of the estimation using the all data is shown in Figure 5. As the statistic indicator in the bottom of the figure suggests, the estimation result is statistically acceptable.

The result indicates that:

- i) Damages from the earthquake provoke countermeasures against possible aftermath while media information triggers information gathering.
- ii) The real experience induced altruistic action such as donating money and doing volunteer activities while the same level of altruistic action was induced by media information.
- iii) Real communities motivate people to collect information. On the other hand, virtual communities induce altruistic behavior.

With the model presented in the previous session, in addition to the analysis on the whole data set, several analyses can be carried out by categorizing the data according to data attributes such as the major media for collecting information, age groups and regions. Among others, it is interesting to show how the influences are different among media. The primary statistics shows that TV played a dominant role in providing information over other media such as the Internet, radio and newspaper, as shown in Table 4. Approximately seventy-five per cent of the respondents regarded TV as the most important source of information. Some may suspect that the role of the Internet is more and more important because it is said that IP-based communication such as emails, blogs and social networking services provided useful information. However, as Table 5 indicates, more than ninety per cent of internet users collected information even from TV while only a half of TV viewers accessed the Internet. Consequently, the structural equation modeling approach was not successful in identifying the difference between TV and other media in terms of the creation of motivations. Table 6 listed the set of correlations that show statistically different at a five per cent significant level. From statistical point of view, six links of cause-effect relationship showed some

difference between TV and the Internet. However, the differences seem very small as far as correlation coefficients are concerned. Radio had a slightly different structure. Experience of the disaster more induced countermeasures against possible aftermath.

2) An Exploratory Approach

This approach examines how people were impressed by media information and how they reacted after the earthquake. An exploratory factor analysis was applied in order to extract factors regarding the impacts of media information on the earthquake and subsequent behaviors. Then, the respondents were classified into several groups with a cluster analysis by utilizing the factors derived. The data used are all the answers from the respondents except those related to “suffering damage from the earthquake”. A common factor analysis, i.e., the principal factor analysis, was applied with a varimax rotation. The Kaiser rule (i.e., the eigenvalue > 1) was adopted for determining the number of factors.

Five factors were included in the appropriate range of solutions to adopt. The names and implications of the factors were derived from their factor loadings as follows (see Table 6):

- (1) Shock of the earthquake --- impressed by media information on the earthquake and seek to collect more information;
- (2) Ties --- seeking communication and interaction with families, friends and neighboring people;
- (3) Virtual ties --- seeking communication and interaction online;
- (4) Countermeasures --- taking action for preparing for evacuation or joining volunteer activities; and
- (5) Stupors --- disengaging from collecting information or taking countermeasures.

Using these factors as principal components, a cluster analysis was applied in order to categorize respondents who shared a similar feature into a group. Since the data set was large, the k-means algorithm was used instead of hierarchical clustering. The number of clusters was given *a priori* as required by the algorithm. Calculation was successful for the number of clusters from two to five. As the number increases, the iterative process is hard to converge to a solution. As the result of calculation, the maximum number of cluster was five. From the coordinates of the cluster centers in the principal component coordinate space as shown in Table 7, the features of people in the clusters can be interpreted as follows:

The 1st cluster: community activist

The 2nd cluster: media-savvy activist

The 3rd cluster: escapist

The 4th cluster: resurgent

The 5th cluster: isolationist

The number of the respondents in each cluster and the percentage share are listed in the bottom of Table 7.

5. Implications and Conclusion

This paper aimed to show empirical evidence of how media and ICT (Information and Communication Technology) motivate people to take after-quake initiatives such as collecting information, preparing for another disaster and participating in volunteer activities and making donations.

Based on the data collected through an online questionnaire survey, two different approaches were taken for revealing the impact of media information in conjunction with the influence of the experience of the Great East Japan Earthquake and the existence of communities. The idea embedded in the analysis was that the impact of media information was enormous as compared to other disasters we have experienced so far.

The deterministic approach employing structural equation modeling has examined the validity of the structural hypothesis based on the idea. The result suggests that media information has a different contribution to post-quake behavior as compared to real experience in that it triggers information gathering while damages from the earthquake provoke countermeasures against possible aftermath. They both have the same influence on altruism. In addition, real communities motivate people to collect information. In contrast, virtual communities induce altruistic behavior.

On the other hand, the exploratory approach has successfully revealed the behavior of people after the earthquake. Actually, they are categorized in to five groups, each of which shows a typical behavioral response.

There are activists, whether relying on communities or media, who took after-quake initiatives. On the other hand, those who are categorized in “escapist” or “isolationist” tend to stay away from the fact or ignore it, and do not want to get involved in after-quake activities. Those grouped in “resurgent” were depressed by experiencing the earthquake and/or by being exposed to media information but reanimated. The result seems consistent with a general understanding that reaction can be positive, negative or neutral.

The result in this paper, however, is solely based on the data collected through an online survey. The existence of sampling bias cannot be denied. In the sense, it should

be careful to take the result as general. As shown in Section 4, regarding the source of information after the quake, TV played a dominant role and the role of the Internet is still limited although the usefulness of the Internet is getting more and more important.

Further findings will be provided by additional analyses. It will yield an interesting finding to examine the influence of physical distance on the comparative impacts between the experience and medial information on people's attitude toward after-quake initiatives. It can be assumed that the impact of the disaster will decrease as the distance from the seismic center increases while the impact of media information will not depend on the distance. This means the impact of media information will relatively increase with the increasing distance. The respondents of the questionnaire survey distribute all over Japan except the three prefectures close to the seismic center. For this purpose, another survey will be necessary that includes the three prefectures to highlight the impact of closeness to the center.

Different media will bring about different impact. Further media-specific analysis will also provide interesting findings. These are left to future research.

Keywords: Role of ICT and media; Pythagorean Effect; Great East Japan Earthquake; altruism

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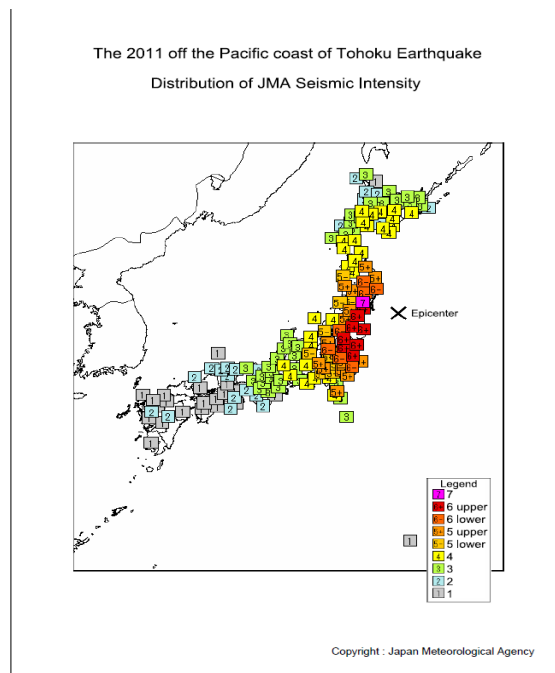


Figure 1: Distribution of Seismic Intensity of the Great East Japan Earthquake

Source: http://www.jst.go.jp/pr/pdf/great_east_japan_earthquake.pdf

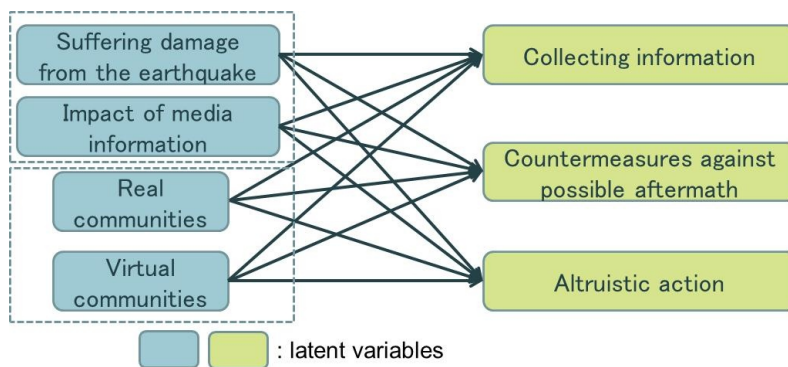


Figure 2: The relationship between the latent variables

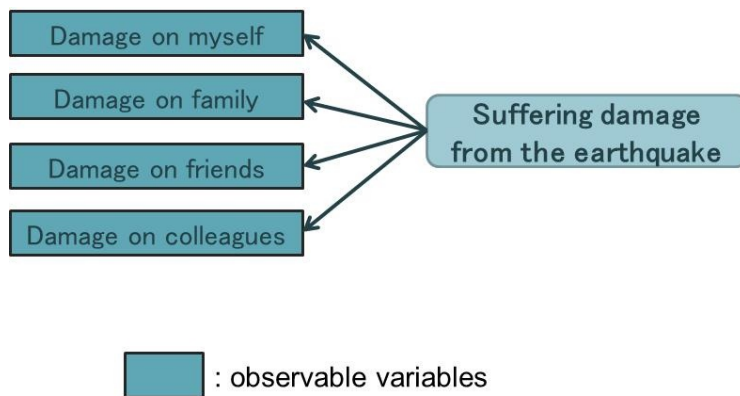


Figure 3: Composition of a latent variable “suffering damage from the earthquake”

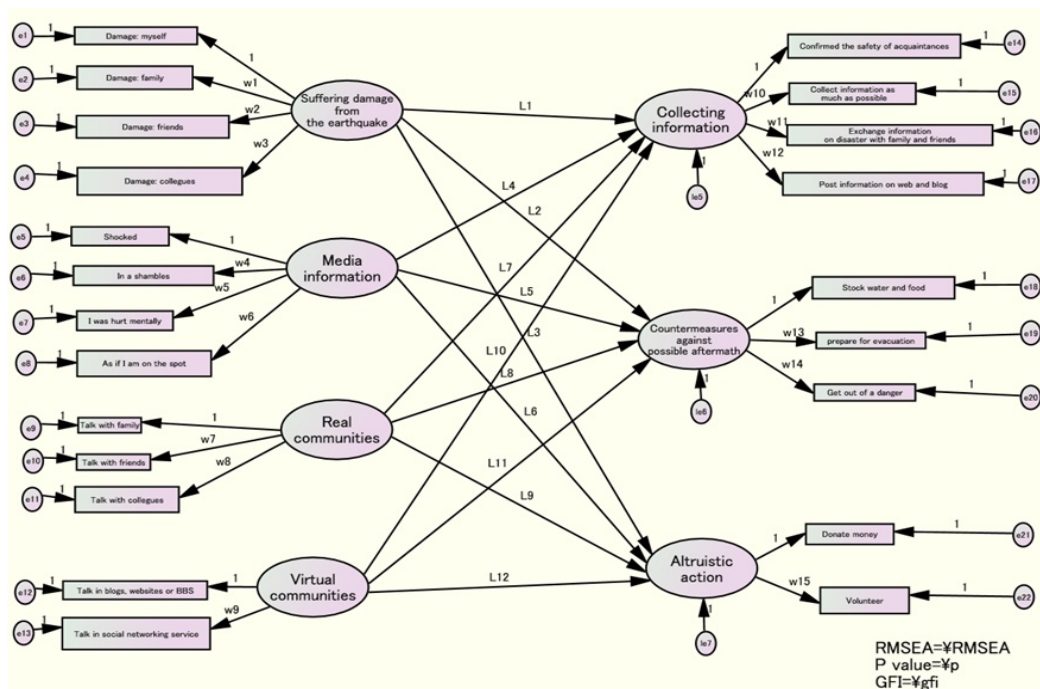


Figure 4: The structure of the deterministic model

TV

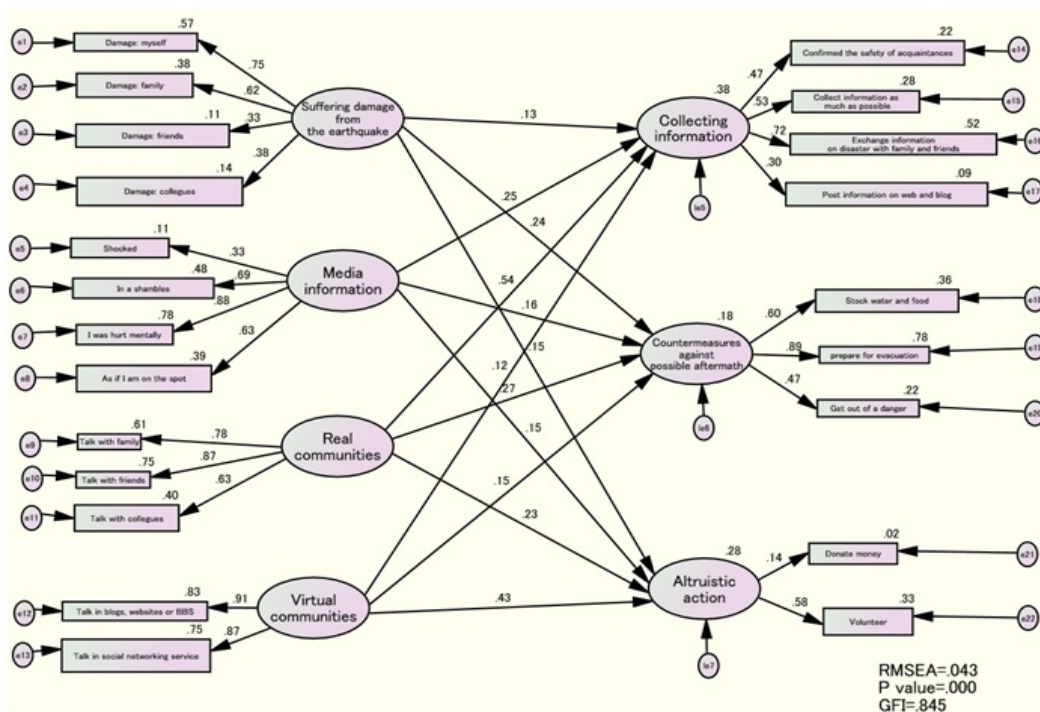


Figure 5: The result of the statistical estimation

Table 1: Regional distribution of the samples

Region	Number of samples collected	%
Hokkaido	118	5.7
Tohoku	45	2.2
Kanto	865	41.8
Chubu	328	15.9
Kinki	409	19.8
Chugoku	97	4.7
Shikoku	47	2.3
Kyushu	157	7.6
Total	2066	100.0

Table 3: Gender distribution

Age group	%
12 or less	0.0
12 - 19	6.7
20 - 24	6.7
25 - 29	9.1
30 - 34	9.2
35 - 39	11.4
40 - 44	10.1
45 - 49	8.3
50 - 54	10.6
55 - 59	7.7
60 or over	20.2
Total	100.0

Table 2: Age distribution

Male	Female
50.3%	49.7%

Table 4: Comparison between TV and the Internet significant at 5% level

Cause	Effect	TV	Comparison	The Internet
Impact of media information	Countermeasures	0.16	>	0.15
	Altruistic action	0.15	>	0.12
Real communities	Collecting information	0.54	<	0.57
	Countermeasures	0.27	>	0.25
Virtual Communities	Collecting information	0.15	<	0.17
	Countermeasures	0.43	<	0.45

Table 5: Comparison between TV and radio significant at 5% level

Cause	Effect	TV	Comparison	Radio
Suffering damage from the earthquake	Countermeasures	0.24	<	0.35
	Altruistic action	0.15	<	0.17
Virtual Communities	Collecting information	0.12	<	0.17

Table 6: The result of factor analysis

Factors Questions		Shock of the earthquake	Ties	Virtual ties	Countermeasures	Stupors
Impression	Shocked	.139	-.017	-.009	-.076	-.074
	Felt the necessity of information	.194	-.024	-.003	-.015	-.224
	In a shambles	.098	-.037	.006	-.012	.309
	Was hurt mentally	.212	-.082	.037	.026	.426
	As if I am on the spot	.082	-.059	.015	.072	.091
	Watched TV repeatedly	.131	-.046	.005	-.020	-.132
	Level-headed	.033	-.023	.021	-.001	-.130
	In deep sorrow	.215	-.032	.009	-.058	.007
	Very anxious	.141	-.014	-.015	-.012	.021
Action	Collected a lot of information	.149	.035	-.013	.016	-.281
	Exchanged information on the disaster	.071	.087	-.043	.080	-.154
	Confirmed the safety of acquaintances in the affected area	.015	.004	.013	.078	-.044
	Secured food and water	.009	.021	-.080	.201	-.025
	Prepared for evacuation	-.055	-.015	-.114	.474	.023
	Evacuated	-.056	-.046	.045	.220	.032
	Volunteered	-.015	-.041	.078	.123	-.011
	Posted information online	-.011	-.093	.201	.143	-.047
	Donated	.033	.003	.004	-.002	-.014
Communication	With family members	-.030	.297	-.078	-.013	.033
	With friends	-.101	.574	-.001	-.075	.184
	Acquaintances or colleagues	-.032	.142	.028	-.022	-.001
	Blog, website or BBS	.002	.004	.556	-.158	.002
	Facebook, twitter or other social networking service	-.010	.016	.247	-.068	-.047

Table 7: The features of people in the clusters

Cluster (group) Factor	Community activist	Media-savvy activist	Escapist	Resurgent	Isolationist
Shock of the earthquake	0.415	0.286	-0.450	-1.792	0.261
Ties	0.665	0.295	0.039	-0.271	-1.300
Virtual ties	-0.636	1.372	-0.174	0.157	-0.331
Countermeasures	0.176	0.315	-0.691	0.591	-0.176
Stupors	0.005	-0.062	0.349	0.064	-0.320
The number of respondents	648	430	408	405	175
Percent constituent	31.4	20.8	19.7	19.6	8.5