

Overall Image of Nuclear Tests and Their Human Effects at Semipalatinsk: An Attempt at Analyses Based on Verbal Data[†]

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Nuclear test/Image/Verbal data/Testimony/Semipalatinsk/Principal component analysis.

The present paper is part of an attempt at finally reconstructing the realities of nuclear tests and their human effects near Semipalatinsk, Kazakhstan. As a first step, it tries to reconstruct the overall image of nuclear tests and their human effects. Our data are 199 written testimonies of those affected by radiation, which were collected in 2002 and 2003. We statistically processed them, and categorized those words and expressions, which occurred most frequently in the testimonies, and obtained some forty categories, which represent the experiences, feelings, desires of those affected by radiation. Next, we conducted a principal component analysis of the categories. The result shows: (1) The experiences of the nuclear tests are arranged along the time axis, with direct experiences of the nuclear tests forming one coherent part of the perception and memory, and with other subsequent experiences forming another. (2) Of the latter, we can discern a core of the experiences on human effects such as “disease,” “death,” “family,” “radiation,” and so on. (3) And around this core, we see two different trends: one pointing to the current distress and plight, and the other pointing to future fear and hope.

INTRODUCTION

The former Soviet Union conducted more than four hundred and fifty nuclear tests at the Semipalatinsk test site, Kazakhstan.^{1,2)} Many studies have been done on the physical and medical aspects of the nuclear tests and their human and ecological effects. Little or no social scientific or humanistic research has, however, been made on them. Even in Hiroshima and Nagasaki, such studies are hard to find and scattered.³⁾ Ours is the first and initial social scientific step toward the understanding of the realities of nuclear tests and their human effects near Semipalatinsk. Though this research does not deal directly with the radiation exposure,

we believe that it will contribute to the better understanding of radiation effects at Semipalatinsk.

MATERIALS

Since 2002, we have conducted questionnaire surveys of those affected by radiation near Semipalatinsk, Kazakhstan, as part of the research project of Research Institute for Radiation Biology and Medicine, Hiroshima University (RIRBM). The questionnaire contains the following open-ended question asking the respondents to write their experiences and feelings concerning the nuclear tests.

Please write about anything concerning the nuclear tests that cannot be forgotten, that still haunts you, that you regret, or any opinions about nuclear testing in detail in the space provided below. You may write about your experiences, or that of your family or your close neighbors. Also, if there is anything you wish to add or comment on the previous questions, please write them down here. (The original text is in Russian)

We collected 706 responses for the surveys, of which 468 contained what we call “testimonies,” that is, answers to the open-ended question above. Our research is based on these “testimonies.” Of these testimonies, we used 199 testimonies

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for the present research as is shown in Table 1, since we have not yet processed testimonies we collected in 2004. According to the previous studies, two of the five villages in Table 1, Sarjal and Dolon, were exposed to high doses and the other three villages received rather low doses,^{4,5)} as Table 2 shows. What follows is a sample testimony from a female in Sarjal born in 1946. All the testimonies collected in 2002 were previously reported.⁶⁾

Table 1. Number of Responses and “Testimonies”. Parentheses show the number of respondents

village	2002	2003	2004
Sarjal	48 (48)	20 (51)	68 (94)
Dolon	20 (28)	10 (51)	30 (79)
Kaynar	48 (48)	7 (26)	55 (74)
Kara-Aul		31 (50)	31 (50)
Znamenka		15 (24)	35 (50)
Our data = 199 testimonies			
Kokpekti	23 (47)	9 (50)	32 (97)
Burus			40 (50)
Bodene			45 (50)
Mostik			45 (50)
Cheremushky			41 (50)
Grachi			28 (30)
total	139 (171)	92 (252)	234 (280)
			465 (703)

Table 2. The Estimated Radiation Dose of the Five Villages

Village	Estimated Radiation Dose (Sv)	
	Gordeev <i>et al.</i> ⁴⁾	Rosenson <i>et al.</i> ⁵⁾
Sarjal	1.51	2.46
Dolon	1.30	4.47
Kara-Aul	0.83	0.87
Kaynar	0.12	0.68
Znamenka	No Data	0.62

For 25 years I worked as a nurse in Sarjal’s district hospital. Every year 2–3 people, sometimes 4–5 died from cancer. Together with the exhausted patients I myself had a hard time. In 1989 3500 people lived in the village, and the cases of suicide were also often encountered. I am convinced that the test site depresses the human body. My grandson is a cripple from birth. Although this land is contaminated, we do not want to abandon it, our homeland. It is time for the state to take care of us. (Translated from Russian).

These are the data we used for this research, though we must admit that our data are very limited in number. This is the first attempt at the reconstruction of the realities and experiences of nuclear tests and their effects on the basis of written texts.

METHODS AND PROCEDURES

Since our research is based upon written texts, some preliminary explanations and considerations are in order. We assume that we can reconstruct the factual realities of nuclear tests and their human effects, by starting with written texts, “testimonies” in our case. In dealing with written texts for the purpose of reconstructing realities, however, we must first make some general methodological considerations. There are a few similar approaches to verbal data such as content analysis, ethnomethodology, qualitative analysis and so on. Perhaps only the content analysis method is oriented toward an aggregate statistical method. Our method can be regarded as a kind of content analysis.

First of all, we assume the following process. As Fig. 1 illustrates, the realities of nuclear tests and their effects are stored in the memory of those affected and then expressed in words and/or language with possible distortions, deletions and additions. In the case of Semipalatinsk nuclear tests and their effects, they were experienced first. This is the first stage, which we call “reality.” Then, or at the same time, they were perceived and/or understood, and stored in memory. This is the second stage, which we call “perception” or “understanding” in general, or “memory” in particular. Next, they are expressed or represented in terms of some medium, overwhelmingly in terms of language. This is the third stage,

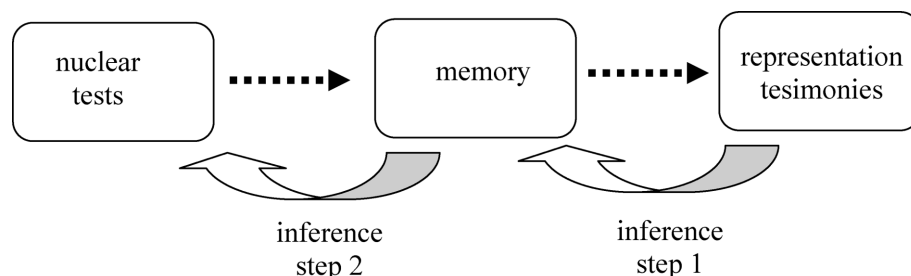


Fig. 1. Nuclear Tests, Memory and Representation. Source: Matsuo, M. *et al* 2004⁷⁾.

which we call “representation” in general and “testimony” in particular. Without this last, that is, verbal (or sometimes non-verbal) representation, we would have no means to know what the perception, understanding, or memory of the nuclear tests and their effects is like. And in this process, there is always a possibility or danger of intentional or unintentional distortions, deletions and additions in transition from one stage to the next.

All that we have at hand are verbal representations or testimonies in our case. So, we must start from the “representations,” or “testimonies,” that is, expressed words, and attempt to reconstruct, through perception or memory, the realities of nuclear tests and their human effects, though with possible errors due to our misunderstandings, bias of the data, translation errors and so on. In this research, we attempt the first step of reconstruction, that is, the reconstruction of the perception or memory of the experiences of nuclear tests and their effects, even if it is a very incomplete one.

WORD COUNTS AND CODING

In extracting the significant elements from the testimonies, we simply assumed that the frequencies of the words and/or phrases reflect the relevance or importance of the concepts represented by them. So, our first step was to create a list of words used in the data with their frequency counts. For this purpose, we used TERESA developed by one of the authors.⁷⁾ TERESA produces various word lists with the frequency counts, and it also outputs various citation lists as we

Table 3. Rank List of Words, source (extracts, function words excluded)

words	count
test	105
people	97
atomic	95
nuclear	83
site	83
tests	71
children	67
died	60
explosions	58
cancer	43
health	42
explosion	40
years	39
ill	37
consequences	36
saw	36
think	36
time	36
wish	36

Table 4. Coding and Preprocessing: Full-text Retrieval Sample Output for “(Ill) Health”

te, does not care about the so much damage to people’s the ones who are alive are ion. /My sister is mentally s. /There are many mentally ite is to blame for all the all the ill, related to my n. /And it has affected our our health. /All of us are thing was secret. /Now I am ened our lives. /All of our have certainly affected our thing was secret. /Now I am site is to blame for all my /Everybody in our family is ter who suffers from mental rs from mental illness. /My My children are now getting y. /It all has affected our ed from epilepsy, and /I am ird son suffers from mental heir bronchi and joints are hildren are born disable or d-field athlete, physically people in this village are ng. /When he fell seriously roken out. /My son was born	health of the people who use the mea health. /Now I experience the conseq ill. /The sovereign Kazakh land beca ill, she lags behind her peers, and ill and mentally handicapped people ill, related to my health. /During health. /During the explosions the g health. /All of us are ill. /It is i ill. /It is impossible to count up a ill myself, my two sons also suffer ill, and diseases are related to the health. /My eyesight is poor. /My pa ill myself, my son hanged himself, a ill. /Indisputably, every inhabitan ill, and I am especially worried abo illness. /My health is gone. /Day an health is gone. /Day and night, ther ill with the same diseases that I ha health. /I have pain in the joints a ill myself. /In 1953 some changes in illness. /My husband died from heart ill. /My grandchildren are on the ne ill. /Our children are grown-up, edu healthy and strong. /Many people in ill and disabled, some people don’t ill, he used to say he would recover ill with epilepsy in May 1957, and h	SR M 1931 SR F 1935 SR M 1934 SR F 1940 SR F 1945 SR M 1938 SR M 1938 SR F 1945 SR F 1945 SR M 1937 SR M 1930 SR F 1939 SR M 1935 SR M 1935 SR F 1936 SR F 1936 SR F 1943 SR F 1943 SR M 1938 SR M 1940 SR F 1941 DL F 1927 DL M 1948 DL M 1948 DL M 1948 DL F 1949 DL F 1936
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Table 5. Category List (part)

coded categories	word tokens (category included)
nuclear test	test, explosion, polygon
mushroom	all words meaning mushroom
flash	words meaning light or flash
quake	earthquake, shaking etc
blast	wind
window	
loss of hair	includes reference to animals
evacuation	content
military	soldiers, army, officers
notice	warning
announcement	
outdoors	

Other categories include: outdoor escape, abolition of nuclear weapons, aid/compensation, (ill) health, disease, cancer, death, family, parent, children, grandchildren, friends, effect, radiation, pollution, damage, disability, aftereffect, suicide, mind, life, peace, future

will see below in Table 4. Table 3 gives the rank list of words in the descending order, which occurred in our data.

But, different words and phrases are used to mean the same thing and one and the same word or phrase is used to mean different things. We must both identify words and phrases with the same meaning and distinguish meanings of

the same word or phrase. Through this process, we grouped words and phrases into a single concept such as “nuclear test.” In this process, we utilized a computer program developed by one of the authors in order to ascertain the meaning(s) of the words in each of their contexts. Table 4 shows a sample output of the program TERESA for the occurrences of “health” and/or “ill.” We utilized this kind of outputs to determine the meaning of particular occurrences of the word and the expression in question.

Through this process of merging and distinguishing occurrences (tokens) of words into categories, we established categories to be input to our analysis. Table 5 gives the list of categories we selected on the basis of frequency of occurrences, which we think represent most of the important experiences and their perceptions, feelings, desires of the people concerning nuclear tests and their effects, though we must admit that at present there are some doubtful cases.

We selected some forty concepts given in Table 5, and created a data matrix with each of the testimonies as a case. Each variable (category) in each case is assigned a binary value of one or zero according to the occurrence or non-occurrence of the category.

RESULTS AND DISCUSSIONS

The above data were input to a principal component analysis. Table 6 shows the part of the correlation matrix. Table 7 shows the factor loading scores for all the variables (categories in our cases) for the first three principal factors. Their eigenvalues, contribution rates and cumulative contribution

Table 6. Correlation Matrix (part)

	test	mush	flash	quake	blast	wnd	hair	evac	mil	notc	annc	outdr	escap
test	1.000	-.033	-.087	-.109	.001	.067	.124	.004	.068	-.175	.073	.065	-.013
mush	-.033	1.000	.237	.226	.033	.177	.105	.034	.072	.049	.100	.237	.219
flash	-.087	.237	1.000	.172	.167	-.011	.059	-.058	.072	.136	.154	.043	.273
quake	-.109	.226	.172	1.000	-.035	.186	.006	.104	.101	.079	.258	.070	.261
blast	.001	.033	.167	-.035	1.000	.003	.133	-.032	-.092	-.055	-.026	-.032	.093
wnd	.067	.177	-.011	.186	.003	1.000	-.047	.070	.266	.092	.083	.316	.392
hair	.124	.105	.059	.006	.133	-.047	1.000	.208	.026	-.000	-.036	.010	.066
evac	.004	.034	-.058	.104	-.032	.070	.208	1.000	.179	.189	-.060	.078	.098
mil	.068	.072	.072	.101	-.092	.266	.026	.179	1.000	.158	.056	.251	.291
notc	-.175	.049	.136	.079	-.055	.092	-.000	.189	.158	1.000	-.033	.242	.279
annc	.073	.100	.154	.258	-.026	.083	-.036	-.060	.056	-.033	1.000	.154	.194
outdr	.065	.237	.043	.070	-.032	.316	.010	.078	.251	.242	.154	1.000	.535
escap	-.013	.219	.273	.261	.093	.392	.066	.098	.291	.279	.194	.535	1.000

legend: test = nuclear test, mush = mushroom, wnd = window, hair = loss of hair, evac = evacuation, mil = military, notc = notice, annc = announcement, outdr = outdoors, escap = outdoor escape

Table 7. Principal Component Analysis Factor Loading Scores

coded categories	I	II	III
nuclear test	.4917	-.2330	.2003
mushroom	.1464	.4717	.1802
flash	.1234	.3136	.1115
quake	.0388	.4827	-.0117
blast	-.0721	.0881	.0679
window	.1912	.4679	.1469
loss of hair	.2855	.0872	-.2939
evacuation	.1265	.1637	-.5324
military	.2469	.4053	-.0448
notice	-.0044	.4219	-.2657
announcement	.0567	.3122	.2898
outdoors	.2368	.5595	-.0323
outdoor escape	.2956	.7040	.0564
abolition of nuclear weapons	.1870	-.3214	.4455
aid/compensation	.4265	-.1068	-.3195
(ill) health	.2876	-.3307	-.1407
disease	.6158	-.1096	.0035
cancer	.6125	.1027	-.0017
death	.7452	-.1368	-.0575
family	.6522	-.0068	.0641
parent	.6584	.1388	-.1154
children	.4744	-.2287	.2495
grandchildren	.2158	.0828	.3894
friends	.0818	.1149	.0084
effect	.4774	-.1240	-.0683
radiation	.0771	-.2443	-.1298
pollution	.1761	-.2155	-.3727
damage	.3299	-.1888	.0731
disability	.5908	.0579	-.1147
aftereffect	.2300	.0152	.4294
suicide	.1689	-.2373	-.3178
mind	.1929	-.0146	.0652
life	.2786	-.1208	-.2241
peace	.1612	-.1298	.3721
future	.1683	-.3424	.2212

rates are (4.347, 0.242, 0.1242), (2.841, 0.0812, 0.2053), and (1.903, 0.0544, 0.2597), respectively. The contribution values of the three factors are quite typical of those often found in this type of analysis. As can be seen from Table 7, the first factor is connected most strongly with “death”, “disease,” “cancer,” “family,” and “parent.” The second is strongly connected with “mushroom,” “quake,” “window,” and “outdoor (escape),” and the third with “abolition of nuclear weapons,” “peace,” “grandchildren,” and “aftereffect.” We, therefore, interpret the three factors as symbolizing “human damage,” “direct experience,” and “future hope and fear,” respectively. This would suggest that the continuing past and future impact on human body is perhaps the most important concern of survivors. The first factor does not map variables very well, since most variables correlate positively with it. We therefore used the second and third factors to show the configurations of the variables. Figure 2 shows the result of the plotting the values of these factors for all the variables. The tentative result suggests the existence of three main groupings of variables. On the basis of the principal component analysis of this kind, we can say that:

- (1) In the perception or memory of those exposed to radiation, the experiences of the nuclear tests are arranged along the time axis, with direct experiences of the nuclear tests forming one coherent part of the perception and memory, and with other subsequent experiences forming another.
- (2) Of the latter, we can discern a core of the experiences on human effects such as “disease,” “death,” “family,” “radiation,” and so on. As we suggested above, these are the core of survivors perception of nuclear tests.
- (3) And around this core, we see two different trends: one pointing to the current distress and plight, and the other pointing to future fear and hope.

Thus, we have obtained a provisional, tentative overall image (perception or memory) of the experiences of nuclear tests at Semipalatinsk nuclear test site.

To be sure, the image we obtained is a very crude one, due to various reasons such as the limitation of data, its bias and so on. It is only the first approximation. But the result seems intuitively reasonable. The methodology has not only produced three sensible factors, but the numerical estimates of the impacts of these factors. We believe that the method we adopted can be a useful tool and this kind of research will contribute to our further understanding of the experiences of those exposed to radiation near Semipalatinsk. We should of course collect many more testimonies to obtain a more reliable result. Moreover, we should make efforts toward greater methodological sophistication. Remember that in our present research we relied completely upon the raw type frequencies of the words. We should develop a more reliable way of coding and an indicator for the relevance or importance of the words used by respondents. In addition, we

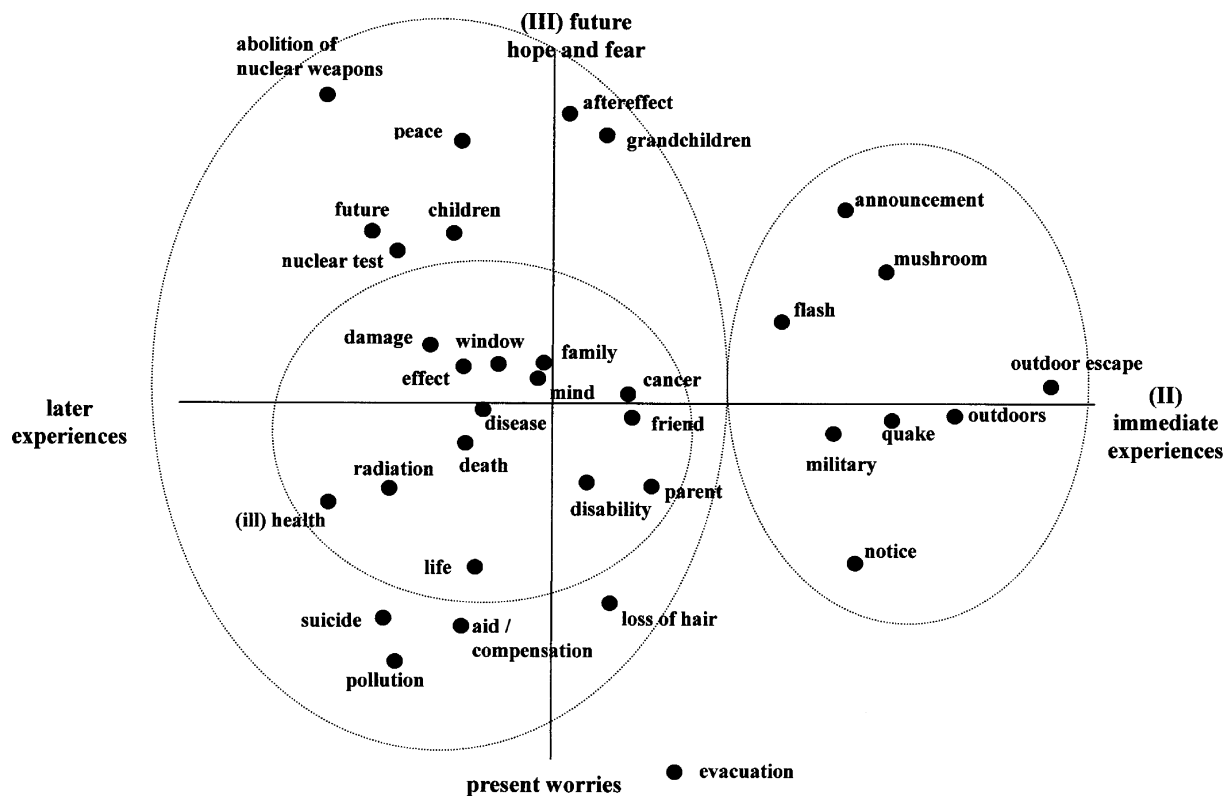


Fig. 2. Overall Images of Nuclear Tests and Their Human Effects

should validate, or of course invalidate, our results in terms of other data, for instance, other documentary sources whether official or unofficial, or medical and physical data.

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