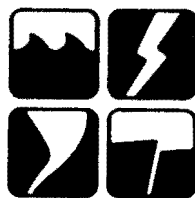


Natural Hazard Research

AVOIDANCE-RESPONSE TO THE
RISK ENVIRONMENT

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PREFACE

This paper is one in a series on research in progress in the field of human adjustments to natural hazards. It is intended that these papers will be used as working documents by the group of scholars directly involved in hazard research as well as inform a larger circle of interested persons. The series is now being supported from funds granted by the U.S. National Science Foundation to the University of Chicago and Clark University. Authorship of papers is not necessarily confined to those working at these institutions.

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AVOIDANCE-RESPONSE TO THE
RISK ENVIRONMENT*

Human behavior in response to threats arising from the natural environment has been a major focus of previous research.¹ In particular variations in the perception of flood and drought hazard have been studied especially in relation to the adoption of adjustments.² An outstanding question is the extent to which observed patterns of behavior are common to threats of all kinds or are specifically related to natural hazards.³ An historical survey by Glacken confirms that human attitudes to nature are complex and have changed in emphasis many times.⁴ The distinction between man and nature has sometimes been viewed as a crucial and fundamental dichotomy. Others have viewed man as essentially part of nature. Both these perceptions may be held concurrently and with varying degrees of emphasis.

It is proposed to make a field study in London, Ontario to examine human response to all environmental risks. Among other problems the study will be directed to testing the hypothesis that human behavior in response to natural hazards differs in significant ways from behavior arising from other sorts of threat. This study will be a second phase of a current analysis of the hazardousness of the London area now nearing completion.⁵

* The authors wish to acknowledge the help of Mrs. S. Goodwillie and Miss P. Crompton in running the experiment reported here and in the preparation of this paper. John Sims of the Department of Psychiatry, University of Chicago read the paper in draft form and made helpful comments and suggestions.

As a preliminary experiment a laboratory test has been carried out which seeks to compare the avoidance-response of subjects to a range of threats. Respondents were handed a test sheet listing the fifteen hazard "situations" as shown in Table 1, and were instructed to rank them.⁶

On the basis of an initial inspection of the data, it appeared that three of the "situations" or hazards (telling a lie, tooth extraction, lightning and thunderstorm) were regarded as essentially trivial or humorous by most of the respondents.⁷ These were therefore eliminated leaving a group of 12 hazard situations to be ranked. For this reason the rank scores reported below include numbers up to 15.

Four of the situations may be described as physical hazards in that they imply discomfort or injury to the person. The second group consists of four social hazards which imply injury or frustration of a psychic or non-physical kind. The third group of four natural hazards probably imply physical rather than psychic threat to most respondents, and to others they undoubtedly imply the possibility of both. The natural hazards are distinguished by the fact that they arise from the natural environment and not directly from man-made or social circumstances. It is this distinction that the experiment is designed to explore.

There has been relatively little research in this area, and there is certainly no body of theory to which hypotheses can be related. The responses reported here are probably a function of many variables. These include the connotations of the twelve hazard situations; the group's perception of the hazards and a range of characteristics of the individuals

TABLE 1THE AVOIDANCE-RESPONSE TEST

HERE ARE FIFTEEN SITUATIONS -
READ THROUGH THE LIST -
DECIDE ON THE SITUATIONS YOU MOST WANT TO AVOID
Rank them 1 to 15 by order of avoidance. Use (1) for
the situation you most want to avoid, and (15) for the
situation you least want to avoid.

- () THIRST
- () TELLING A LIE
- () BEING DISLIKED BY SOMEONE YOU ADMIRE
- () FOREST FIRE
- () EARTHQUAKE
- () ILLNESS
- () PUBLIC EMBARRASSMENT
- () FAILING IN SCHOOL OR JOB
- () AUTO ACCIDENT
- () TORNADO
- () TOOTH EXTRACTION
- () LIGHTNING AND THUNDER STORM
- () LONELINESS
- () FLOOD
- () BEING ATTACKED AND ROBBED

NOW UNDERLINE ANY OF THE ABOVE SITUATIONS THAT YOU HAVE
ACTUALLY EXPERIENCED.

themselves including the nature of their cognitive functioning or psychological make-up; their education; sophistication and educational resources; motivational characteristics; and general life style.⁸ Neither the situational nor the personality variables by themselves or taken together are sufficient to explain all variations in individual behavior. The interaction of the two sets of variables is also crucial for example in response to cognitive dissonance and uncertainty.⁹

In this study a very limited attempt is made to examine the role of individual attributes. In particular the presence or absence of experience, several socio-economic traits and two personality dimensions were considered. The main emphasis, however, is on group response to the various hazard situations.

Analysis of Hazard Situations

The sample of the study comprised 206 respondents each of whom had expressed their rank preferences of avoidance for each of the twelve hazard situations. To facilitate analysis the initial rankings were distributed into five classes and twelve frequency distributions were produced (Table 2). The rankings of 1 to 6 were chosen as representative of a respondent who "most wanted to avoid" a hazard situation.¹⁰ By this criterion it was possible to rank each hazard situation as shown in Table 3. The two physical designated situations of auto accident and being attacked and robbed were most frequently placed in the "greatest avoidance" class by the total sample of respondents while the social situation of being disliked by someone you admire and the physical situation, thirst, occupied the lowest positions. Between these opposite ranks there is an extreme

TABLE 2

AVOIDANCE DISTRIBUTIONS BY INDIVIDUAL HAZARD FOR THE TOTAL SAMPLE

Key: 1-3 Greatest Avoidance

PHYSICAL HAZARDS

Class	<u>Thirst</u>			<u>Illness</u>			<u>Auto Accident</u>			<u>Attacked</u>		
	No.	%	Cum.%	No.	%	Cum.%	No.	%	Cum.%	No.	%	Cum.%
1- 3	29	14.1	14.1	50	24.3	24.3	89	43.2	43.2	68	33.0	33.0
4- 6	26	12.6	26.7	45	21.8	46.1	71	34.5	77.7	59	28.6	61.6
7- 9	45	21.8	48.5	59	28.6	74.7	32	15.5	93.2	45	21.8	83.4
10-12	42	20.4	68.9	32	15.5	90.2	10	4.9	98.1	25	12.1	95.5
13-15	64	31.1	100.0	20	9.7	100.0	4	1.9	100.0	9	4.4	100.0

SOCIAL HAZARDS

Class	<u>Being Disliked</u>			<u>Embarrassment</u>			<u>Failing in School</u>			<u>Loneliness</u>		
	No.	%	Cum.%	No.	%	Cum.%	No.	%	Cum.%	No.	%	Cum.%
1- 3	35	17.0	17.0	32	15.5	15.5	67	32.5	32.5	42	20.4	20.4
4- 6	37	18.0	35.0	41	19.9	35.4	38	18.4	50.9	37	18.0	38.4
7- 9	27	13.1	48.1	46	22.3	57.7	51	24.8	75.7	30	14.5	52.9
10-12	66	32.0	80.1	56	27.2	84.9	40	19.4	95.1	46	22.3	75.2
13-15	41	19.9	100.0	31	15.1	100.0	10	4.9	100.0	51	24.8	100.0

NATURAL HAZARDS

Class	<u>Forest Fire</u>			<u>Earthquake</u>			<u>Tornado</u>			<u>Flood</u>		
	No.	%	Cum.%	No.	%	Cum.%	No.	%	Cum.%	No.	%	Cum.%
1- 3	48	23.3	23.3	55	26.7	26.7	51	24.8	24.8	20	9.7	9.7
4- 6	59	28.6	51.9	51	24.8	51.5	59	28.6	53.4	54	26.2	35.9
7- 9	51	24.8	76.7	48	23.3	74.8	45	21.8	75.2	53	25.7	61.6
10-12	35	17.0	93.7	38	18.4	93.2	39	18.9	94.1	55	26.7	88.3
13-15	13	6.3	100.0	14	6.8	100.0	12	5.8	100.0	24	11.7	100.0

TABLE 3

RANKING OF HAZARDS BASED ON RESPONDENTS (TOTAL SAMPLE)
GREATEST AVOIDANCE MEASURES (1-6)

<u>Rank</u>	<u>Hazard</u>	<u>No.</u>	<u>%</u>
1	Auto Accident (Physical)	160	77.7
2	Attacked and Robbed (Physical)	127	61.6
3	Tornado (Natural)	110	53.4
4	Forest Fire (Natural)	107	51.9
5	Earthquake (Natural)	106	51.5
6	Failing in School or Job (Social)	105	50.9
7	Illness (Physical)	95	46.1
8	Loneliness (Social)	79	38.4
9	Flood (Natural)	74	35.9
10	Public Embarrassment (Social)	73	35.4
11	Being Disliked by Someone You Admire (Social)	72	35.0
12	Thirst (Physical)	55	26.7

variance of attitude ranging from 77.7 to 26.7 per cent of respondents who greatly want to avoid these hazard situations. The three natural hazards were clustered in the upper avoidance ranks, while flood, the other member of this hazard group, occupied a much lower position. The social hazard situations generally were chosen less frequently to be greatly avoided than the other two groups.

It should be emphasized at this point and also for the subsequent analysis and conclusions of this paper that in speaking of "social", "physical", or "natural" hazards, only the particular hazards in this study are being considered. That is, it is not possible to speak of "social" hazards in general. If, for example, other social situations such as losing a spouse or being raped were included, they undoubtedly would occupy different (higher) avoidance ranks. It is also clear that it is necessary to define the precise character of any environmental "situation" before any conclusions or predictions can be made about the nature of the human response. No attempt was made to tell respondents what to think about "Flood" for example. Some respondents did ask questions such as "Is this a major flood or just a small one?". They were told to respond to the test as presented and not to seek further information.

Hazard Experience of Respondent

The respondents were asked to indicate which hazard situations they had actually experienced. Table 4 reveals the percentages of experienced and inexperienced respondents by situation. There is a very high degree of correspondence between the type of situation and the presence or absence of experience. The physical hazards have been the most experienced (three

TABLE 4HAZARD EXPERIENCE OF RESPONDENTS BY SITUATION

<u>Rank</u>	<u>Hazard</u>	<u>Experienced</u>		<u>Not Experienced</u>	
		<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>
1	Illness (Physical)	166	80.6	40	19.4
2	Loneliness (Social)	152	73.8	54	26.2
3	Thirst (Physical)	128	62.1	78	37.9
4	Auto Accident (Physical)	127	61.7	79	38.3
5	Public Embarrassment (Social)	108	52.4	98	47.6
6	Being Disliked by Someone You Admire (Social)	90	43.7	116	56.3
7	Failing in School or Job (Social)	68	33.0	138	67.0
8	Forest Fire (Natural)	29	14.8	177	85.2
9	Earthquake (Natural)	27	13.1	179	86.9
10	Flood (Natural)	27	13.1	179	86.9
11	Tornado (Natural)	19	9.2	187	90.8
12	Being Attacked and Robbed (Physical)	11	5.3	195	94.7

ranking in the top four); the social hazards occupy a somewhat intermediate position, and the natural hazards have been the least experienced (all four rank in the last five). In examining the relationship between Tables 3 and 4 a rank correlation of -0.43 was calculated. This would suggest that the relationship between "greatest avoidance of hazard situation" and experience is an inverse one.

In order to examine this result in greater depth Table 4 was subdivided by inexperienced and experienced hazard respondents creating Tables 5 and 6. Each of the situations in these two tables were then ranked on the basis of "greatest avoidance" frequencies as done previously with the complete study sample.

In recalling the rankings of the complete sample, there was a distinctive correspondence in avoidance response to each of the natural hazard situations. This was true also for the social hazards but not for the physical hazards which contributed to the extreme ranges of response. In examining Tables 7 and 8 quite a different pattern emerges. For both the experienced and inexperienced respondents, physical hazards evoke a very homogeneous response. Social hazards, on the other hand, while displaying fairly consistent ranks for the inexperienced respondents have a large range of response for the experienced respondents. Even more striking is the diverse "greatest avoidance" responses among the natural hazards for the inexperienced respondents. This is not the case, and homogeneity in response is apparent for the experienced natural hazard respondents. This suggests that, in understanding and predicting response to hazard situations from samples of respondents, "the presence of hazard

TABLE 5

FREQUENCY DISTRIBUTIONS OF EXPERIENCED HAZARD PARTICIPANTS

Key: 1-3 Class (Greatest Avoidance)

PHYSICAL HAZARDS

Class	<u>Thirst (128)</u>			<u>Illness (166)</u>			<u>Auto Accident(127)</u>			<u>Attacked (11)</u>		
	No.	%	Cum.%	No.	%	Cum.%	No.	%	Cum.%	No.	%	Cum.%
1 -3	15	11.8	11.8	39	23.5	23.5	48	37.8	37.8	3	27.3	27.3
4- 6	11	8.6	20.4	36	21.7	45.2	43	33.9	71.7	2	18.2	45.5
7- 9	30	23.4	43.8	49	29.5	74.7	26	20.5	92.2	5	45.5	91.0
10-12	21	16.4	60.2	26	15.7	90.4	7	5.5	97.7	1	9.1	100.0
13-15	51	39.8	100.0	16	9.6	100.0	3	2.3	100.0	0	0.0	100.0

SOCIAL HAZARDS

Class	<u>Being Disliked(90)</u>			<u>Embarrassment(108)</u>			<u>Failing School(68)</u>			<u>Loneliness (152)</u>		
	No.	%	Cum.%	No.	%	Cum.%	No.	%	Cum.%	No.	%	Cum.%
1- 3	19	21.1	21.1	19	17.6	17.6	26	38.2	38.2	35	23.0	23.0
4- 6	15	16.7	37.8	16	14.8	32.4	14	20.6	58.8	27	17.8	40.8
7- 9	15	16.7	54.5	21	19.4	51.8	16	23.5	82.3	24	15.8	56.6
10-12	25	27.8	82.3	37	34.3	86.1	11	16.2	98.5	33	21.7	78.3
13-15	16	17.8	100.0	15	13.9	100.0	1	1.5	100.0	33	21.7	100.0

NATURAL HAZARDS

Class	<u>Forest Fire (29)</u>			<u>Earthquake (27)</u>			<u>Tornado (19)</u>			<u>Flood (27)</u>		
	No.	%	Cum.%	No.	%	Cum.%	No.	%	Cum.%	No.	%	Cum.%
1- 3	8	27.6	27.6	4	14.8	14.8	1	5.3	5.3	0	0.0	0.0
4- 6	12	41.4	69.0	4	14.8	29.6	6	31.6	36.9	6	22.2	22.2
7- 9	5	17.2	86.2	8	29.6	59.2	4	21.0	57.9	11	40.7	62.9
10-12	2	6.9	93.1	7	25.9	85.1	4	21.0	78.9	6	22.2	85.1
13-15	2	6.9	100.0	4	14.8	100.0	4	21.0	100.0	4	14.8	100.0

TABLE 6
FREQUENCY DISTRIBUTIONS OF INEXPERIENCED HAZARD PARTICIPANTS

Key: 1-3 Class (Greatest Avoidance)

PHYSICAL HAZARDS

<u>Class</u>	<u>Thirst (78)</u>			<u>Illness (40)</u>			<u>Auto Accident (79)</u>			<u>Attacked (195)</u>		
	<u>No.</u>	<u>%</u>	<u>Cum.%</u>	<u>No.</u>	<u>%</u>	<u>Cum.%</u>	<u>No.</u>	<u>%</u>	<u>Cum.%</u>	<u>No.</u>	<u>%</u>	<u>Cum.%</u>
1- 3	14	17.9	17.9	11	27.5	27.5	41	51.9	51.9	65	33.3	33.3
4- 6	15	19.2	37.1	9	22.5	50.0	28	35.4	87.3	57	29.2	62.5
7- 9	15	19.2	56.3	10	25.0	75.0	6	7.6	94.9	40	20.5	83.0
10-12	21	26.9	83.2	6	15.0	90.0	3	3.8	98.7	24	12.3	95.3
13-15	13	16.7	100.0	4	10.0	100.0	1	1.3	100.0	9	4.6	100.0

SOCIAL HAZARDS

<u>Class</u>	<u>Beind Disliked(116)</u>			<u>Embarrassment (98)</u>			<u>Failing School(138)</u>			<u>Loneliness (54)</u>		
	<u>No.</u>	<u>%</u>	<u>Cum.%</u>	<u>No.</u>	<u>%</u>	<u>Cum.%</u>	<u>No.</u>	<u>%</u>	<u>Cum.%</u>	<u>No.</u>	<u>%</u>	<u>Cum.%</u>
1- 3	16	13.8	13.8	13	13.3	13.3	41	29.7	29.7	7	13.0	13.0
4- 6	22	19.0	32.8	25	25.5	38.8	24	17.4	47.1	10	18.5	31.5
7- 9	12	10.3	43.1	25	25.5	64.3	35	25.4	72.5	6	11.1	42.6
10-12	41	35.3	78.4	19	19.4	83.7	29	21.0	93.5	13	24.1	66.7
13-15	25	21.6	100.0	16	16.3	100.0	9	6.5	100.0	18	33.3	100.0

NATURAL HAZARDS

<u>Class</u>	<u>Forest Fire (177)</u>			<u>Earthquake (179)</u>			<u>Tornado (187)</u>			<u>Flood (179)</u>		
	<u>No.</u>	<u>%</u>	<u>Cum.%</u>	<u>No.</u>	<u>%</u>	<u>Cum.%</u>	<u>No.</u>	<u>%</u>	<u>Cum.%</u>	<u>No.</u>	<u>%</u>	<u>Cum.%</u>
1- 3	40	22.6	22.6	51	28.5	28.5	50	26.7	26.7	20	11.2	11.2
4- 6	47	26.6	49.2	47	26.3	54.8	53	28.3	55.0	48	26.8	38.0
7- 9	46	26.0	75.2	40	22.3	77.1	41	21.0	76.9	42	23.5	61.5
10-12	33	18.6	93.8	31	17.3	94.4	35	18.7	95.6	49	27.4	88.9
13-15	11	6.2	100.0	10	5.6	100.0	8	4.3	100.0	20	11.2	100.0

TABLE 7
RANKING OF HAZARDS BASED ON EXPERIENCED RESPONDENTS
GREATEST AVOIDANCE MEASURES (1-6)

<u>Rank</u>	<u>Hazard</u>	<u>No.</u>	<u>%</u>
1	Auto Accident (Physical)	91	71.7
2	Forest Fire (Natural)	20	69.0
3	Failing in School or Job (Social)	40	58.8
4	Attacked and Robbed (Physical)	5	45.5
5	Illness (Physical)	75	45.2
6	Loneliness (Social)	62	40.8
7	Being Disliked by Someone You Admire (Social)	34	37.8
8	Tornado (Natural)	7	36.9
9	Public Embarrassment (Social)	35	32.4
10	Earthquake (Natural)	8	29.6
11	Flood (Natural)	6	22.2
12	Thirst (Physical)	26	20.4

TABLE 8
RANKING OF HAZARDS BASED ON INEXPERIENCED RESPONDENTS
GREATEST AVOIDANCE MEASURES (1-6)

<u>Rank</u>	<u>Hazard</u>	<u>No.</u>	<u>%</u>
1	Auto Accident (Physical)	69	87.3
2	Attacked and Robbed (Physical)	122	62.5
3	Tornado (Natural)	103	55.0
4	Earthquake (Natural)	98	54.8
5	Illness (Physical)	20	50.0
6	Forest Fire (Natural)	87	49.2
7	Failing in School or Job (Social)	65	47.1
8	Public Embarrassment (Social)	38	38.8
9	Flood (Natural)	68	38.0
10	Thirst (Physical)	29	37.1
11	Being Disliked by Someone You Admire (Social)	38	32.8
12	Loneliness	17	31.5

experience" could be very useful for predicting responses to physical and natural hazards but not for social hazards. Being aware that a group is inexperienced with regard to particular hazard situations should lead to better prediction for social and physical hazards but not for natural hazards. For the latter, there is suggestion that other factors are in operation.

The avoidance rankings of the inexperienced respondents (Table 8) varies substantially from those of the experienced for the individual hazard situations. The rank size correlation between the two sets of responses (Table 9) is only 0.45. While several of the situation ranks remained constant, irrespective of the experience factor, others showed substantial shifts in position. This is the case for the situations of tornado, earthquake, forest fire, failing in school or job, being disliked by someone you admire, and loneliness.

In order to examine more closely the direction and magnitude of the change in attitude to a hazard situation occurring as a result of the experience factor, the greatest avoidance percentage frequencies (classes 1-6) of the experienced and inexperienced respondents were compared for each hazard situation. These are summarized in Table 10.

Physical Hazards: Without exception, for all four physical hazards the inexperienced respondents indicated far more strongly their desire to avoid these hazards than did the experienced group. For the thirst situation, for example, over 37 per cent of the inexperienced respondents greatly wanted to avoid the situation compared to only 20.4 per cent of these respondents who had previously experienced thirst. This percentage

TABLE 9

RANK COMPARISONS OF EXPERIENCED AND INEXPERIENCED RESPONDENTS
ON GREATEST AVOIDANCE MEASURES

<u>Hazard</u>	<u>Experienced</u>	<u>Not Experienced</u>
Auto Accident (Physical)	1	1
Forest Fire (Natural)	2	6
Failing in School or Job (Social)	3	7
Attacked and Robbed (Physical)	4	2
Illness (Physical)	5	5
Loneliness (Social)	6	12
Being Disliked by Someone You Admire (Social)	7	11
Tornado (Natural)	8	3
Public Embarrassment (Social)	9	8
Earthquake (Natural)	10	4
Flood (Natural)	11	9
Thirst (Physical)	12	10

TABLE 10

GREATEST AVOIDANCE PERCENTAGE FREQUENCIES
OF EXPERIENCED AND INEXPERIENCED RESPONDENTS

Hazard Group	Situation	Inexp.	Exp.	Diff.	Sig. Level
Physical	Thirst	37.1	20.4	-16.7	$\alpha = .005$
	Illness	50.0	45.2	- 4.8	Not sig.*
	Auto Accident	87.3	71.7	-15.6	$\alpha = .005$
	Being Attacked and Robbed	62.5	45.5	-17.0	Not sig.*
Social	Being Disliked by Someone You Admire	32.8	37.8	+ 6.0	Not sig.*
	Public Embarrassment	38.8	32.4	- 6.2	Not Sig.*
	Failing in School or Job	47.1	58.8	+11.7	$\alpha = .10$
	Loneliness	31.5	40.8	+ 9.3	Not Sig.*
Natural	Forest Fire	49.2	69.0	+19.8	$\alpha = .05$
	Earthquake	54.8	29.6	-25.2	$\alpha = .01$
	Tornado	55.0	36.9	-18.1	$\alpha = .10$
	Flood	38.0	22.2	-15.8	$\alpha = .05$

*Not significant at $\alpha = .10$

change as well as the decrease for the situation of being attacked and robbed are both highly statistically significant.

Social Hazards: With the exception of the public embarrassment situation, the direction of change in avoidance levels between inexperienced and experienced respondents was opposite to physical hazards. The magnitude of change was also less and only failing in school or job incurred a change which was statistically significant ($\alpha = .10$). There is a clear indication then that those who have experienced these social hazards have a stronger desire to avoid them in the future than those who have not.

Natural Hazards: With the exception of the forest fire situation there is perhaps surprisingly overwhelming evidence suggesting that those who have not experienced the natural hazard have a greater tendency to want to avoid it in the future. The suggestion perhaps is that those who have experienced these hazards have found them not as bad or frightening as the uninitiated conceive them to be. Alternatively, they may have some confidence that they will be able to avoid these natural hazards in the future, either by their own efforts or because they perceive the probability of another experience as extremely low. The difference in greatest avoidance levels was very great and all four percentage changes were statistically significant.

Avoidance-Level of Hazard Groupings

As natural, social and physical hazards are usually studied and analyzed independently of each other, it is useful to examine the individual hazard situations in their group context. A re-examination of Table 3 reveals the varying levels of homogeneity in the natural, physical, and social

hazard groups based on the "greatest avoidance" measures of individual situations. The natural hazards clearly represent the most homogeneous group followed by social hazards. The range of measures in the physical group is, however, quite extreme. The grouping analysis should then be considered given this limitation.

The grouping analysis involved the aggregation of each respondent's ranks given for the four hazard situations in each hazard group. A measure of an individual's avoidance was thereby determined for each of the three hazard groups. If, for example, a respondent ranked thirst as 4, illness as 3, auto accident as 6, and being attacked and robbed as 9, he would have an aggregate avoidance score of 22 for physical hazards. The values of the avoidance scores range from 10 ($4 + 3 + 2 + 1$) to 54 ($15 + 14 + 13 + 12$) and have been grouped into nine classes to produce frequency distributions. These are listed in Table 11 and graphically represented in Figure 1. If the distinction between natural and non-natural hazards has any meaning for the respondents it might be expected that the frequency distributions would differ substantially in shape. In fact the greatest contrast is between physical hazards on the one hand and social and natural on the other. The physical hazards distribution is very symmetrical or bell-shaped and has a coefficient of skewness of -0.15. The social and natural hazards groups and especially the latter can be more correctly described as rectangular distributions; they have coefficients of skewness of -0.28 and 0.22 respectively. The physical hazard ogive in Figure 1 shows the common S-shaped curve of the symmetrical distribution with a somewhat overly flattened upper tail. The ogive of the social hazards distribution displays a much more

TABLE 11

FREQUENCY DISTRIBUTION OF AVOIDANCE SCORES

Key: 10-14 Greatest Avoidance

Physical Hazards

<u>Class</u>	<u>Number</u>	<u>Cumulative Number</u>	<u>Percent</u>	<u>Cumulative Percent</u>
10-14	7	7	3.4	3.4
15-19	31	38	15.0	18.4
20-24	38	76	18.4	36.9
25-29	55	131	26.7	63.6
30-34	50	181	24.3	87.9
35-39	21	202	10.2	98.1
40-44	4	206	1.9	100.0
45-49	0	206	0.0	100.0
50-54	0	206	0.0	100.0

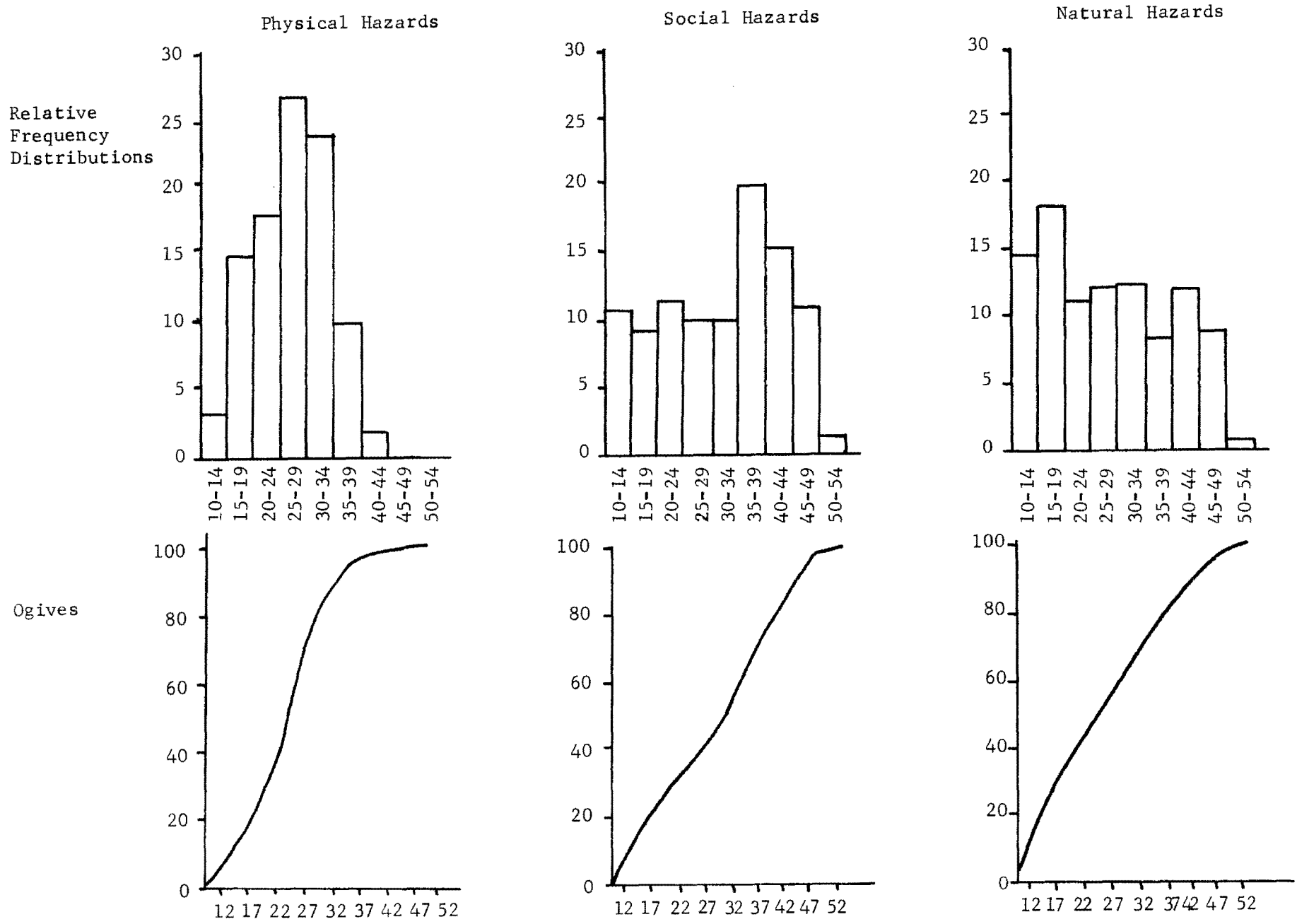
Social Hazards

<u>Class</u>	<u>Number</u>	<u>Cumulative Number</u>	<u>Percent</u>	<u>Cumulative Percent</u>
10-14	22	22	10.7	10.7
15-19	19	41	9.2	19.9
20-24	24	65	11.7	31.6
25-29	21	86	10.2	41.7
30-34	21	107	10.2	51.9
35-39	41	148	19.9	71.8
40-44	32	180	15.5	87.4
45-49	23	203	11.2	98.5
50-54	3	206	1.5	100.0

Natural Hazards

<u>Class</u>	<u>Number</u>	<u>Cumulative Number</u>	<u>Percent</u>	<u>Cumulative Percent</u>
10-14	30	30	14.6	14.6
15-19	38	68	18.4	33.0
20-24	23	91	11.2	44.2
25-29	25	116	12.1	56.3
30-34	26	142	12.6	68.9
35-39	17	159	8.3	77.2
40-44	25	184	12.1	89.3
45-49	18	202	8.7	98.1
50-54	4	206	1.9	100.0

FIGURE 1. FREQUENCY DISTRIBUTIONS OF AVOIDANCE SCORES



gradual and irregular slope with the natural hazards ogive showing a very smooth, almost straight, curve. These curves indicate that for the physical hazards group there is a very uneven and concentrated distribution of attitudes while for the social and natural hazards, with the exception of the 50-54 class, there is a relatively even distribution with all "levels" being well represented.

The mean "avoidance level" of each hazard represents one statistical measure, albeit a crude one, for comparing the three distributions. The three means for the physical, social and natural hazard groups are respectively, 26.4, 31.3, and 27.8.⁵ The much higher social hazards mean suggests that this group of hazards ranks third in terms of the desire of the respondent sample to avoid this type of hazard. The means of the physical and natural hazard groups are very similar and statistically are significantly different only at the $\alpha = .10$ level.¹¹

A more revealing analysis of the distributions comes from examining the individual class intervals. In order to facilitate comparability with the individual hazard situation analysis, the first three classes were consolidated and have been referred to as the group greatest avoidance level (Table 12).

TABLE 12

<u>Hazard Group</u>	<u>Group Greatest Avoidance Level</u>
Physical	36.9%
Social	31.6%
Natural	44.2%
Average	37.5%

The highest percentage in the greatest avoidance class is found in the natural hazards distribution with 44.2% of the sample in this group. Second is the physical hazard group with 36.9% and third, the social hazards group with 31.6%. It perhaps can be argued that the greatest avoidance class group should include the 25-29 class interval. In this case, the situation would be reversed with physical hazards ranking first with 63.6% and natural hazards second with 56.3%. The interpretation of these distributions depends to a large extent on the significance placed on the "rank values" by the respondents. It can be suggested, for example, that with the exception of the first six or seven ranks, the adjacent rank values represent a rather vague indecisive grey zone of response in regard to the respondent's "greatest avoidance" evaluation procedure.

The results demonstrate clearly that for this group of respondents the natural and physical hazards are most to be avoided. If attention is focussed on the first few choices or the extremely high values of avoidance, then it seems that the natural hazards provoke a greater avoidance-desire than the physical hazards group.

Hazard Group Avoidance Levels and Socio-Economic Characteristics

The second factor employed in the search for pattern and explanation among the individual's responses was his socio-economic status. In addition, then, to answering questions about "experience", the respondents replied to some standard socio-economic questions (Table 13). These data are compared in Table 14 with the group greatest avoidance levels. Observed and expected (actual proportion of respondents in socio-economic group) percentages in the various socio-economic categories are compared. Various statistical tests

TABLE 13SOCIO-ECONOMIC CHARACTERISTICS OF AVOIDANCE TEST DATA

206 Respondents

<u>Category</u>	<u>Division</u>	<u>No.</u>	<u>Percentage</u>
Sex	Male	121	58.7
	Female	85	41.3
Occupation	Blue Collar	0	0.0
	White Collar	14	6.8
	Student	62	30.1
	Professional-Managerial	126	61.2
	Other	4	1.9
Nationality	Toronto	54	26.2
	Other Canada	82	39.8
	U.S.A.	23	11.2
	Europe & Soviet	37	18.0
	Non-European	10	4.9
Travel	U.S. and/or Canada	78	37.9
	U.S. / Foreign	20	9.7
	U.S./Can./Foreign	108	52.4
Age	Under 25 years	85	41.3
	26-35	74	35.9
	36-45	34	16.5
	46 or over	13	6.3

TABLE 14

GREATEST AVOIDANCE LEVEL

Socio-Economic Representation by Hazard Group

O = Observed Percentage E = Expected Percentage D = Difference

	E	<u>Physical</u>		<u>Social</u>		<u>Natural</u>	
		O	D	O	D	O	D
SEX:							
Male	58.7	63.2	+4.5	60.0	+1.3	58.6	-0.1
Female	41.3	36.8	-4.5	40.0	-1.3	41.4	+0.1
OCCUPATION:							
White Collar	6.8	6.6	-0.2	9.2	+2.4	7.8	+1.0
Student	30.1	34.2	+4.1	32.3	+2.2	30.6	+0.5
Prof.-Manag.	61.2	57.9	-3.3	58.5	-2.7	60.3	-0.9
Other	1.9	1.3	-0.6	0.0	-1.9	1.3	-0.6
NATIONALITY:							
Toronto	26.2	23.7	-2.5	27.7	+1.5	26.3	+0.1
Other Canadian	39.8	40.8	+1.0	41.5	+1.7	39.7	-0.1
U.S.A.	11.2	17.1	+5.9*	9.2	-2.0	12.1	+0.9
Europe-Soviet	18.0	17.1	-0.9	18.5	+0.5	18.1	+0.1
Non-European	4.9	1.3	-3.6*	3.1	-1.8	3.9	-1.0
AGE:							
Under 25	41.3	39.5	-1.8	43.1	+1.8	41.8	+0.5
26-35	35.9	35.5	-0.4	35.4	-0.5	33.2	-2.7
36-45	16.5	19.7	+3.2	15.4	-1.1	18.5	+2.0
46 and over	6.3	5.3	-1.0	6.1	-0.2	6.5	+0.2

* Significant at $\alpha = .10$ level

were applied to these data in order to evaluate the statistical significance of the results. With the exception of United States and non-European nationals, none of the other socio-economic categories displayed statistically significant deviations from the expected. In addition neither sex, occupation, nationality or age treated as whole groups were significantly either over- or under-represented. The major conclusion from this analysis is that irrespective of these common socio-economic categories there is apparent homogeneity in the attitudes of respondents to avoiding natural, social and, for the most part, physical hazards. While variations may exist, they are not revealed by this study. More significant results might have been obtained if variables describing the intellectual capacities of the respondents such as education or intelligence had been examined.¹²

The Personality Factor

Previous research has suggested that human response to natural hazards is related to a personality variable.¹³ In order to examine this hypothesis 62 subjects of the larger 206 sample group were given an Eysenck Personality Inventory test. "This test measures personality in terms of two pervasive, independent dimensions. These dimensions are identified as extraversion-introversion (E) and neuroticism-stability (N). Each of these traits is measured by means of 24 questions, selected on the basis of item and factor analysis to which the examinee answers 'Yes' or 'No'."¹⁴ On the basis of this test each of the 62 respondents were given scores for the E and N personality factors.¹⁵ Each of these two scores was then correlated with the avoidance scores of all the study's respondents (206) and also with those respondents with the "group greatest avoidance scores" (i.e. 10-24). Table 15

TABLE 15

FREQUENCY DISTRIBUTION OF AVOIDANCE SCORES (62 RESPONDENTS)PERSONALITY TEST SUBSAMPLEPhysical Hazards

<u>Class</u>	<u>Number</u>	<u>Cumulative Number</u>	<u>Percent</u>	<u>Cumulative Percent</u>
10-14	2	2	3.2	3.2
15-19	10	12	16.1	19.4
20-24	8	20	12.9	32.3
25-29	19	39	30.6	62.9
30-34	15	54	24.2	87.1
35-39	6	60	9.7	96.8
40-44	2	62	3.2	100.0
45-49	0	62	0.0	100.0
50-54	0	62	0.0	100.0

Social Hazards

<u>Class</u>	<u>Number</u>	<u>Cumulative Number</u>	<u>Percent</u>	<u>Cumulative Percent</u>
10-14	4	4	6.5	6.5
15-19	4	8	6.5	12.9
20-24	10	18	16.1	29.0
25-29	4	22	6.5	35.5
30-34	6	28	9.7	45.2
35-39	11	39	17.7	62.9
40-44	11	50	17.7	80.6
45-49	12	62	19.4	100.0
50-54	0	62	0.0	100.0

Natural Hazards

<u>Class</u>	<u>Number</u>	<u>Cumulative Number</u>	<u>Percent</u>	<u>Cumulative Percent</u>
10-14	10	10	16.1	16.1
15-19	16	26	25.8	41.9
20-24	8	34	12.9	54.8
25-29	8	42	12.9	67.7
30-34	7	49	11.3	79.0
35-39	5	54	8.1	87.1
40-44	2	56	3.2	90.3
45-49	6	62	9.7	100.0
50-54	0	62	0.0	100.0

showing the frequency distribution of avoidance scores reveals the 62 respondents displayed almost an identical distribution of avoidance levels as the larger 206 sample group. Conclusions, therefore, regarding this sample can reasonably be extended to the larger sample.

Statistically the results were disappointing with only the physical hazards sample of "greatest avoiders" (G.A.) showing a "significant" correlation ($\alpha = .05$) with the measure of extraversion (Table 16).¹⁶ Of some importance is the noticeable increase in all the correlation coefficients when only the G.A. samples are considered. One must be wary of putting too much weight on this observation given that the correlations for both groups of samples (with exception of physical hazards pair) are statistically insignificant. Also noticeable are the sign directions of the coefficients but these too must be considered with caution.

These results suggest that other measures and tests of personality should be employed.¹⁷

Table 17 summarizes the means of the E and N measures for each G.A. hazard group. On the former, the natural G.A. group has the highest mean extravert value followed by the physical and social G.A. On the latter, on the other hand, the natural G.A. sample occupied a middle position between the social G.A. group with the highest N value and the physical G.A. with the lowest.

Summary of Results

Despite the fact that respondents were "forced" to rank situations in terms of "greatest avoidance" nevertheless the extreme range of attitudes among respondents wanting to avoid these situations (from 26.7 to 77.7%) suggests the

TABLE 16

CORRELATIONS BETWEEN AVOIDANCE AND PERSONALITY SCORES

	Physical Hazards All Scores	Social Hazards All Scores	Natural Hazards All Scores	Physical Hazards G.A.*Only	Social Hazards G.A.*Only	Natural Hazards G.A.*Only	E	N
E	0.21	0.00	-0.18	0.55 ⁺	-0.41	-0.29	1.00	**
N	0.12	-0.11	0.02	0.19	-0.18	-0.18	**	1.00

* Greatest Avoidance Scores Only

** For all situations E on N $r = 0.13$ confirming validity of personality measures.

⁺ Significant at $\alpha = .05$

TABLE 17

GROUP GREATEST AVOIDANCE SAMPLE PERSONALITY MEANS

Means*	E	N
Physical G.A. Sample (20)	9.3	7.4
Social G.A. Sample (18)	8.8	10.2
Natural G.A. Sample (34)	10.4	8.6

* All combinations of means were shown to be statistically significantly different at $\alpha = .01$

importance of environmental situation in understanding and predicting human response.

The variance in attitude was greatest among the physical hazards and least among the natural hazards with the social hazards occupying an intermediate position. On the basis of these situations and this group of respondents, the natural hazards represent the most homogeneous group. This pattern changed considerably when the experience-inexperience dichotomous "greatest avoidance" samples were treated separately. In terms of the avoidance rankings, physical hazards evoked a generally homogeneous response in both samples. This was true only for the inexperienced and experienced samples of the social and natural hazards respectively.

For this sample and this group of situations, physical, social, and natural hazards appear to be most clearly differentiated by the factor of experience. The physical hazards have been the most experienced and the natural hazards the least.

Between the experienced and inexperienced respondents, there is a considerable difference in their attitudes to the hazard situation. For the physical and natural hazards there is a strong indication that inexperienced hazard respondents desire far more strongly to avoid these situations than the experienced group. For social hazards just the opposite is true although the direction magnitude is not as great.

When the situations are grouped according to their traditional divisions of natural, social, and physical hazards, the results pointed to the remarkably strong desire to avoid natural hazards. The commonsense expectation that natural hazards are regarded in ways similar to physical hazards and distinctively different from social hazards appears to be well supported.

There appears to be little or no significant variation in the response to any of the hazard situations on the basis of several socio-economic variables. It is possible, however, that other variables such as intelligence, education, or general level of sophistication might prove to be more effective.

There was little or no statistically significant relationship between two personality dimensions and a respondent's avoidance level. The natural hazards "greatest avoiders", however, have a higher average level of extraversion than either the physical or social group. They occupy a median position in terms of the neuroticism-stability measure. Other personality measures of motivation and alienation might provide better results.

FOOTNOTES

1. See, for example, Ian Burton, Robert Kates, and Rodman Snead, The Human Ecology of Coastal Flood Hazard in Megalopolis, Department of Geography Research Paper No. 115 (Chicago: Department of Geography, University of Chicago, 1969).
2. Robert William Kates, Hazard and Choice Perception in Flood Plain Management, Department of Geography Research Paper No. 78 (Chicago: Department of Geography, University of Chicago, 1962).
Thomas Saarinen, Perception of the Drought Hazard on the Great Plains, Department of Geography Research Paper No. 106 (Chicago: Department of Geography, University of Chicago, 1966).
3. Ian Burton, Robert W. Kates, and Gilbert F. White, The Human Ecology of Extreme Geophysical Events, Natural Hazard Research Working Paper No. 1 (Toronto: Department of Geography, University of Toronto, 1968).
4. Clarence J. Glacken, Traces on the Rhodian Shore (Berkeley, Calif.: University of California Press, 1967).
5. Kenneth Hewitt and Ian Burton, The Hazardousness of a Place: Extreme Events in London, Ontario (forthcoming publication in Department of Geography, University of Toronto Publication Series).
6. The test as originally devised by Robert W. Kates has been used with minor modifications. It was accompanied by a request for additional information on sex, age, occupation, place of birth and residence and amount of travel.
7. In the case of certain individual respondents this response may imply the opposite--it suggests the possible operation of conscious and unconscious defense mechanisms. The focus of this experiment, however, is on variations in response of the whole group and not on individual differences.
8. Kurt Lewin, Field Theory in Social Science (London: Tavistock Publications, 1952).
Richard S. Lazarus, Psychological Stress and the Coping Process (Toronto: McGraw-Hill Co., 1966), pp. 31-148.
Julian Wolpert, "Behavioral Aspects of the Decision to Migrate," Papers and Proceedings of the Regional Science Association, XV (1965), 159-169.
9. J. McV. Hunt, "Traditional Personality Theory in the Light of Recent Evidence," American Scientist, 53 (March, 1956), 80-96; and Douglas H. K. Lee, "The Role of Attitude in Response to Environmental Stress," Journal of Social Issues, XXII, 4 (October, 1966), 83-91.

10. It is possible to focus the analysis on either one and/or both the upper tail (greatest avoidance) and lower tail (least avoidance) of the rank distribution. This study will concern itself with the upper tail principally because of the structure of the test schedule which emphasized the attitude of "most wanting to avoid" and secondly, of the two tails, it probably encourages the clearest response "signal" (that is, the most emphatic, least hazy response.)
11. At $\alpha = .002$ the null hypothesis $\mu_1 = \mu_2$ and $\mu_1 = \mu_2$ can both be rejected (one-tailed test).
12. See Lazarus, op cit., pp. 120-149.
13. See, for example, Roy Lachman, Maurice Tatsuoka, and William J. Bonk, "Human Behaviour During the Tsunami of May, 1960," Science, 133 (May 5, 1961), pp. 1405-1409.
14. For a description of this test and supporting references see H. J. Eysenck, and Sybil B. G. Eysenck, Manual for the Eysenck Personality Inventory (San Diego: Educational and Industrial Testing Service, 1968).
15. High E scores are indicative of extraversion. High N scores are indicative of emotional lability and overreactivity.
16. The correlation results, however, do confirm the validity of this particular personality test. E on N by nature of their construction should be statistically independent of each other, which they are.
17. Lazarus, op. cit., pp. 120-149. See also A. Davids, "Alienation, Social Apperception, and Ego Structure," Journal of Consulting Psychology, 19 (1955), 21-27.