Risk Perception of Different Societal Groups: Australian Findings and Crossnational Comparisons

Bernd Rohrmann

Mannheim, Germany and Melbourne, Australia

Beliefs about hazards and subjective evaluations of risky activities and environmental conditions were studied in three countries, employing a quasi-experimental psychometric approach. The recent data collection in Australia continues previous research conducted in Germany and New Zealand.
The aim of the project is to analyse the cognitive structure of judgments about the magnitude and the acceptability of risks to which individuals are exposed, to identify the relevance of hazard characteristics, and to compare risk judgments across cultural contexts. This relates to both societal groups and to countries in which risk issues in general, as well as particular types of risk, have different salience.
The Australian results–like previous findings from other countries–demonstrate the considerable influence of psychological aspects on judging risks and the societal and cultural determination of risk evaluations. People with a "technological", "monetarian", "ecological", or "feminist" orientation differ considerably in their responses.
The findings improve the understanding of individual risk perception and are also valuable for applied tasks, such as improving information and communication about controversial risk issues in society.

RESEARCH ISSUE

The Study of Risk Perception

Risk perception is a salient societal issue as well as a challenging scientific topic, and its study has become a flourishing area of both basic and applied research. This was stimulated by two circumstances: the prominence of risk issues in the discourse about the "environment", "technology" and "society" (Conrad, 1980; Dietz, Scottfrey, & Rosa, in press; Luhmann, 1990; Sjoeberg, 1987; Waterstone, 1991); and the increasing awareness of researchers that restricting risk analysis to a "technical" or "monetarian" perspective (as predominant in natural sciences or economics) is too narrow an approach (O'Riordan, 1983; Renn, 1992; Slovic, Fischhoff, & Lichtenstein, 1982; Vlek & Stallen, 1980; Yates & Stone, 1992).

Individuals as well as society at large have to deal with numerous risks; car accidents, smoking, drugs, AIDS, pesticides, nuclear energy, forest and soil degradation, and climatic changes are just a few examples. Some disasters, such as the accidents in Bophal or Chernobyl, the earthquakes in San Francisco or Armenia, or the recent oil catastrophe in Kuwait, have further increased the awareness of risks (Fischer, Morgan, & Fischhoff, 1991; MacGregor, 1991) and the concern about the environmental impact of human activities.

The assessment of those risks has become very demanding, partly due to their innate complexity and partly because of the manifold implied values that individuals and societies adhere to — which makes controversies almost inevitable. In most countries, severe conflicts about the evaluation of risks have emerged, particularly with respect to large-scale technologies such as chemical industries, nuclear energy and genetic engineering (Beck 1986; Jungermann, Rohrmann, & Wiedemann, 1991; Schwarz & Thompson, 1990). An obvious gap between how experts think about risks and how nonprofessional people judge and evaluate risks contributes to this situation. It is salient that many of the risks most prominent to the public are not those with the worst statistical record (in terms of accident figures, mortality rates, health impacts, and so on). Definitions and criteria vary considerably across groups (even among experts), leading to quite heterogeneous risk assessments (Bradbury, 1989; Edwards & Winterfeldt, 1987; Fischhoff, Slovic, & Lichtenstein, 1981; Renn, 1992a; Slovic, Fischhoff, & Lichtenstein, 1985; Winterfeldt, John, & Borcherding, 1981). The more "nonstatistical" aspects (i.e., social, psychological and ethical considerations) influence risk perception, risk behaviour and risk management, the more complicated and often painful political decision making about risk issues will be.

Under these conditions it seems essential to complement "technical" risk research with social–scientific approaches in order to expand on how "risk" is conceptualised and to understand the "psychology of risk".

Overview of Previous Research

Within social–scientific risk research, risk perception is the central topic. In particular, psychologists have dealt with the meaning of the concept "risk" as such, with the subjective understanding and evaluation of particular risk sources, and with the determinants of risk judgments. Studying the cognitive structure of subjective risk evaluations relates to three issues: the acceptance and acceptability of risks, from the perspective of either an individual or society; the contingency between "objective" data (e.g. statistical estimates) and subjective risk ratings; and cross-cultural differences in the evaluation of risks. The most salient application of risk perception research is in risk information and communication about risk problems. For overviews and a critical discussion see Brehmer (1987), Fischhoff, Bostrom, and Quadrel (1993), Guerin (1991), Heimer (1988), Jungermann and Slovic (1993), Lopes (1992), Slovic (1992), Renn (1990), Rohrmann (1991a), The Royal Society (1992), Vlek and Stallen (1980).

For the study of risk perception, predominantly psychometric methods have been used. The so-called *psychometric approach* is based on four intentions:

- to establish "risk" as a subjective (i.e., psychological), not an objective (e.g. statistical) concept;

Address for correspondence: Dr B. Rohrmann, Department of Psychology, University of Melbourne, Parkville VIC 3052, Australia. Telephone: (61) (3) 344 6349. Facsimile 347 6618. Email: U1715328@UCSVC.UCS.UNIMELB.EDU.AU In conducting this study, I received considerable help from many people. In particular I would like to thank my Australian colleagues Lex Brown (Brisbane), Mark Groves (Brisbane), Keith Houghton (Melbourne), Arthur Shulman (Brisbane), Alex Wearing (Melbourne), and Jack Williamson (Melbourne) for their cooperation in the data collection. I also appreciate the constructive comments of Tony Loquet (Melbourne) and David Mellor (Warnambool) who read an earlier version of this report. Finally, I am very grateful to Ursula Glunk (Mannheim) and Margaret Ambrose (Melbourne) who assisted me effectively with data analyses and text processing.

Australian Journal of Psychology Vol. 46, No. 3, 1994 pp. 150–163

- to include technical/physical *and* social/psychological aspects as criteria for risk magnitude and acceptance;
- to study opinions of "the public" (i.e., lay people, not experts) as the object of interest;
- to analyse the cognitive structure of risk judgments, using multivariate statistical procedures (such as multidimensional scaling, factor analysis and multiple regression).

This line of research was originated by B. Fischhoff, S. Lichtenstein and P. Slovic (see Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Slovic, Fischhoff, & Lichtenstein, 1980, 1985). Quite a number of studies followed, mainly in the USA, Germany and the Netherlands (e.g. Winterfeldt et al., 1981; Vlek & Stallen, 1981; Johnson & Tversky, 1984; Tiemann & Tiemann, 1985; Borcherding, Rohrmann, & Eppel, 1986; Gould et al., 1988).

Recently an increasing interest in *crosscultural* studies has evolved, questioning the concept that risk perception can be treated in terms of "communalities" or "universals". Actually, the technical or natural disasters mentioned above demonstrated the diverse responses to those risks from both the public and the government in different countries. Macrosociological, anthropological and philosophical literature (e.g. Douglas & Wildavsky, 1982; Heimer, 1988; Johnson & Covello, 1987; Rayner & Cantor, 1987; Schwarz & Thompson, 1990; Schuez, 1990; cf. also Cvetkovich & Earle, 1991) has been most influential in establishing the "cultural approach" of risk research. According to this perspective, the evaluative process of risk perception is determined by the norms, value systems and cultural idiosyncrasies of societies or societal (sub)groups.

"Crosscultural" differences can be studied from two perspectives: In *crossnational* studies, data from different nations (e.g. France versus Germany) or types of countries (e.g. industrialised versus developing ones) are compared, in *intranational* "crossgroup" comparisons, differences in risk evaluation between societal groups (defined according to social/political views or membership in interest groups etc.) would be analysed. While the latter study type is rare, a number of empirical investigations have looked at crossnational distinctions; for an overview see Table 1 (which includes the present study).Usually a sample of risks was presented to the respondents who had to rate them according to a set of risk aspects. Other crossnational studies have dealt wit one risk source only (e.g. Eiser et al., 1990; Swaton & Renn, 1984) or with decision-making about risks, e.g. in business (Harnett & Cummings, 1980; Tse, Lee, Vertinsky, and Wehrung, 1988). For a documentation of risk perception studies see Rohrmann, 1991a; for a framework of crosscultural risk research see McDaniels & Gregory, 1991.

Most of these comparisons were not planned as synchronous studies but resulted from full or partial replications of earlier work (using research such as the pioneering studies of Fischhoff, Slovic & Lichtenstein as a reference). The samples were usually very small and hardly representative of the population. Also, the selection of hazards, of risk aspects and of respondents in most risk perception studies is ad hoc rather than based on theoretical frameworks. Nevertheless, the results indicate considerable crosscultural differences.

Aside from research on single specific hazards, risk perception has not yet been studied in Australia.

Objectives of the Project

The project "Crosscultural Comparison of Risk Evaluations (CRE)" was started in Germany by K. Borcherding & B. Rohrmann and then continued by the present author in Australia and New Zealand. The objectives of the investigation are:

- to analyse the structure of judgments about the magnitude and the acceptability of risks to which individuals are exposed and the influence of underlying psychological factors;
- to specify the relevance of hazard characteristics for subjective risk evaluations;
- to compare risk judgments across cultural contexts, looking at both the influence of professional and societal orientations within a country and disparities between different countries.

The purpose of the present paper is to analyse risk perception based on the data collected in Australia and to compare the results with findings from homologous samples surveyed elsewhere.

In the following section, the theoretical background and the methodological approach of this study will be described, plus a description of the data collection in three countries. In the next section, selected results on mean ratings, group differences and correlational analyses (including structural models) will be presented, followed by a section on crossnational comparisons. Finally, some considerations about the meaning of risk percep-

Table 1 Crosscultural Risk Perception Studies

Study	Countries	Sample size(s)	Subgroups	Risk sources	Risk aspects
Winterfeldt et al. (1984)	USA+Germany	57+68	—	14	4
Englander et al. (1986)	Hungary (USA)	30/29 (175)	—	90/30	1/9
Teigen et al. (1988)	Norway (USA)	37/35/64 (175)	—	30/90/35	9/1/9
Hoefer & Raju (1989)	France/USA	50+26	—	6	10/1
Keown (1989)	Hong Kong (USA)	65 (175)	—	30/15	2/6
Mechitov & Rebrik (1990)	Russia (USA)	24/24 (175)	2	13/9/75	4/7/1
Kleinhesselink & Rosa (1991)	USA/Japan	62+69	—	70	7
Goszczynska et al. (1991)	Poland (USA)	140	4	40	1/15
Rohrmann (1990, 1993b) plus Borcherding et al. (1986)	Germany+NZ+ Australia	217+278+339	4/8	24	11

Notes. "(USA)" refers to American data published by Fischhoff et al., 1978. "#/#" indicates subsamples within a study. Except in the last two studies, all respondents were students.

tion research and its potential for applied objectives (such as risk communication) will be outlined.

PROJECT DESIGN

Theoretical Framework

The substantive core of this project is the conceptual framework developed in Borcherding et al. (1986) and Rohrmann & Borcherding (1985). In a step 1, relevant concepts for the subjective evaluation of risky activities and residential conditions were selected; in step 2, structural relations between the variables representing the respective cognitions have been hypothesised. This framework is shown in Figure 1.

The two key aspects of evaluating risks are risk magnitude and acceptance of risk. It is assumed that these variables are influenced by other characteristics of the studied risk sources, negative impacts on the one hand and benefits on the other, and that ecological attitudes as well as socio-economic characteristics are relevant codeterminants. For both risk acceptance and benefits of risky enterprises, a distinction is made between the individual perspective and the societal viewpoint. This has to be considered in the operationalisation of the concepts and the subsequent statistical analyses.

Empirical Approach

The general design is to measure relevant risk evaluation criteria (i.e., risk aspects) with respect to a heterogeneous set of risk sources, and to collect such data for distinctive societal groups (combining an intranational and crossnational approach). Each of the three principal aspects of the "problem space" (i.e., aspects, sources, and respondents) were treated according to a specific substructure.

Respondents. The study is based on a contrast-group design in order to compare groups with specific societal, professional, and cultural orientations (Dake, 1991, and Douglas & Wildavsky, 1982, use the term "worldview"). It is obvious from the political debates about risks, particularly those related to the use of

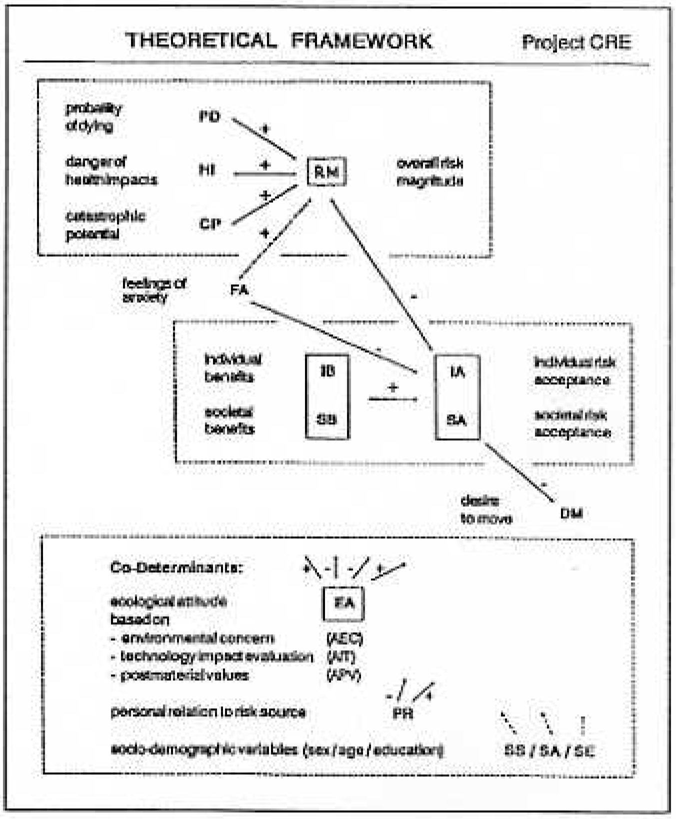

Figure 1 Proposed structure of risk aspects and codeterminants.

technologies, that the professional socialisation of the proponents leads to distinct evaluations of risk issues. (This notion relates to the "group" aspect of Douglas', 1982, "grid/group" concept of sociality; cf. also Thompson, Ellis, & Wildavsky, 1990). In the sampling plan, three factors were considered:

- *Central values.* In a first phase, respondents with a predominantly "technological" or "ecological" orientation were studied; later respondents working in "monetarian" professions and those involved in "feminist" issues were included as further groups.
- *Professional status.* Employed people and students were differentiated.
- *Nation.* The countries included so far are all industrialised and Western, but differ in population and size, in the significance of "nature" to the people, and in the political relevance of risk issues.

It should be noted, however, that representative samples of these groups were neither possible (due to limited resources) nor even intended. Certainly the project does not claim to compare "Australians" with "New Zealanders" or "Germans". The idea, rather, is to use such societal distinctions in order to elucidate typical intracultural and crosscultural differences in risk evaluation.

The societal groups included in the project were considered for the following reasons. (1) The literature on controversies about risks (especially those related to large-scale technologies) clearly shows that engineers/technicians on the one hand and environmental/"green" movements on the other hand are crucial proponents of this discourse (see, e.g., Conrad, 1980; Gould et al., 1988; Edwards & Winterfeldt, 1987). (2) The groups sharing "feminist" views (female employees being members of women's groups etc., and female students enrolled in a department of women's studies) were added because of findings that politically or socially involved women have specific views on technology, environmental issues and risks (see, e.g. Brody, 1984; Fischer et al., 1991; Kistler & Jaufmann, 1990; Savage, 1993). (3) Finally, research on decision making and risk taking of managers (see, e.g., Keyes, 1985; March & Shapira, 1987; McCrimmon & Wehrung, 1990; Shapira, 1986) suggests that people regularly dealing with "monetarian" issues have developed specific perspectives on risk evaluation and are less inclined to comply with "ideological" positions.

In this grouping, gender is inevitably confounded with the ideological/professional factor; thus the possible impact of sex roles has to be considered.

Risk Sources. As the risk type could have a strong influence on risk judgments, the selection of hazard to be investigated in this study was based on a taxonomy distinguishing four aspects: (1) activities/professions versus residential/environmental conditions; (2) acute versus chronic impacts; (3) for activities, occupational versus private; (4) for residential conditions, natural versus technology-induced hazards. The resulting classification is shown in Table 2.

It should be noted that for each risk source the relation to humans was specified, for example, "working as..." or "living near..." while general terms (such as "cars", "asbestos", "nuclear power", "climate") were avoided.

Hazard and Person Variables. All of these risk sources were judged with respect to the *risk aspects* defined in the conceptual framework (Figure 1). Furthermore, characteristics of the respondents had to be measured. For this purpose, a standardised instrument (the Risk Evaluation Questionnaire, REQ) was constructed.

The REQ consists of three parts:

(1) judgments of 24 risks according to 11 evaluative criteria;
(2) attitude scales; and
(3) questions about demographic variables.

Three attitudes were measured: environmental concern (AEC), evaluation of technology impacts (AIT) and societal value orien-

Table 2 Classification of Risk Sources – Project CRE

Source	Impact	
		TYPE 1: ACTIVITIES/PROFESSIONS
private	acute	A Parachuting as a sport B Driving in car races C Downhill ski training
occupational	acute	K Working as a firefighter L Working as a blaster in quarries M Flying an emergency service helicopter
private	chronic	G Long-term heavy smoking H Regularly taking tranquillisers I Eating too much and very fatty food
occupational	chronic	D Working in asbestos production E Working in an X-ray laboratory F Frequent working with air compressor tools
		TYPE 2: RESIDENTIAL CONDITIONS
natural	acute	Q Living in an avalanche-prone area R Living in an earthquake-prone area S Living in an area with many electric storms
technological	acute	T Living near an explosives factory U Living near a nuclear power plant V Living near a petrochemical industry
natural	chronic	W Living in a polluted dense urban area X Living in an area with unhealthy climate Y Living in an area with natural radioactivity
technological	chronic	N Living near a coal power plant O Living near a smelter/metal production factory P Living near a large airport

tation (ASV) (economic versus "postmaterial" values, Inglehart 1977). The items were taken from studies in environmental psychology (Fietkau, Hassebrauck, & Watts, 1980; Maloney, Ward, & Braucht, 1975; Prester, Rohrmann, & Schellhammer, 1987).

For all risk ratings, a response scale ranging from 0 to 10 was given, with 10 denoting the highest level of the criterion. The list of variables (altogether about 270 items) is identical for all groups of respondents.

In order to continue the project outside of Germany, an English version of the REQ had to be prepared. No substantive changes were made, apart from a few modifications to the instructional texts. The translation was thoroughly discussed with colleagues from Psychology and German departments and checked via back-translations.

Propositions

The main propositions of the first study had been that qualitative risk aspects, rather than (estimated) fatality rates determine risk judgments; that the structure of risk evaluations is dependent on the type of the risk source; and that attitudes towards environment, technology and society strongly influence risk ratings and risk acceptance (cf. Figure 1). In principle, the same is expected for the Australian data. With respect to differences between the four "orientations" considered in this project, it is assumed that respondents involved in "ecological" or "feminist" issues give more negative risk evaluations and less acceptance of risks than the "technological" group, and that the judgments of the "monetarian" people would fall in between these extreme positions.

For the data collected in Australia, the following deviations from the German results were expected:

- *Risk evaluation in general:* Lower risk magnitude ratings and higher risk acceptance. *Reasons*: Accidents with large-scale consequences are more likely in a densely populated European country, and many disasters have occurred nearby (e.g. the Chernobyl catastrophe or earthquakes in Italy and Yugoslavia); also, in Australia the societal "risk debate" is generally not as intense as in Germany (and admitting difficulties seems to be not very acceptable — a "no worries" / "won't-be-a-problem" attitude).
- *Specific risk sources:* Less negative evaluations for private activities (e.g. sport risks, consumption risks); higher risk scores for natural hazards; and more acceptance of large-scale technologies. *Reasons*: Health movements are less influential than in Germany; hazards such as earthquakes are rather unfamiliar in Australia; large-scale industrial plants are less of a problem because of the expanse of the country; vigorous debates about technologies (e.g. the antinuclear issue) are less common in Australia; and facilities such as airports are much more essential than in Germany.
- *Risk perception in subgroups:* Same overall structure (i.e., more risk-averse ratings with "environmentalists" than "technology-oriented" people); however, less polarisation between groups in Australia than in Germany. *Reasons*: The public discussion of risk issues seems to be less controversial and defiant in Australia; student groups tend to be less radical; and ecological movements are not involved in political ideologies as much as in Germany (where a strong "green" party exists).
- *Codeterminants of risk evaluations:* In general, a similar structure was postulated for the contingencies between risk magnitude, acceptance of risk, and factors assumed to influence these judgments, but attitudes and negative associations were expected to be less significant. *Reasons*: Ideology-related attitudes towards technology use and lifestyle are more salient in Germany; threatening events are less often reported in Australia; and risk issues are less likely to be a "principal matter" (beyond the hazard per se).

Of course, these considerations are not hypotheses in a strict sense but rather conjectures. (They mainly originate from informal discussions with social scientists in Australia.) Also, on the whole, subcultural disparities were expected to be larger than crossnational differences.

Data Collection

Up to now, three substudies have been conducted, the basic one in Germany (abbreviated as <FRG>), a second one in New Zealand <NZ> and the third — substantially enlarged — in Australia <AUS> The available samples are summarised in Table 3. (As further extension, an additional data collection in Germany and New Zealand is under way, and studies in Norway and in China are in preparation.)

Study I <FRG> was conducted in Mannheim and Darmstadt and is described in Borcherding et al. (1986). The four groups of the sample are given in the upper part of Table 3. (A group of risk experts was also included in order to study differences between "lay people" and "experts" but this issue will not be examined here.) Most of the results obtained were in line with the presupposed theoretical framework. Because of the small sample size, the study was considered an exploratory one. As an addition and enlargement to the German study, a second set of data was collected in the area of Hamilton, New Zealand (Study II, Rohrmann, 1990). A total of 224 respondents participated; see Table 3 for the resulting subsamples. Comparisons between the New Zealand and the German data yielded significant mean differences for particular risk sources such as sport-related risks, natural hazards or large-scale technologies such as nuclear power plants. However, the correlational structure of risk judgments as well as the type of disparities between the compared societal groups was quite similar in both samples.

For the sampling plan of the present Australian study there were three objectives: to replicate the groups enclosed in Studies I and II as closely as possible, to enlarge the scope of the sample, and possibly to obtain larger numbers of respondents. The NZ set of 3 x 2 groups of respondents was repeated, and two groups with a "monetarian orientation" were added. The data collection took place in cooperation with the Departments of Psychology of Melbourne University and the University of Queensland, and the Department of Environmental Studies, Griffith University, Brisbane. As shown in Table 3, a total of 339 people took part in the Australian study.

A short comment on the three countries: With 7.7 million square kilometres, Australia is about 30 times as large as (West) Germany or New Zealand, but with 16.5 million inhabitants it is far less densely populated than Germany or even New Zealand (however, two-thirds of the population live in the six capital cities of the states). In terms of industrialisation and use of large-scale technologies, as well as in the importance of agriculture, Australia stands between New Zealand and Germany. Controversies about risk issues and "green" topics seem to be slightly less salient in the public debate. Within Australia, considerable cultural differences exist because of its much larger ethnic heterogeneity and disparities between the big cities and the rest of the nation.

AUSTRALIAN RESULTS

Overview of Data Analyses

The project yields a three-dimensional data cube, with risk sources (actually 2 x 2 x 2 sets), judgmental aspects (11 criteria,

Table 3 Sampling: Group of Respondents

	AUS Australia	FRG Germany	NZ New Zealand
<T> "Technological orientation"	65	40	65
<T-e> Engineers	28	20	34
<T-s> Students of technical sciences	37	20	31
<E> "Ecological orientation"	73	40	65
<E-e> Environmentalists	32	20	26
<E-s> Students of (environmental) psychology	41+67	20	39+27
<F> "Feministic orientation"	72	60	67
<F-e> Members of feministic groups	40	30*	47
<F-s> Students of women's studies	32	30*	20
<M> "Monetarian orientation"	62	77	54
<M-e> Accountants/finance managers	33	36*	26*
<M-s> Students in economics/finance	29	41*	28*
$N = 834$	272+67	80+137*	197+27+54*

Notes. "s" denotes students and "e" denotes people employed in companies or institutions etc. Also studied: "Geography students" in NZ, $N = 27$; "Psychology-1 students" in AUS, $N = 67$; and "Experts in risk research" ($N = 10$); data not analysed in detail because of small N).
* data not yet fully analysed.

Table 4 Some Demographic Characteristics of the Respondents

Country:	Australia				Germany	
Subgroup:	Techn.	Mon.	Ecol.	Fem.	Techn.	Ecol.
Age	28.7	31.0	30.5	33.8	29.8	29.8
Sex (% male/female)	75/25	77/23	48/52	0/100	10/0	50/50
Employees/Students (%)	44/56	53.47	44/56	55/45	50/50	50/50
Attitudes (means) towards						
Impacts of technology (AIT)	2.9	2.9	4.3	4.0	2.7	4.6
Environmental concern (AEC)	4.3	4.1	5.3	5.2	4.3	5.8
Societal values (ASV)	4.4	4.2	5.4	5.4	4.6	5.6

Note. The attitude scores are based on 9/7/5 items which were measured on 7-point scales (1..7); where necessary, employees and students have been equally weighted.

organised by a conceptual framework), and respondents (4 x 2 groups, 3 countries). Consequently, the statistical analysis of the collected data is quite laborious. In the present text, mainly two types of results are considered: mean ratings and differences of group means for various sets of respondents (available for all risk aspects and sources); and analyses of the cognitive structure of risk evaluations, based on correlations among risk sources.

It should be noted that these correlations can be (and have been) determined in several ways:

- *Across risk sources.* The respective correlation matrix could be computed for each respondent or for mean data sets (either means of the whole sample or for means of specific subgroups).
- *Across respondents.* An analogous matrix could be computed for each risk source or mean ratings based on defined sets of risks.

In the following, the text focuses on a description of the Australian results and selected comparisons with German and some New Zealand data (restricted to the subgroups available in all data sets). Due to space restrictions, the number and content of tables and figures in this article had to be reduced considerably; a full report is available from the author (Rohrmann, 1993b).

Demographic information about the groups is given in Table 4. The attitude means illustrate the evident difference between "technologically" and "ecologically oriented" respondents (which are greater for German than for Australian groups). The "feminists" means in these variables are very similar to those of the ecologists while the attitude scores of the "monetarian" groups tend to parallel the characteristics of engineers/technicians.

Judgments about Risk Sources

Firstly, results for the whole Australian sample are considered (merging the eight groups). Table 5 presents mean judgments in 11 risk aspects for 24 risk sources. Overall, the following risks get the most negative evaluations in terms of perceived risk magnitude <RM>, health impacts <HI> and (non)acceptability <IA/SA>: long-term heavy smoking, working in asbestos production, and living near a nuclear power plant. These risk sources also induce the most fear associations <FA>. The least

Table 5 Risk Ratings: Means for 11 Risk Aspects Across 8 Groups (N = 272)

RM = Overall risk magnitude rating
PD = (Assumed) probability of dying
HI = (Danger of) health impact
CP = Catastrophic potential
FA = Feelings of anxiety about risk
IB = Individual benefit (of activity)
SB = Societal benefit (of activity)
IA = Individual risk acceptance
SA = Societal risk acceptance
PR = Personal relationship to risk
DM = Desire to move

Var.	RM	PD	HI	CP	FA	IB	SB	IA	SA	PR	DM	
Haz.												
A	6.4	3.5	3.1		6.8	7.3	2.2	7.5	6.3	2.9		Parachuting
B	7.0	4.2	4.3		6.4	7.2	2.6	7.3	5.6	2.0		Car racing
C	5.3	2.5	3.6		5.0	7.6	3.0	7.8	6.9	3.7		Skiing
D	8.6	5.8	7.7		7.7	3.2	3.1	3.1	2.6	1.0		Asbest. prod.
E	6.0	3.2	5.3		5.3	5.5	7.3	5.0	6.7	2.1		X-ray lab
F	5.9	2.4	5.4		4.9	4.0	6.1	4.9	5.6	1.9		Compr. tools
G	9.0	6.2	8.3		7.9	3.2	0.9	5.0	1.6	4.5		Smoking
H	8.0	5.1	7.3		7.5	3.6	1.6	4.7	2.2	2.3		Tranquillisers
I	7.4	5.2	7.1		6.3	3.9	1.6	5.4	3.1	4.6		Overeating
K	6.0	3.8	4.3		5.7	7.1	8.7	6.7	8.6	2.0		Firefighter
L	5.9	3.6	4.7		5.6	5.1	6.1	5.7	6.0	1.2		Blaster
M	5.0	3.4	3.3		5.4	7.8	8.7	6.9	8.7	1.6		Emerg. helic.
N	5.6	2.5	4.8	4.5	4.8		6.4	4.2	4.0	2.0	6.8	Coal p. plant
O	5.6	2.5	4.7	4.6	4.9		7.0	4.2	4.1	2.0	6.9	Metal prod.
P	4.2	1.6	3.2	5.0	4.3		7.3	5.0	4.9	3.4	6.4	Airport
Q	7.0	3.7	3.3	6.5	6.2			4.8	3.5	1.2	7.2	Avalanche area
R	6.8	3.7	3.2	7.6	6.4			4.9	4.0	1.8	7.0	Earthquake ar.
S	4.5	2.1	2.4	3.7	3.8			6.0	5.9	3.2	4.3	El. storms ar.
T	5.8	2.7	3.2	5.9	5.6		4.5	3.9	3.5	1.5	6.8	Explos. fact.
U	7.7	4.0	5.7	9.2	8.2		4.4	2.9	2.2	1.2	9.0	Nucl. p. plant
V	6.8	3.3	5.1	7.1	6.7		6.1	3.5	3.1	2.5	7.9	Chem. industry
W	6.6	3.1	6.0	6.2	5.9			4.4	3.7	5.5	6.9	Poll. urb. area
X	5.8	2.9	5.4	5.3	5.4			4.9	4.3	4.2	6.5	Unh. climate
Y	6.9	3.3	5.3	5.8	5.8			4.5	3.8	2.0	6.4	Nat. radiation
	6.4	3.5	4.9	5.9	5.9	5.4	4.9	5.1	4.6	2.5	6.8	(Mean)

Note. For abbreviations, see Figure 2 and Table 2. Empty cells: not measured.

negative ratings are given to risks such as living near an airport, electric storm areas, flying an emergency helicopter, or skiing.

For sporting activities, a positive individual benefit <IB> is seen, and for public service professionals (e.g. firefighters) both individual and societal benefit <SB> are highly valued. Commonplace technical facilities (e.g. airports, metal production, coal power plants) are accepted as fairly beneficial as well.

Most respondents rate their personal risk exposure <PR> as low for most risk sources; the highest scores are for living in a polluted urban area, overeating and smoking. (Consequently, hazard familiarity is unlikely to have much impact on the judgments studied here, possibly except in the case of smoking.) Finally, the (rather hypothetical) desire to move <DM> would be highest for people living near nuclear power plants or chemical industry.

The data were also analysed with respect to general risk characteristics. The (predetermined) classification of risk sources turned out to be effective: analyses of variance show significant effects of the four factors for most of the risk variables. These analyses will not be treated here in detail; however, some means are summarised in Table 6. As expected:

- fear of health impacts <HI> is higher for risks with acute rather than chronic effects;
- risk acceptance <IA> is higher for activities than for residential/environmental hazards (and within the latter, for natural rather than technology-induced risks);
- while societal acceptance <SA> is higher for occupational risks, individual acceptance is higher for risks associated with private activities; and
- much more societal benefit is seen for risky occupational activities than private ones.

Differences in risk magnitude are minor and were neither expected nor even intended, given the selection rationale for the 24 risk sources of this study.

Differences Among Societal Groups

Selected subgroup means for three risk aspects and eight risk sources (one of each hazard type) are listed in Table 7, with

Table 6 Mean Judgments for Different Types of Risk (AUS data, $N = 272$)

	Kind of Hazard		Effect		Activities		Res./Env. Condition	
	Activity	Res./Env.	Acute	Chronic	Private	Occup.	Natural	Technol.
Criterion	12	12	12	12	6	6	6	6
RM Risk magnitude	6.8	6.1	6.2	6.6	7.2	6.3	6.2	6.0
PD Probability of dying			3.4	3.6				
HI Health impacts			3.8	5.8				
IA Individual risk acceptance	5.9	4.6			6.4	5.4	5.2	4.0
SA Societal risk acceptance	5.3	4.0			4.3	6.3	4.3	3.7
IB Individual benefit					5.5	5.4		
SB Societal benefit					2.0	6.6		

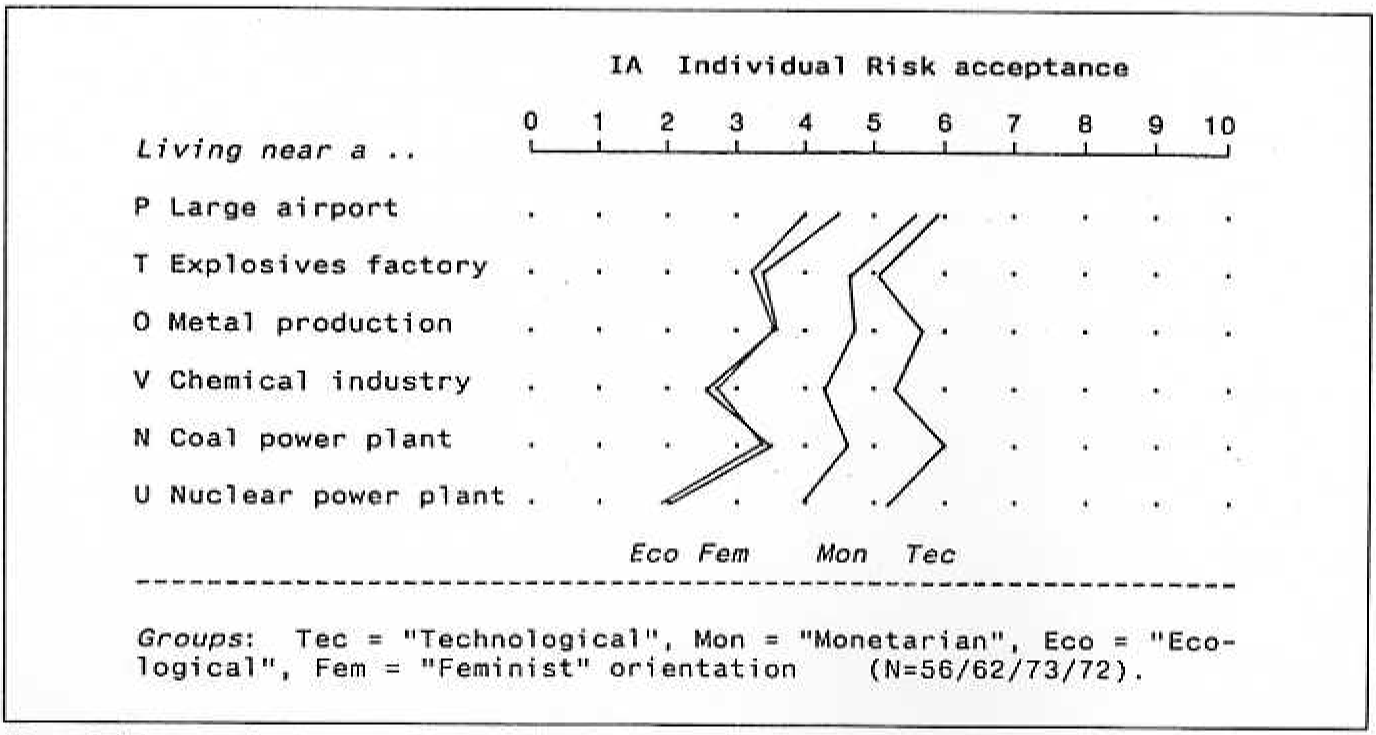

Figure 2 Judgments of technological risks by different groups (Means).

employees and students pooled. (Part 2 of Table 7 refers to country differences, Part 3 gives some results of significance tests for sets of risks, as well as "ETA" coefficients, indicating the magnitude of effects.)

The findings of group comparisons can be summarised as follows:

- People with an "ecological orientation", as well as those involved in "feminist" issues, evaluate risks much more critically than the other two groups; that is, for most risk sources, their ratings on all riskiness scales <RM, PD, HI, CP> and feelings of anxiety <FA> are higher, while benefit judgments <IB, SB> and risk acceptance <IA, SA> are lower. By comparison, those with a "technological orientation" show the lowest risk ratings, see more benefits and are more ready to accept risks. The judgments of the "monetarian" group are in between the extremes. (*Note:* Only RM, SB and IA are included in Table 7.)
- This pattern is most obvious for technology-induced risks, as shown in Figure 2. The largest group differences occur with "living near a nuclear power plant" or "chemical industry" (which in fact are the most debated large-scale technologies anyway).
- There are some interesting exceptions from the general pattern. For example, with respect to "consumption risks" such as smoking, tranquillisers and overeating, engineers and technology students give the lowest acceptance ratings while the "ecological" and "feminists" groups yield the highest scores.

Table 7. Mean Risk Ratings: Subgroup and Country Data for Three Selected Risk Aspects

Part 1. Subgroup comparison

Risk aspect: Group (AUS)	RM Overall risk magnitude Tec	Mon	Eco	Fem	SB Societal benefits Tec	Mon	Eco	Fem	IA Individual risk acceptance Tec	Mon	Eco	Fem
B Car racing	6.5	7.1	7.0	7.3	3.5	3.0	2.1	2.2	7.2	7.2	7.3	7.6
D Asbestos prod.	8.1	8.4	8.6	9.0	4.0	3.1	3.0	2.5	3.6	3.6	2.8	2.7
G Smoking	9.0	8.9	8.9	9.1	0.9	1.2	0.8	0.7	4.0	5.0	5.5	5.5
K Firefighter	5.7	5.8	6.5	6.1	8.7	8.8	8.6	8.9	6.7	6.9	6.5	6.5
N Coal p. plant	4.4	5.7	5.9	6.3	7.6	6.5	6.0	5.7	5.5	4.6	3.4	3.5
R Earthquake ar.	6.7	6.9	6.9	6.9					5.5	4.6	4.9	5.0
U Nucl. p. plant	6.2	7.5	8.1	8.6	6.4	5.3	3.7	2.4	4.1	4.0	2.0	2.0
W Poll. urb. area	6.1	6.1	7.3	6.8					4.5	5.2	3.6	4.5
M (mean)	5.8	6.4	6.7	6.7	5.5	5.0	4.5	4.5	5.4	5.4	4.9	4.9

Part 2. Comparison AUS/NZ/FRG, for groups "Tec" + "Eco" (N = 129/130/80)

Country:	RM FRG	AUS	NZ	SB FRG	AUS	NZ	IA FRG	AUS	NZ
B Car racing	7.5	6.7	6.4	1.4	2.8	2.5	6.4	7.3	7.4
D Asbest. prod.	8.0	8.4	8.2	4.2	3.2	3.4	3.4	3.1	3.6
G Smoking	8.0	9.0	8.9	0.9	0.9	0.7	3.7	5.1	4.7
K Firefighter	4.5	6.3	6.3	8.7	8.5	8.7	7.7	6.4	6.5
N Coal p. plant	5.6	5.1	4.3	7.2	6.6	6.1	4.5	4.5	4.8
R Earthquake ar.	6.0	6.7	5.8				5.1	5.4	5.9
U Nucl. p. plant	6.1	7.0	7.0	5.0	4.9	4.4	4.0	3.4	3.3
W Poll. urb. area	6.3	6.7	7.0				3.7	4.1	3.9
M (Mean)	5.8	6.3	6.1	4.7	4.8	4.8	5.2	5.3	5.3

Part 3. Significance and ETAs for mean differences between groups (Tec/Eco) and countries (AUS/NZ/FRG) for types of risk <ANOVAs>

Effect (Group, Country):	RM G	C	SB G	C	IA G	C
ABC Risky sport activities	—	—	***/29	**/19	—	—
DEF Dangerous workplaces	***/28	*/06	*/18	—	*/14	—
GHI Smoking/Pills/Overeat.	—	—	—	—	*/17	**/14
KLM Dang. publ. -serv. jobs	**/19	***/37	—	—	—/	***/22
NOPTUV Technology hazards	***/43	—	***/41	—	***/32	—
QRS Natural hazards	—	***/28	/	/	—	—
WXY Unhealthy environments	***/24	**/21	/	/	*/10	—

Notes. ETAs given for significant effects only; decimal point omitted. All interactions C x G insignificant, except of "IA" for sources NOPTUV (**). For abbreviations see Table 2; for number of cases, see Table 3.

- Group differences with respect to employees versus students were also analysed. The effects were smaller than expected and insignificant for most risk sources and risk aspects. Thus the groups were pooled.

Subjective Determinants of Risk Evaluations

The propositions about the cognitive structure of risk evaluations — as shown in the theoretical framework (see Figure 1 above) — were analysed by means of multiple regression and linear structural modeling. Table 8 presents selected single and multiple correlations for risk magnitude <RM> and individual risk acceptance <IA>, that is, those computed across respondents. (Methodological note: In this case, person-related variables, particularly attitude measures, can be included in the analysis, which is not possible if correlations across risk sources are used.)

The analyses were conducted for different sets of risk sources (which were aggregated as additive sum scores in case of sufficient homogeneity) and partly for subgroups as well. The results demonstrate the following:

- As assumed, the (subjective) probability of dying <PD>, concern about health effects <HI> and the catastrophic potential of risk sources <CP> (if applicable) are all predictive of perceived risk magnitudes <RM>.
- For hazards with the risk of acute impacts, such as sport activities (A/B/C) or natural hazards (Q/R/S), the probability of dying <PD> has higher weight than health effects <HI>. However, for technological risks (sources N/O/P/T/U/V), health impacts <HI> is clearly a better predictor than the "classical" risk indicator <PD>, and catastrophic potential <CP> is relevant as well.
- The proposed framework assumes that individual risk acceptance <IA> is significantly determined by risk magnitude <RM>, social benefit <SB> and feelings of anxiety <FA>, but this model works well for technological risks only, with anxiety as best predictor.
- Attitudes towards environmental issues, impacts of technology and social values (here aggregated into the overall ecological attitude <FA>) have considerable influence on both perceived magnitude and acceptance of technological risks.
- The main correlations are roughly similar for each of the considered subgroups (due to space limitations, results are given for one risk set only). However, the assumed structure is not valid for the "monetarian" subgroup. Also, attitudes are less predictive (but that might be due to reduced variance in the case of intragroup analyses).

The structure of risk judgments was then analysed by means of the LISREL approach (Jöreskog & Sörbom, 1983, 1987). Its purpose is to identify "linear structural relationships" among constructs on the basis of a hypothesised theoretical model. In Figure 3 an analysis is shown which was computed with the

Table 8 Single and Multiple Correlations for Risk Judgments

CRITERION: **RM = Risk magnitude**		PREDICTORS: PD Probability of dying		HI Health impacts		CP Catastrophic potential		PR Personal relevance		EA Ecological attitude		
Risk Set	Group Set	rPC	Beta	rPC	Beta	rPC	Beta	rPC	Beta	rPC	Beta	multR
ABC	T+E+M+F	.44	.45	.19	–.01			–.12	–.16			.46*
GHI	T+E+M+F	.36	.23	.35	.25			–.07	–.11			.42*
KLM	T+E+M+F	.37	.25	.36	.23			.06	–.03			.41*
NOPTUV	T+E+M+F	.52	.08	.62	.36	.53	.19			–.46	.18	.67*
NOPTUV	T	.56	.26	.59	.37	.45	.18			.20	.16	.65*
NOPTUV	E	.57	.20	.65	.43	.48	.08			.37	.07	.68*
NOPTUV	M	.40	.02	.54	.40	.43	.15			.26	.15	.57*
NOPTUV	F	.46	.01	.62	.43	.50	.15			.46	.17	.65*
QRS	T+E+M+F	.40	.24	.37	.20	.24	.07			.17	.10	.45*

CRITERION: **IA = Individual risk acceptance**		PREDICTORS: RM Risk magnitude		IB Individual benefit		SB Societal benefit		FA Feelings of anxiety		EA Ecological attitude		
Risk Set	Group Set	rPC	Beta	rPC	Beta	rPC	Beta	rPC	Beta	rPC	Beta	multR
ABC	T+E+M+F	–.16	0.15	.41	.43	–0.5	0.13	.01	.07			.45*
GHI	T+E+M+F	–.05	.00	.13	.11	.06	.03	–.09	0.07			.15
KLM	T+E+M+F	-.06	–.01	.14	.13	.04	.00	–.09	–.08			.16
NOPTUV	T+E+M+F	0.25	.15			.37	.20	–.41	–.38	–.36	–.15	.50*
NOPTUV	T	–.32	.17			.24	.15	–.32	–.20	–.31	–.28	.44*
NPOTUV	E	–.31	.00			.33	.13	–.46	–.34	–.33	–.10	.48*
NOPTUV	M	–.14	.16			.00	.02	–.29	–.41	–.03	.01	.31
NOPTUV	F	–.14	.42			.42	.41	–.34	–.53	–.32	–.03	.56*
QRS	T+E+M+F	–.18	.00					–.32	0.32	.02	.03	.32*

rPC = single correlation between predictor and criterion; multR = multiple correlation. For abbreviations of risk sources, see Table 3; for groups (and number of cases), see Table 4. * = multR significant ($p < .05$).

German data (cf. Borcherding, Rohrmann, & Eppel, 1986; values on the left in the graph) and which has now been repeated with the Australian data (values on the right). It is restricted to three risk sources (N/P/V) which relate to the principal environmental problems, that is, air/water/noise pollution. The constructs included in the structural model represent the core of the framework in Figure 2; the measurement model is based on source-specific judgments (for <PD, HI, RM, SB, IA>) or on domain-specific attitudes (for <EA>). (Note that coefficients are multiplied by 100.)

The results again demonstrate that, as predicted, risk acceptance <IA> is determined by perceived risk magnitude <MR> and benefit considerations <SB>; that concern about health impacts <HI> is more important than probability of dying <PD>; and that attitudes such as environmental concern, negative evaluations of technology and "postmaterial" value orientations have considerable influence. (Differences AUS/FRG will be discussed later.)

It should be noted that the "fit" of the model is only moderate (yet for comparability reasons the replicated model was not modified). the mean difference between the empirical correlation matrix and the respective model-derived coefficients is 0.08, indicating a fair correspondence.

Finally a higher level LISREL model was evolved by introducing overarching constructs, that is, "adverse impacts", with probability of dying <PD> and concern about health impacts <HI> as indicators, and "risk as threat", determined by risk magnitude <RM>, fear associations <FA> and catastrophic potential <CP> (these variables represent the negative evaluation of hazards). Societal risk acceptance <SA> is introduced as a final dependent variable.

Regarding risk sources, as in some of the regression models above, six technological hazards (N/O/P/T/U/V) are used and directly aggregated into additive sum variables. (This model is called <C> as it is developed from a model "<B>" discussed in Rohrmann 1990).

The result (see Figure 4) is well in line with the basic claims of the proposed theoretical framework, and it particularly affirms the significance of the "threat" aspect in risk perception.

Together, these findings elucidate the psychological factors (such as negative associations or critical attitudes towards technology and its environmental and societal consequences) contributing to the "intuitive" risk concept which people use for risk evaluations.

COMPARISON WITH GERMAN AND NEW ZEALAND DATA

Mean Differences in Risk Ratings

Firstly, means of risk judgments obtained from the Australian data deck (AUS) will be contrasted with previous results from Germany (FRG) and New Zealand (NZ); see Table 7 (Part 2).

At the present stage of the project, the AUS findings can be compared to FRG data for 4 groups and NZ data for 6 groups; Table 7 is computed for the joint ones. For significance tests and ETAs see column C in Table 7 (Part 3).

The crossnational comparisons (including those not listed in Table 7) yield interesting differences between the Australian and German respondents. For example, the respondents from the AUS groups reveal more acceptance <IA, SA> for sport-related risks (e.g. car racing or skiing) and unhealthy private behaviours (e.g. smoking, overeating), and they give lower risk ratings <RM, PD, HI, CP> for "conventional" technologies (e.g.

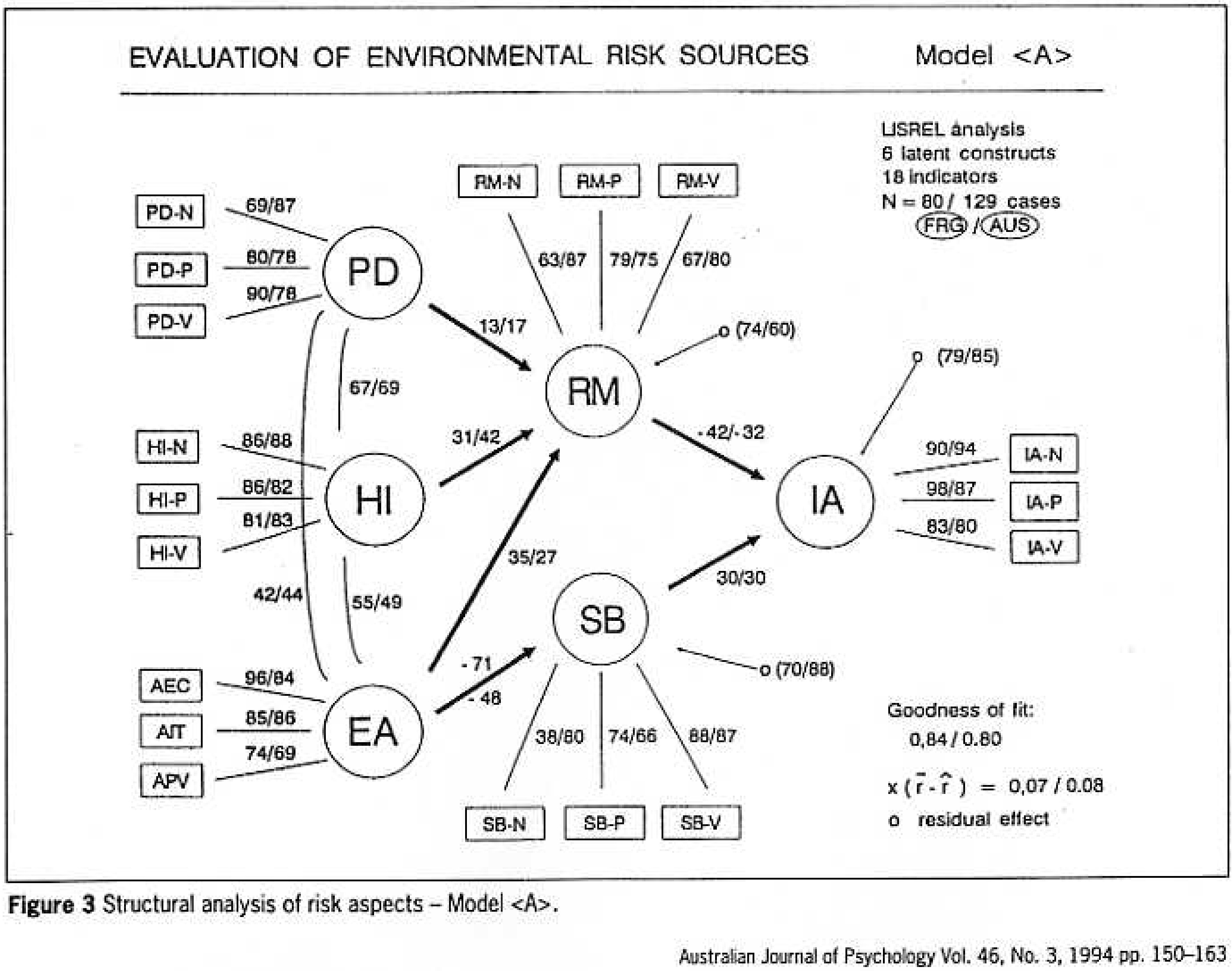

Figure 3 Structural analysis of risk aspects – Model <A>.

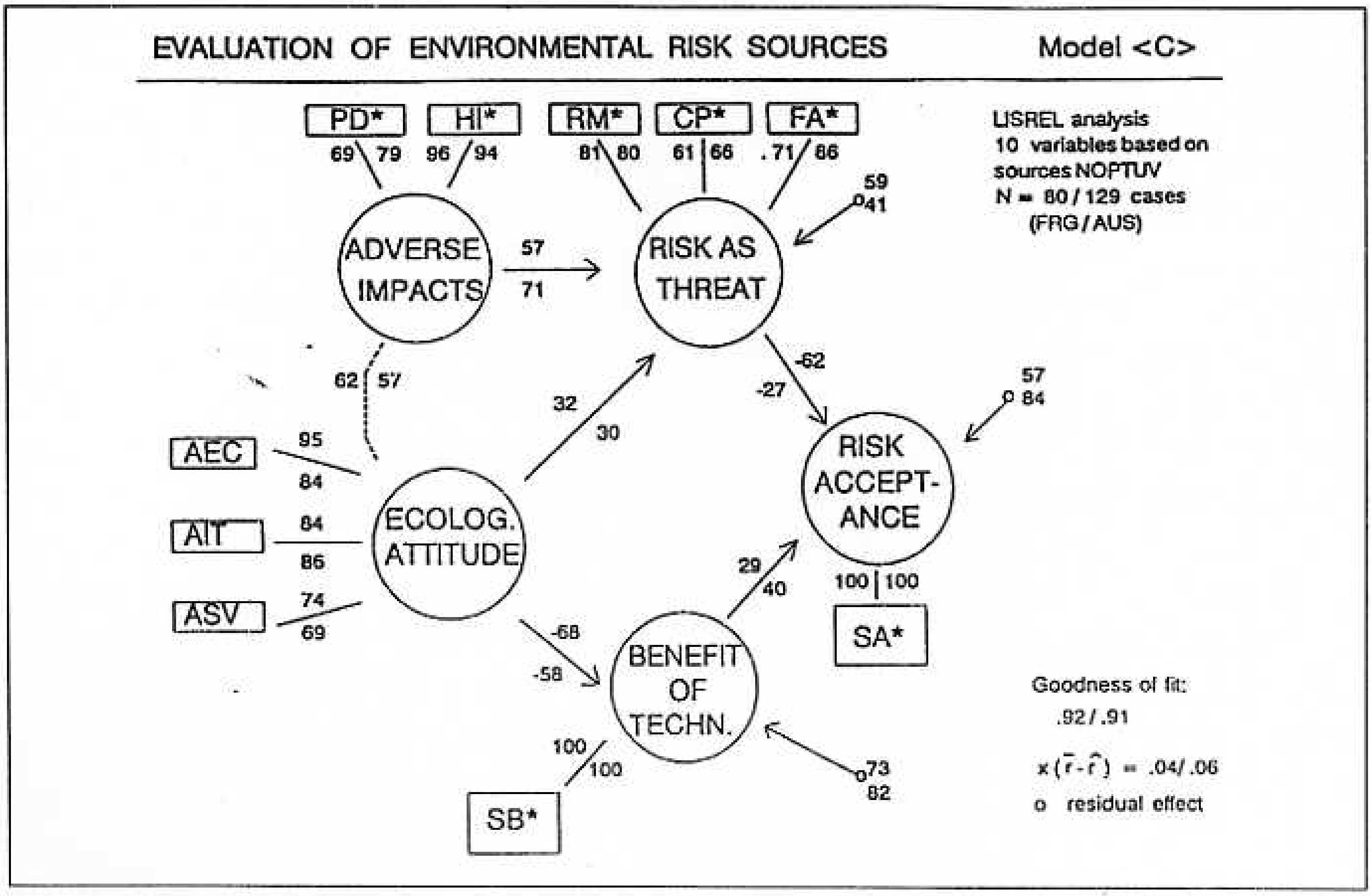

Figure 4 Structural analysis of risk aspects – Model <C>.

airports, coal power plants). In contrast, risk-exposed occupations (even those of high social benefit <SB>, e.g. firefighting), environmental pollution and a large-scale technology such as nuclear energy get more negative evaluations than by the FRG respondents. However, the latter difference is not as large as expected, given the views on nuclear power in Australia. The results from AUS and NZ are much the same, apart from slight disparities regarding earthquakes, a hazard much more familiar to New Zealanders.

Finally, there is not much difference in risk sensitivity between the AUS, NZ and FRG groups; the general range of the responses is similar in the three data sets, and the overall mean of all risk ratings is nearly the same (e.g. 5.3 versus 5.2 versus 5.3 for <IA>). Thus the assumed overall difference (lower perceived risk magnitudes and higher acceptance with Australian respondents) was not found.

Group-Specific Differences

Differences in risk judgments among societal groups (as described above) had also been analysed for the FRG and the NZ data (see Borcherding et al., 1986; Rohrmann, 1990). Respective comparative tables cannot be included here, but the findings compare as follows:

- The structure of disparities between groups with a "technological" versus "ecological" orientation is quite similar; most of the effects shown in Table 7 are true for the FRG data (and even more for the NZ data) as well.
- However, the described intergroup differences are stronger for the FRG than for the AUS data; the most salient examples are acceptability ratings and perceived benefits for technological risks such as X-rays, compressor tools, airports, chemical industry, and nuclear power plants. This means that, as predicted, group polarisation is lower for the Australian than the German groups.

The two types of crosscultural differences investigated in this project, group and country effects in risk judgments, have also been analysed for aggregated sets of risk sources by means of two-way analyses of variance; see Table 7 (Part 3).

On the whole, differences between societal/ideological groups are rather larger than crossnational differences, and the "pattern" is generally similar in the Australian, German and New Zealand data.

Differences in the Cognitive Structure of Risk Evaluations

A further issue is whether the contingencies between risk evaluations differ or not. For comparisons, the respective regression and LISREL analyses can be compared (in this text, only the latter is provided) as long as the same group set is used.

As can be seen from model <A> (cf. Figure 3), the obtained empirical structure is strikingly similar for the Australian and German respondents. The main disparity is that ecological attitudes <EA> are slightly less predictive for evaluations (both <RM> and IA>) of technological risks.

The results for model <C> (cf. Figure 4) again are quite homogeneous. There is one substantial difference: the concept of risk as a threat, developed within the Australian analyses an then applied to the previous data decks as well, is less predictive for societal risk acceptance <SA> in the German data. The main reason is that fear associations <FA> and catastrophic potential <CP> are less correlated with SA. The other parts of the model — and certainly the measurement structure — show similar coefficients.

In summary, similarities in the cognitive structure of risk evaluations — at least for technology-related hazards, as considered here — are more evident than disparities.

FINAL CONSIDERATIONS

Interpretation of Findings

This investigation of risk perception in Australia has shown that societal groups affiliated with particular professional, cultural and political orientations differ considerably in their judgment and evaluation of risks, and that crossnational variation exists as well. It is also obvious that some hazards are perceived as either more perilous (e.g. parachuting or nuclear power) or less severe (e.g. airports) than epidemiological risk data on health impairments and fatalities would suggest. Both findings are quite in line with the "cultural approach" to risk issues (e.g. Dake, 1991; Douglas & Wildavsky, 1982; Schwarz & Thompson, 1990).

To understand the complex picture of risk perception, various psychological and social processes need to be considered. In a theoretical framework developed by Kasperson, Kasperson, & Renn (1992a), the "social amplification of risks" is seen as a core phenomenon. They particularly stress the influence of factors such as political/environmental movements or media coverage, which either intensify or attenuate the perception and interpretation of risk-related events. Judgmental heuristics and biases (Kahnemann, Slovic, & Tversky, 1982), especially the subjective "availability" of information, play an important role in this context. The enormous (but quite selective) public attention for some risks over the last decade is indeed salient. Yet effects on individuals' cognitions are not just distortions. Reinterpreting or modifying beliefs about risks serves various purposes, such as avoiding "cognitive dissonance" (Festinger, 1964) when dealing with heterogeneous information or adjusting to one's peer group or deciding about the personal response to threatening but not-yet-present dangers. The more people are exposed to "internal" conflicts or to "external"/social influences (or even pressures), the more likely they are to adjust their risk evaluations.

It is interesting to note that "cultural" theorists (e.g. Thompson, Ellis, & Wildavsky, 1990; Dake, 1991) use the term "bias" somewhat differently, referring to culture-based orientations towards perceiving the world. Clearly, the individual history and the social context of people shape the set of values they apply to appraisals/evaluations of events and environments (Almond, 1988; Maag, 1991). Expressing and sustaining such values might seem to be harder in case of so-called alternative value orientations such as "ecological" attitudes. It has been found though that the views of minorities can have considerable influence on society if they maintain consistency and relate to evolving societal trends (cf. Moscovici, 1985). The far-reaching influence of "green" movements in most Western and supposedly also Eastern countries is a significant example for the impact of determined societal groups.

Altogether, the results of this research elucidate the crucial role of socio-psychological factors in the evaluation process. Thus it becomes clear, as various authors have noted, that the "technical"/"quantitative" approach of risk analysis is inadequate to reflect the complex pattern of individual risk evaluations (e.g. Jungermann & Slovic, 1993; Lopes, 1992; Renn, 1992b; Edwards & Winterfeldt, 1987). How people think about the magnitude and the acceptability of risks and how they make their respective judgments and decisions is influenced by knowledge, values and feelings. They include a variety of "qualitative" consequences of risky activities or living conditions which are not reflected in hazard scenarios, fatality probabilities and so on. Importantly, this general conclusion is true across the different groups under study.

Use of Social–Scientific Risk Research

Beyond theoretical interests, the findings are relevant for applied issues as well. Risks related to technical facilities, environmental problems, occupational activities, and so on lead to manifold societal problems. Regarding psychological research on subjective risk judgments, outcomes are particularly valuable for a better understanding of conflicts about risk evaluation and could be utilised for improving risk communication among the various involved parties (see, e.g., Covello, Winterfeldt, & Slovic, 1986; Fisher, Pavlova, & Covello, 1991; Kasperson & Stallen, 1990). Interactive communication and cooperative conflict resolution must be based on mutual knowledge and acceptance of the actors' way of thinking about risk (Renn, 1992; Rohrmann, 1991b). Further fields of application within risk communication tasks are effective information about hazards and related behaviour modification programs because they are usually designed to change risk-related cognitions within a particular cultural context.

Well-founded and effective risk management is a major challenge for modern societies (Renn, 1990; Rohrmann, 1993a; The Royal Society, 1992). Psychological expertise about universal and culture-specific factors of risk perception and evaluation is an indispensable part of that.

Perspectives for Further Studies

Risk perception is a manifold and complex field of social–scientific research, and each single study is necessarily confined in many respects. In *substantive* terms, more research is needed for issues such as the following:

- Contingencies in the cognitive processes underlying risk evaluations have been identified, but causes and effects are not yet sufficiently clarified. Related to this is the cognitive representation of hazards (see, e.g., Bostrom, Fischhoff, & Morgan, 1992).
- The present study mainly dealt with judgments, that is, verbal reactions to (more or less hypothetical) risk situations. How cognitions and emotions about risks are related to actual behaviour (e.g. risk-avoiding activities, job change, protests against risky technologies) needs to be thoroughly examined. This could be done by employing attitude–behavior models, such as Ajzen's theory of planned behaviour (1992) or the composite model of attitude–behavior relations by Eagly & Chaiken (1993).
- For a comprehensive analysis of cultural influences on the interpretation of risks and risk acceptance, more social-psychological and sociological data are necessary (cf. McDaniels & Gregory, 1991, for a research framework).
- Up to now, most risk perception studies have been performed in industrialised, Western countries; other types of political/economical cultures (e.g. Asian countries) should be considered as well.

From a *methodological* viewpoint, the empirical basis of the presented results is obviously small. Larger and more broadly defined samples is the most important means in order to increase validity — which obviously is restricted for single studies conducted in just one societal context. Yet the findings gained so far will justify continuing crosscultural risk studies.

In summary, the understanding of risk perception and its relation to other aspects of human behaviour and social processes is not yet sufficiently coherent. Ongoing research is needed to advance the theoretical foundation of the field as well as the practical utilisation of findings.

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