Comparisons of risk perception in different cultures:
Profile and synopsis of a social science research venture conducted in 9 countries

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Note: *This is the final report about the author's risk perception research program; it will appear in August 2013 on the "RohrmannResearch" website, and can be downloaded from there.*

Comparisons of risk perception in different cultures - Studies in 9 countries - Synopsis

Abstract

This is a compact report about the author's long-term multicultural research program on "risk perception", conducted at several universities until 2012. Risk perception has been a vivid area of both societal debate and social science research for quite some time - initially triggered by new, somewhat mysterious and thus feared technologies such as nuclear power, and later on by threatening health or safety crises.

In this interdisciplinary area, psychologists, sociologists and political scientists investigate how individuals judge and evaluate hazards related to working conditions, private activities, technological developments, residential settings, environmental hazards and global ecological changes.

The research reported here was realized in three phases: Project CRE "Cross-cultural Risk Evaluation", Project CRC "Comparisons of Risk Perception in 'Western' and 'Eastern' Countries", and Project CRH "Cognition of Risks from Hazards - Ibero-american Countries"; all were based on data collections in several countries, altogether 9.

In this article, at first the underlying conceptualizations and propositions are outlined. Then the utilized research methodology is described, including participant sampling and scaling approaches. For all surveys the Hazard Evaluation Questionnaire was developed, a standardized instrument which was translated in all needed languages.

The results are far too large to present them fully. Instead, core outcome are presented which are distinctive for main research questions. This includes: People's judgments of hazards, appraisal of the acceptability of risk sources, subjective determinants of risk evaluations, specific evaluations in different social groups and disparities across countries.

Overall, risk perceptions are interpretations of hazards, based on exposure, personal experiences and beliefs. They are embedded in the norms, value systems and cultural idiosyncrasies of societies, and therefore vary across groups and countries. Both group effects and country impacts are considerable, and they are intertwined.

Findings are very beneficial for designing comprehensive risk communication, which is an indispensable component of effective risk preparedness and disaster management. It is true that the insights gained so far are immense - yet there is no doubt that the further enrichment of our pertinent knowledge will be valuable for all people who deal with hazards.

List of boxes:

Note: In this report, all tables, lists, figures, diagrams, graphs etc are labelled as "box".

Comparisons of risk perception in different cultures - Studies in 9 countries - Synopsis

1 ISSUES AND AIMS

1.1 Risk as an issue of social-science research - Socio-psychological perspectives

Risk, risk, risk - what is it? Is this concept referring to a physical or a psychological phenomenon, or both? And how do people perceive a risk, in terms of, how substantial or not, how scaring or not, and how controllable or not a risk is in their evaluation?

In their professional and their private world, humans are exposed to manifold hazards, including working conditions, private activities, technological developments, residential settings, environmental hazards and global ecological changes. Examples are: working with toxic materials, smoking, unprotected sex, mobile phones, chemical factories, floods, air pollution. In social-science risk research, psychologists and sociologists investigate how people think and feel about risks linked to such hazards, which impacts on health and safety they assume, what their attitudes towards risk-taking are, how they behave when facing a risk situation, and how information and education are designed and realized to avoid or at least reduce dangerous hazard impacts.

The core area, called "risk perception", has been a vivid subject of both societal debate and scientific research for two decades now. The starting point was to establish "risk" as a subjective concept, not an objective entity; to include technical/physical and social/ psychological aspects in risk criteria; and to accept opinions of "the public" (i.e., not just scientists) as the matter of interest. This approach was developed by B. Fischhoff, S. Lichtenstein and P. Slovic, the "Oregon Group".

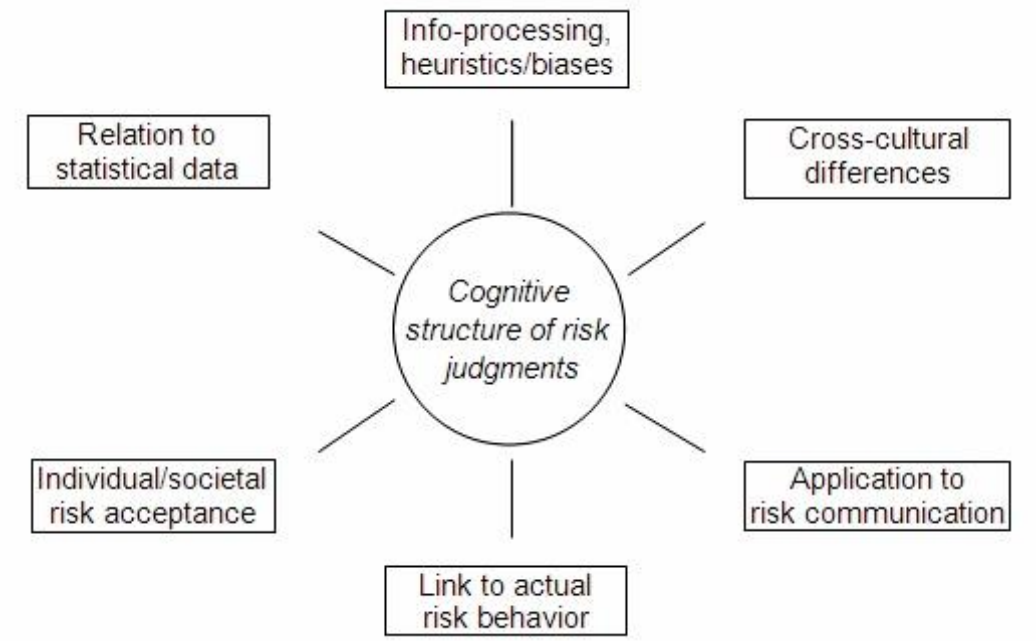
Main issues are the cognitive structure of risk ratings, subjective concepts underlying risk judgments, the determinants of perceived risk magnitude and risk acceptance, links to actual behaviour, and differences between societal groups or countries and cultures (cf., e.g., Finucane & Holup 2006, Fischhoff et al. 1982, Fischhoff et al. 1997, Rohrmann 2003, Rohrmann 2006, Rohrmann & Renn 2000, Sjoeberg 1999, Slovic 2000, Slovic 2010). In ***Box 1*****,** these issues are linked.

While this research sphere originated in psychology, it soon became obvious how enriching sociology perspectives as well as philosophy notions are. The multifold findings are essential for understanding conflicts about risk acceptance and enhancing risk management.

Before designing risk perception research, some epistemological issues need to be clarified. There are many meanings of the concept "risk", in terms of both denotations and connotations, as the literature demonstrates (cf., e.g., Aven, Renn & Rosa 2011, Drottz-Sjoeberg 1991, Fischhoff, Watson & Hope 1984, Lupton 1999, Renn 1992, Rohrmann 1998, Short 1989, Vlek 1996, Yates & Stone 1992). One reason for this is that hazards, the sources of risks, are very heterogeneous (this will be outlined below). From a socio-psychological perspective, it is important to be conscious of differences between physical and psychological phenomena. A "hazard" is a physical entity while "risk" is not.

Box 1:

ISSUES OF RISK PERCEPTION RESEARCH



A hazard is a situation, event or substance that can become harmful for people, nature or human-made facilities. Risk is an inference about the implications of a hazard, that is, the possibility of a physical or social or financial harm/detriment/loss when exposed to that hazard.

In most contexts “risk” refers to a danger of unwanted negative effects; however, in some fields “risk” is treated as a neutral term (equating to uncertainty about the outcomes of choices), and there is also a positive connotation, such as ‘desired risk’ (e.g., 'getting a thrill' by acting in a risky manner). Clearly risk is a multi-facetted concept.

1.2 Measuring people's attitudes towards hazards

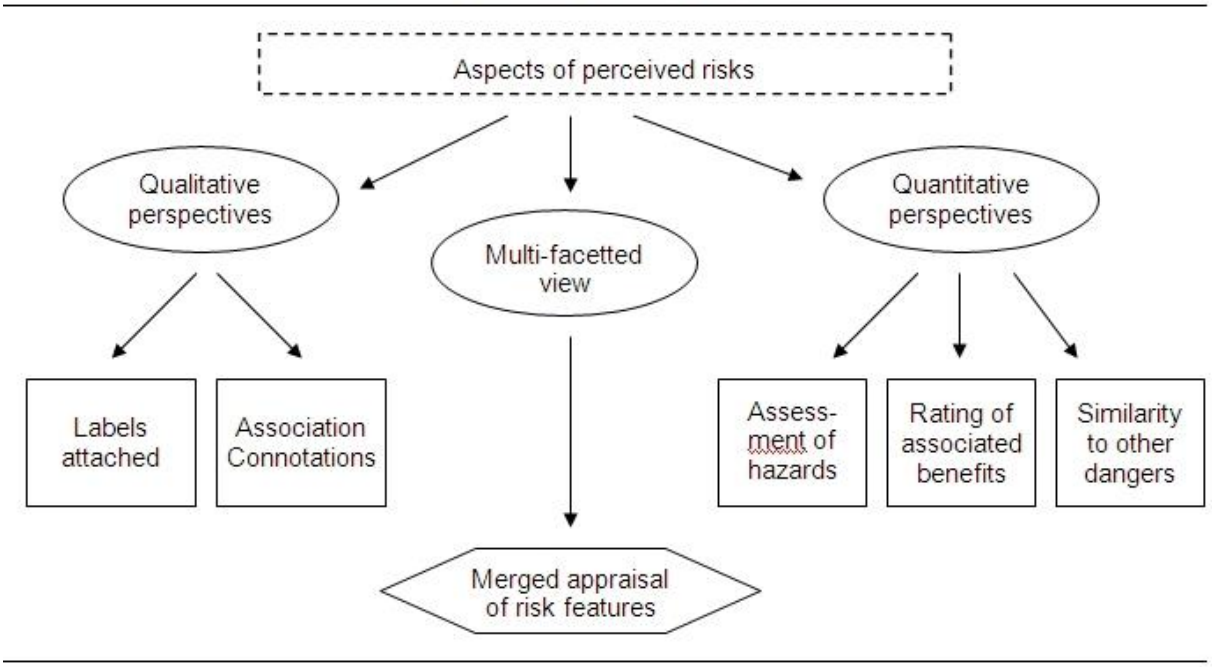
In risk perception research, the agenda is to investigate how individuals notice, judge and evaluate hazards to which they are or may be exposed. In ***Box 2***, some main types of risk perception measures for qualitative and quantitative approaches and merged appraisals are presented.

Most studies are based on a 'psychometric' approach (sensu Slovic 1992, 2000), i.e., risk sources are scaled according to a set of substantive risk criteria. These criteria include dangers, compensating benefits of risky activities, and resulting acceptability ratings. Exploring views of the general public was a crucial step in this research field; psychometric data allow for complex analyses of both expert and lay-people judgments.

Quite a few enquiries have looked at specific hazards (cf. Baghal 2011 as an example) yet risk perception surveys require an overarching mode.

Box 2:

TYPES OF RISK PERCEPTION MEASURES



1.3 Objectives of cross-cultural risk perception studies

In a first phase, general principles of risk perception were the dominating interest. Yet people's risk appraisals may be dependent on the specific cultural background in which they grew up and reside now. Therefore risk perception research needs to reflect this sociological context. "Cross-cultural" factors can be looked at in two ways (cf. Rohrmann 2000), as shown in ***Box 3***.

Box 3:

NOTIONS OF "CROSS-CULTURAL" RISK PERCEPTION RESEARCH		
Level of comparison	*intra-national*	*inter-national*
Units of study	professional or ideological sub-groups of society	countries or cultures
Core variables	beliefs & attitudes towards perceived risk sources	culturally embedded values regarding safety & risk

In international studies, usually countries or cultures (e.g., "Western" and "Eastern") are compared. However, cultural disparities also exist within a society, and this aspect can be surveyed via relevant professional or ideological sub-groups of a nation. For example, engineers or teachers or members of a 'green' organization are likely to assess risks from hazards differently.

2 RESEARCH APPROACH

2.1 Conceptual framework

For each empirical risk perception research project a set of substantive decisions is due: Which hazards shall be looked at, and assessed according to which risk aspects? How will participants of the study be sampled? Which social-science tools, e.g., questionnaires and rating scales, are needed to measure people's views? On which theory can the interpretation of findings be based? These facets will be further discussed below. For relevant literature cf., e.g., Beck 1992, Dake 1992, Fischhoff et al 1982, Kasperson et al. 1988, Rayner 1992, Renn 1992, Renn 2008, Rohrmann & Renn 2000, Sjoeberg 2006, Slovic 1992, Weber & Hsee 2000.

Obviously a sound conceptual framework is necessary to chose valid methods and to clarify why particular risks are seen as large or not, why acceptance ratings for some hazards are not in line with scientific data (i.e., overestimating or underestimating riskiness of smoking or nuclear power), and why people are often insufficiently aware of or overly worried about risks for their health and safety.

2.2 Design: Hazards, risk judgments, respondents

Before outlining the essential facets of any investigation of risk perception processes, the structure of the three projects covered in this report shall be revealed - see ***Box 4***.

Box 4:

RISK PERCEPTION RESEARCH - OVERVIEW CONDUCTED STUDIES

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[1] Project CRE: **C**ross-cultural **R**isk **E**valuation

[2] Project CRC: **C**omparisons of **R**isk Perception in 'Western' and 'Eastern' **C**ountries

[3] Project CRH: **C**ognition of **R**isks from **H**azards - 'Ibero-american' Countries

Countries:

Argentina/BuenosAires [3]
Australia [1] [2]
Brazil/Recife [3]
Canada/Vancouver [2]
Chile/Santiago [3] *not realized*
China/Beijing [2]
Germany=Deutschland [1] [2]
Japan [2]
NewZealand [1]
Singapore [2]
Switzerland/Zuerich *added to* [1]

Questionnaire:

"HEQ" = Hazard Evaluation Questionnaire, by Rohrmann,
created in English, German, Chinese, Japanese, Portuguese and Spanish language.

***Data collection*:**

From 1989 to 2010, in co-op of Rohrmann and a local university researcher in each country.

Altogether studies in 9 countries were conducted, in three successive projects, set up to widen the focus; studies in two further countries were not realized or limited and are not included here. (*Note*: The major reports and publications about these projects are listed in the second part of the reference chapter).

The principal "problem space" of a risk perception project is described in ***Box 5*** - there are always three facets to be considered. This table is based on Projects CRE and CRC (cf. Rohrmann 2006), in which 24 hazards were assessed according to 12 risk aspects by 4 groups of respondents, each sampled in several countries.

Box 5:

STUDY DESIGN FACETS:

Problem space in studies within Projects CRE, CRC, CRH

FACET	*Included:*	*Conceptual basis:*	*Example:*
Hazards:	24 risk sources	hazard taxonomy	earthquake
Risk features:	12 evaluation aspects	causal model of risk perception	rated magnitude
Respondents:	(A) 9 countries (B) 3 or 4 societal groups	cultural characteristics professional & political affiliations	Germany, Brazil engineers

These design features need to be maintained if the tasks are cross-cultural comparisons. The validity of results can only be substantial if the covered hazards and risk aspects are representative for the researched problem.

Box 6:

TAXONOMY OF RISK SOURCES

Subject of risk:

/ Risks for the state of the environment
:
\ Risks for human's health, well-being and their assets

Types of personal risk exposure:

Individual activities / occupational / private
Residential conditions / natural hazards / technology-induced hazards

Kind of effects:

/ physical / acute / local / present
- financial : - regional - next generation
\ social \ chronic \ global \ future

Regarding risk sources, the essential elements are: Subject of risk, type of exposure, kind of effects; these are listed in ***Box 6*** (above).

For each of the reported studies about 24 explicit hazards were chosen, which belong to four types: Individual risky activities, financial (non-physical) risks, social (non-physical) dangers, and residential conditions which can become a hazards; these are listed in ***Box 7.*** The main hazards are marked.

Box 7:

HAZARDS STUDIED IN PRESENTED RISK PERCEPTION RESEARCH

Research projects CRE, CRC & CRH ⦿ main surveyed hazards, used in most studies

Individual risky activities

Regularly driving in cars ⦿
Cycling in dense urban traffic ⦿
Regularly partaking in high impact sports ⦿
Parachuting as a sport
Swimming at dangerous beaches
Intensive sun-bathing ⦿
Down-hill skiing
Long-term heavy smoking ⦿
Having unsafe/unprotected sex ⦿
Eating too much and very fatty food ⦿
Consuming hallucinogenic drugs ⦿
Regularly taking tranquilizers
Working in an X-ray laboratory ⦿
Working as a fire-fighter ⦿
Working with toxic materials ⦿
Working underground as a miner ⦿
Regularly using a mobile phone
Travelling in a unstable and unsafe country

Social (non-physical) dangers

Arguing for non-acceptable attitudes/behaviors
Revealing homosexuality at a party
Living in a remote research station

Residential conditions

Living in an earthquake-prone area ⦿
Living in an area prone to storms/hurricanes ⦿
Living in an area where there are landslides
Living in an area where often fires occur ⦿
Living in an avalanche-prone area
Living in an area with many electric storms
Living in an area with frequent floods ⦿
Living in an area with high air pollution ⦿
Living near a large airport ⦿
Living near a coal power plant ⦿
Living near a nuclear power plant ⦿
Living near chemical industry facilities ⦿
Living near electrical powerlines/pylons
Living in a high-crime area ⦿

Financial (non-physical) risks

Investing in an uncertain product/new firm ⦿
Regularly participating in gambling ⦿
Being in places where thieves operate
Giving up a dissatisfactory but secure job ⦿

When people assess the risks they are - or may be - exposed to, they can consider many factors. Of these, 12 were considered, as listed in ***Box 8***. They represent 5 aspects: Negative impacts, benefits which are attributed to the risk source, risk acceptance, allocated necessity of risk management, and an integrating overall judgement.

As each investigated hazard has to be evaluated by all risk aspects, 24x12=288 ratings are requested by research participants.

2.3 Questionnaires for surveys

In order to measure judgments about hazards (as outlined in the theoretical framework of a study) as well as relevant personal characteristics of the respondents, a standardized questionnaire is needed.

Box 8:

ASPECTS FOR RISK APPRAISALS - AS IN PROJECTS CRE, CRC, CRH

Aspects for evaluating the impacts of hazards: five types:

RM	Overall risk magnitude	SB	Societal benefits
		IB	Individual benefits
PD	Probability of dying	AA	Attractiveness of activity
HI	Danger of health impacts		
EI	Economic impacts	SA	Societal acceptance of risk
CP	Catastrophic potential	IA	Individual acceptance of risk
FA	Feelings of anxiety	NM	Necessity of risk management

Note: For ratings, a response scale 0...10 is used

The core part is a combination of hazards and risk aspects, each pair is to be assessed on a scale, which may be a 5-point or a zero-to-ten rating scale. As personality characteristics, environmental concern, risk propensity attitudes and demographic attributes are of interest.

An example for such an instrument is the Hazard Evaluation Questionnaire (HEQ) (cf. Rohrmann 1994). It is multi-dimensional and was carefully tested before used in all projects reported here.

2.4 Sampling: Countries and social groups

As outlined above, within a country ideally a random sample of the population is to be taken, although this may be out of reach. Alternatively, social groups can be sampled for which different risk appraisals are expected (cf., e.g., Beck 1992, Chauvin et al. 2007, Rohrmann 1994, Sjoberg 1999, Willis & Dekay 2007). Risk perception theories may also induce cross-national sampling, i.e., to explore how the health-and-safety culture of a country determines whether people accept or not a workplace or a lifestyle or an environmental hazard. This is linked to the 'actors' in risk communication processes (as outlined in Rohrmann 1991).

In *Box 9* the realized samples for all 9 countries are presented; please note that in Australia two studies were conducted, and that the studies in Argentina and Chile are not yet completed. All projects combined a country set and social-group sampling (cf. Rohrmann 2008, 2010).

In Project CRE the sociological aim was to compare groups with different professional or ideological background, labelled "Technological", "Ecological", "Feminist" and "Monetarian" orientation. About 50% were working these areas, and the other half were students in pertinent subjects. In Project CRC and Project CRH "Western" and "Eastern" and "Ibero-american" countries were compared. All participants were students in three disciplines. In

some countries additionally a sample of scientists was drawn, in order to study the influence of expert knowledge.

Box 9:

SAMPLING GROUPS OF RESPONDENTS

[1] Project CRE

Country: / *Sub-Group*:	Australia	Germany	NewZealand	
<T> "Technological orientation"	*65*	*40*	*65*	*170*
<T-e> Engineers	28	20	34	
<T-s> Students in techn. sciences	37	20	31	
<E> "Ecological orientation"	*73*	*40*	*65*	*178+94*
<E-e> Environmentalists	32	20	26	
<E-s> Students in (env.) psychology	41+67	20	39+27	
<F> "Feminist orientation"	*72*	*60*	*67*	*199*
<F-e> Members of fem./women groups	40	30	47	
<F-s> Students in women's studies	32	30	20	
<M> "Monetarian orientation"	*62*	*77*	*54*	*193*
<M-e> Accountants/Finance managers	33	36	26	
<M-s> Students in economics/finance	29	41	28	
Sum: N =	272+67	217	251+27	*834*

Note: Samples "E-s" were extended. Not included: "Psych-1 students" in Switzerland, N=67

	[2] Project CRC						**[3] Project CRH**			
	"Western" countries			*"Eastern" countries*			*"Iberoamerican" countries*			
	Australia	Germany	Canada	China	Japan	Singapore	Argentina	Chile	Brazil	
S t u d e n t s										*1184*
T-s Technology/Engineering	60	46	46	90	57	70	*30*	50	*30*	
G-s Geography	50	45	47	52	44	42	*30*	51	*30*	
P-s Psychology/Sociology	60	50	58	74	52	84	*50*	59	*30*	
S c i e n t i s t s										*171*
X-e Techn. & Social Sciences	33	--	84	54	--	--	*10*	--	--	
Sum: N =	203	141	235	270	153	196	??	160	00	*1355*

Note: Analysis of Argentinian data set on hold; study in Chile not yet realized.

2.5 Propositions re socio-psychological factors

How humans perceive and weigh up hazards for health and safety is influenced by manifold sociological and psychological factors. The conducted risk perception research publicized in this report was based on the following propositions:

> Hazards are assessed according to the risk they present for people's life and health.

> Acceptance of risks is the outcome of weighing up negative outcomes and potential benefits of an action or technology.

> Emotional facets, such as fear associations, co-determine risk judgements.
> Attitudes, especially environmental concern and technology scepticism, influence most risk appraisals.
> Beliefs about risk acceptance differs for hazard types, such as technology-induced risks (e.g. chemical industry waste, air pollution) or natural hazards (e.g. earthquakes, floods).
> There are disparities between societal groups and professions, depending on their ideological orientations and social setting.
> Risk perception features vary across countries which differ in their developmental status and health and safety culture.

For the aspects of risk appraisals which were presented in Box 8 (above), a theoretical model was developed which summarizes the hypotheses about their structural and causal relationships; this is shown in ***Box 10***.

The outlined propositions steered the design of the project, especially the design of the Hazard Evaluation Questionnaire (HEQ) and the sampling of survey participants.

3 PEOPLE'S JUDGMENTS OF HAZARDS

Initial remark:
The amount of results from this research, that is, three multi-cultural projects conducted in 9 countries over more than a decade, looking at 24 hazards according to 12 risk aspects, is so overwhelming that it is not possible to cover all findings. Instead, selected results will be presented which are distinctive for main research questions.

3.1 Viewpoints regarding hazard's risk level

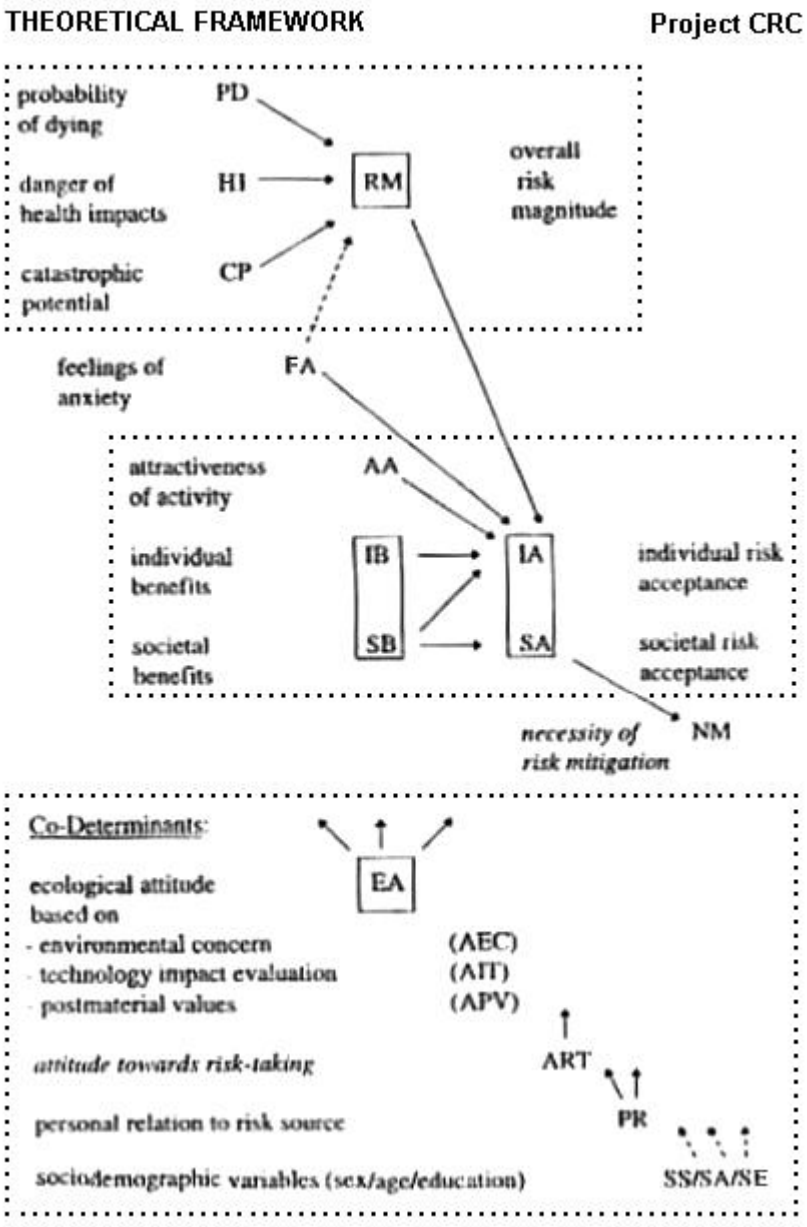
Judgements about the riskiness of hazards have several aspects, including the assumed probability of dying, danger of health impacts, the catastrophic potential of a disaster, feelings of anxiety about risks, and an overall risk magnitude rating. In ***Box 11*** (further below), pertinent findings are presented in a table based on findings in one of the 9 countries, Australia (cf. Rohrmann 2000).

Within risky human activities, Smoking, Unsafe/unprotected sex, Halucinogenic drugs and Sunbathing get the highest and Car driving and Giving up a job surprisingly low ratings. Regarding professions, working as an Underground miner is seen as most risky. The scores for fear associations are similar. Within dangers from residential and environmental hazards, Nuclear power plants and Air pollution are seen as largest hazards; a high catastrophic potential is also seen for Earthquakes. The risks from Airports and Power lines are least threatening.

The risk magnitude appraisals are not really in line with statistical data about the number of illnesses or accidents and fatalities resulting from risk sources. For example, Earthquakes or Car crashes induce high numbers of deaths, Coal power plants have much more health-impairing impacts than Nuclear power plants, and Gambling does harm millions of people financially (at least in Australia) - yet the pertinent risk ratings and safety worries seem to underestimate these hazards.

***Box 10*:**

FRAMEWORK FOR VARIABLES AND THEIR STRUCTURAL RELATIONS



In this context is has to be contemplated that many hazards are not personally experienced (see column "RP" in Box 11) - only Car driving has a mean judgement above 5.0 on the 0-to-10 rating scale, and some hazards (such as Nuclear power plants) don't exist in Australia. Consequently, many risk appraisals are based on what people hear or assume about risk sources.

A table which integrates the results from studies in six countries - three "Western" and three "Eastern" countries, studied in Project CRC - is provided in ***Box 12*** (further below; source: Rohrmann 2003). The mean results were computed by giving each country the same weight; the overall sample is N=1024.

Box 11:

HAZARD RATINGS: MEANS FOR 11 RISK ASPECTS

PROJECT CRC - AUSTRALIAN SAMPLE RPA (N=203)

Risk aspect:

RM = Overall risk magnitude rating
PD = (Assumed) Probability of dying
HI = (Danger of) Health impacts
CP = Catastrophic potential
FA = Feelings of anxiety about risk
IB = Individual benefit (of activity)
SB = Societal benefit (of activity)
AA = Attractiveness of activity
IA = Individual risk acceptance
SA = Societal risk acceptance
PR = Personal relation to risk source

	RM	**PD**	**HI**	**CP**	**FA**	**IB**	**SB**	**AA**	**IA**	**SA**	**PR**	
Hazard:												
Z1	6.3	3.8	4.1		5.9	6.3	6.3	3.8	6.7	6.3	4.7	Urban cycling
Z2	4.0	3.5	3.2		3.3	6.5	3.9	6.1	7.9	6.7	7.9	Car driving
C'	6.6	5.5	4.5		6.9	3.9	2.1	4.5	5.6	3.6	3.5	Dangerous beaches
G	8.8	6.9	8.8		7.8	2.4	1.9	1.7	4.8	2.1	3.2	Smoking
J'	8.2	5.8	7.6		7.7	3.4	2.0	3.9	5.0	2.0	2.4	Unsafe sex
I'	7.7	5.3	7.6		6.6	3.5	2.2	3.5	5.3	2.9	4.1	Sun-bathing
I	6.5	4.8	7.3		5.7	3.9	2.7	4.2	5.7	3.9	4.5	Overeating
H'	7.7	5.9	7.6		7.4	4.1	2.2	4.4	5.0	2.4	1.9	Hallucinogen drugs
K	6.0	4.4	4.9		5.9	6.6	8.4	5.3	7.0	8.4	0.8	Firefighting
E	5.0	3.1	4.8		4.6	5.7	7.3	3.7	6.7	7.8	0.6	X-ray lab
L'	6.6	4.7	5.8		6.7	4.8	7.0	2.8	6.1	7.1	0.5	Underground miner
$3	3.8	-/-	1.8		4.7	7.0	4.4	6.5	7.7	6.2	3.2	Giving up job
$1	5.8	-/-	3.4		6.0	4.4	2.8	4.3	5.8	3.5	1.9	Gambling
$2	5.8	-/-	3.0		6.5	2.6	-/-	2.2	5.0	2.8	2.4	Thieve places
R	6.8	4.3	3.4	7.5	6.5		-/-		6.2	5.0	0.7	Earthquakes
R'	6.4	3.7	3.5	5.6	5.8		-/-		6.0	5.0	2.4	Fire areas
Q'	6.6	4.0	3.4	6.3	6.1		-/-		6.2	5.2	0.9	Hurricanes
S'	6.2	3.2	3.0	5.1	5.6		-/-		6.2	5.0	1.1	Floods
X'	6.2	3.1	6.3	5.4	6.0		-/-		5.0	4.2	3.9	Air pollution
X	5.5	3.0	6.0	5.1	5.6		-/-		5.7	4.8	2.2	Unhealthy climate
P	4.2	1.5	3.7	4.2	4.2		7.5		6.0	5.3	1.1	Airport
N	5.3	2.1	4.8	4.7	4.8		7.0		5.4	4.5	0.7	Coal powerplant
U	7.1	3.8	5.5	8.1	7.5		5.4		4.6	2.8	0.2	Nuclear powerplant
O'	4.6	2.0	3.4	3.7	3.8		7.9		6.0	5.8	2.9	Power lines
V	6.2	2.8	4.7	6.1	5.7		7.4		5.2	4.3	1.3	Chemical industry
	6.2	*4.0*	*4.9*	*5.6*	*5.9*	*4.7*	*4.9*	*4.1*	*5.9*	*4.7*	*2.4*	*(Mean)*

Notes: *Response scale: 0...10. Empty cells: variable not measured for activities or residential condition. For each aspect (except AA and PR), high and low risk perception rating are marked.*

Looking at the results for "Overall risk magnitude rating" (RM), Smoking, Unsafe/unprotected sex and Halucinogenic drugs get the highest risk ratings, Car driving and Giving up a job the lowest.

Box 12

JUDGMENTS OF HAZARDS - RESULTS FROM 6-COUNTRIES-STUDY - PROJECT CRC

CRC samples (Australia, Canada, China, Germany, Japan, Singapore) merged **(N=1024)**

Risk aspect:

RM = Overall risk magnitude rating
PD = (Assumed) Probability of dying
HI = (Danger of) Health impacts
CP = Catastrophic potential
FA = Feelings of anxiety about risk
IB = Individual benefit (of activity)
SB = Societal benefit (of activity)
AA = Attractiveness of activity
IA = Individual risk acceptance
SA = Societal risk acceptance
NM = Necessity of risk management

	RM	PD	HI	CP	FA	IB	SB	AA	IA	SA	NM	
↙ *Hazard*												
Z1	5.8	4.0	3.9		5.0	5.3	5.1	3.7	6.4	6.0	3.1	Cycling in urban traffic
Z2	4.1	3.8.	3.2		3.5	6.5	4.0	6.3	7.4	6.4	3.7	Regularly driving in cars
G	8.2	6.2	8.3		7.1	3.3	2.2	1.9	4.1	3.4	3.2	Longterm heavy smoking
J'	8.1	5.5	7.5		7.5	3.9	1.9	3.6	4.0	3.2	4.0	Unsafe/unprotected sex
I	6.5	4.8	7.2		5.6	3.9	2.7	3.9	5.0	4.2	2.9	Overeating
H'	8.3	6.8	8.1		7.8	4.1	1.6	3.4	3.7	2.8	5.1	Hallucinogenic drugs
K	5.8	4.7	4.8		5.7	6.0	8.3	4.8	6.7	7.8	2.3	Working as firefighter
L'	6.7	5.1	6.0		6.6	4.7	6.7	2.4	5.7	7.2	3.0	Work underground miner
$3	3.9	-/-	2.7	-/-	4.8	5.9	4.1	5.9	6.9	5.9	2.0	Giving up good&bad job
$1	6.1	-/-	3.7	-/-	5.7	4.7	2.6	4.1	4.7	3.8	2.5	Participating in gambling
$5	6.1	-/-	3.5	-/-	6.7	4.1	4.6	3.6	5.5	5.4	2.4	Uncertain investment
$2	5.7	-/-	3.7	-/-	6.5	4.3	-/-	2.2	3.6	3.1	-/-	Being in thieve places
R	6.5	5.0	3.8	7.7	6.5		-/-		5.5	5.6	4.2	Earthquake-prone area
Q'	6.7	5.0	4.0	6.9	6.5		-/-		5.3	5.4	4.2	Area prone to hurricanes
S'	6.6	4.6	3.9	6.4	6.3		-/-		5.2	5.4	4.9	Area with frequent floods
X'	6.9	4.2	7.0	6.3	6.4		-/-		4.2	5.5	4.9	Area w high air pollution
P	4.8	2.4	4.6	4.5	4.6		7.2		5.3	5.1	4.5	Large airport nearby
N	5.5	3.1	5.3	5.2	5.0		6.2		4.9	5.1	3.8	Coal power plant
U	7.0	4.2	5.7	7.7	6.9		5.9		4.2	4.3	4.5	Nuclear power plant
V	6.5	3.8	5.7	6.6	6.2		6.2		4.7	4.9	3.9	Chemical industry facilities
	6.2	*4.5*	*5.1*	*6.2*	*6.0*	*4.6*	*4.7*	*3.7*	*5.2*	*5.2*	*3.7*	*(Mean)*

Notes: *For full hazard names cf. Box 7. Empty cells: variable not measured for activities or residential condition. Selected results; for complete table see Rohrmann 2003.*

Regarding residential conditions, Living in an area with a nuclear power plant induces more fear than any environmental hazard. It appears that the judgements of the hazard Earthquakes, which has by far the highest number of fatalities, are too 'soft', compared to technology-induced risks.

3.2 Appraisal of the acceptability of risk sources

The concept "risk acceptance" refers to statements about the acceptability of a risk in individual or societal terms, i.e., whether it is evaluated as being tolerable or not. *Principal* acceptability is the normative, and *actual* acceptance the empirical aspect. In strict terms "acceptance" would need to be based on a deliberate decision; however, if people do not choose or refuse a risk situation intentionally, defacto-acceptance results.

The acceptance judgements (cf. the right section of *Box11* and *Box12* above) are lowest for Drugs, Smoking and Unsafe sex, and highest for social occupations such as Firefighting, Giving up a meagre but secure job, and the never-ending Driving - in spite of the enormous number of fatalities caused year after year by car traffic.

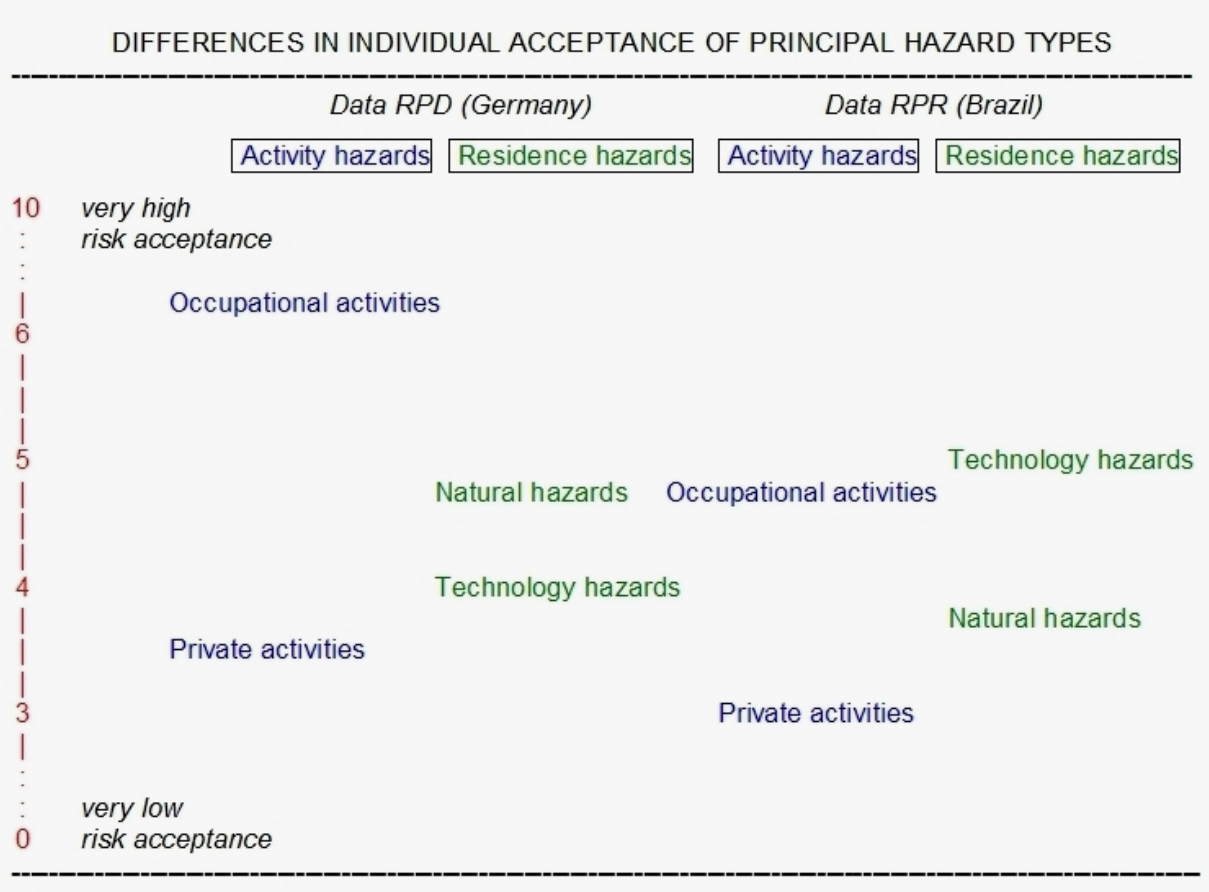
As expected, risks are more accepted if a hazardous action or technology provides benefits as well; this is especially the case with Firefighting, Cardriving, Cycling, Airports and Powerlines. For activities like Smoking, Unsafe sex, Hallucinogenic drugs and Gambling, some individual but almost no societal benefits are perceived.

If asked where the necessity of risk management is urgent, Drugs and environmental hazards like Floods, Hurricanes and Air pollution are main answers.

3.3 Influence of hazard types - risky activities and residential circumstances

As seen in *Box 12* (above), the acceptance of hazards varies considerably; furthermore, it matters what type of risk source is looked at.

Box 13



When merging single hazards into a typology, some trends become apparent; cf. ***Box 13*** (above), where this is done for two of the nine country data sets.

It appears that risks resulting from occupational activities are principally more accepted than those stimulated by private behaviours. Regarding residential conditions, a recurrent finding is that technology-induced are evaluated as less accepted than natural hazards - mainly because they are seen as better avoidable. However, that is less true for developmental countries where technological progress is vital for evolution.

3.4 Subjective determinants of risk evaluations

Risk magnitude ratings and risk acceptance views, the two core aspects of risk perception, are both dependent on two kinds of factors: attributes of the hazard and socio-psychological features of the exposed people. Three of the multiple correlation~regression analyses are presented in ***Box 14***, to show how the significance of selected factors for acceptance judgments can be quantified, using the most recent CRH study. The hazard examples include two most common risk behaviours and the most feared risk source.

Box 14:

MULTIPLE REGRESSION ANALYSES FOR RISK ACCEPTANCE ASPECTS

Data: Project CRH, Risk perception study in Recife/Brazil

Analysis for hazard:	**Regularly driving in cars**		**Long term heavy smoking**		**Living near nuclear power plant**	
Criterion = Dependent variable: **Individual acceptance of risk**						
Predictors = Independent variables ↓	*Beta*	*Corr P-C*	*Beta*	*Corr P-C*	*Beta*	*Corr P-C*
Overall risk magnitude rating	-.20	-.21	-.18	-.23	-.11	-.25
Feelings of anxiety about risk	-.15	-.23	-.08	-.12	-.23	-.30
Individual benefits	.42	.41	.33	.36	-/-	-/-
Attitude environmental concern	-/-	-/-	-/-	-/-	-.02	-.18
Attitude technology scepticism	-/-	-/-	-/-	-/-	-.26	-.31
Risk propensity attitude	.14	.20	.04	.04	-/-	-/-
Risk aversion attitude	.06	-.03	-.05	-.15	-/-	-/-
R	.52		.42		.43	
R^2 (adjusted)	.27		.18		.18	
Significance	**		**		**	

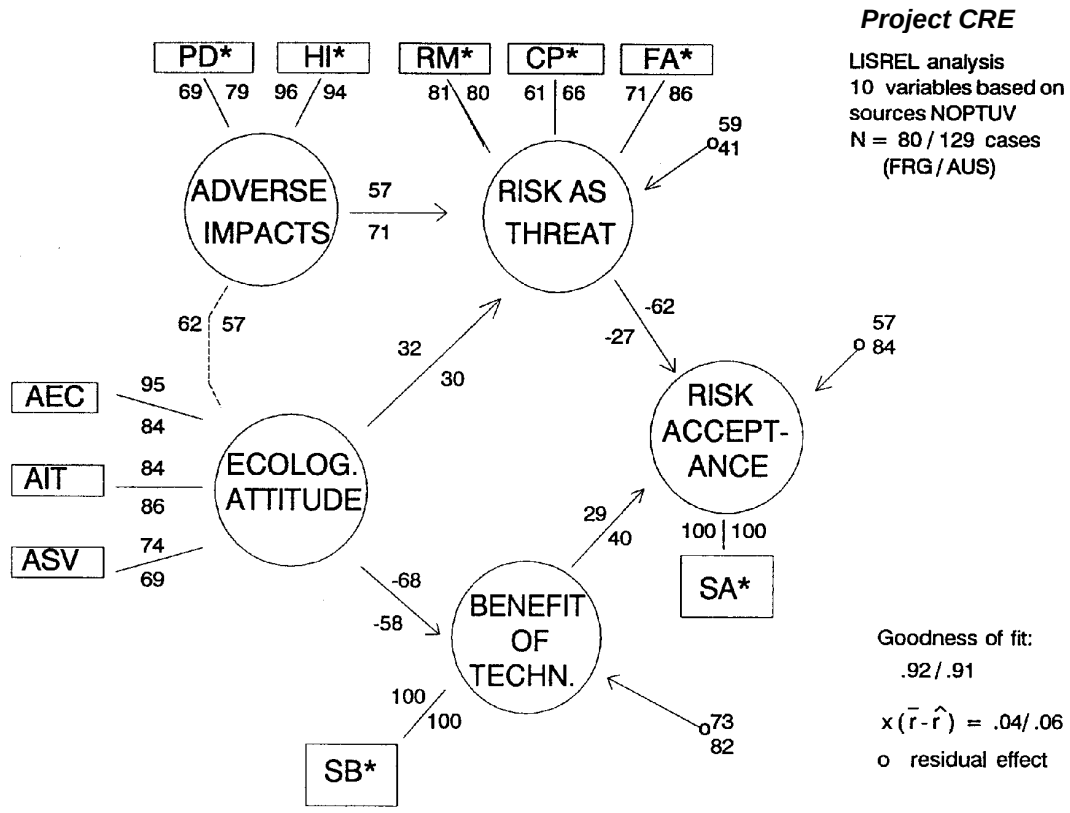
Notes: *Beta = beta-weight of predictor; Corr P-C = correlation of predictor with criterion*.

The individual acceptance of the Car-driving risk is considerably influenced by assumed individual benefits, and risk propensity slightly increases acceptance. The benefit aspect is also substantial for the hazard Smoking, while risk attitudes are irrelevant in this case. Regarding a residential hazard, Living near a nuclear power plant, perceived risk magnitude and technology scepticism are essential factors for (non-)acceptance.

Such analyses were extended by analyses based on causal structure modelling (LISREL, Joereskog & Soerbom 1988). They can be conducted for single hazards or merged hazard groups. For this extensively used method, one example is shown in ***Box 15***. It uses most of the risk assessment variables in Project CRE, and a 'meta-hazard' incorporating the 6 residential and environmental hazards investigated. Results from the Australian and the German sample are depicted in the same graph. The core findings are that risk acceptance is influenced by risk level ratings and attributed benefits, and that ecological attitudes have considerable influence as well.

Box 15:

EVALUATION OF ENVIRONMENTAL HAZARDS: STRUCTURAL ANALYSIS

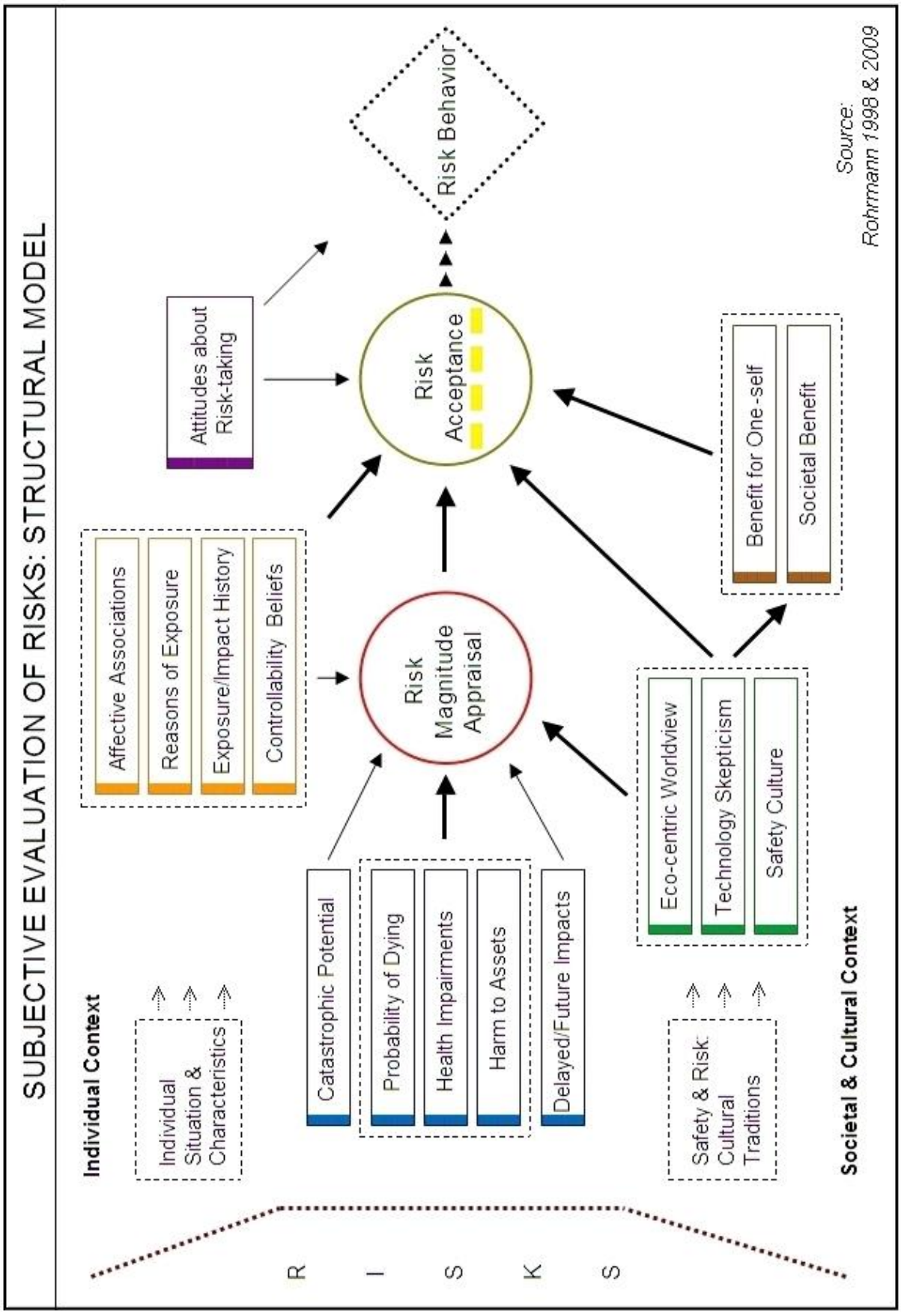


The core research aim was to understand what is happening in people's mind when judging the riskiness of hazards. It turned out that risk perception can *not* be depicted as a simple configuration - it is a complex process.

The correlational and causal data analyses indicated above were finally utilized to create an overarching conceptual model. This essential outcome of the conducted projects is shown in ***Box 16***; it reveals the multiple influences which affect responses to risk exposure (source: Rohrmann 1998, 2003, 2009).

The principal message of this model is that neither perceived risk magnitude nor acceptance of risks can be sufficiently explained by quantitative features such as event probabilities or expected damage.

Box 16


SUBJECTIVE EVALUATION OF RISKS: STRUCTURAL MODEL
Individual Context
Individual Situation & Characteristics
Affective Associations
Reasons of Exposure
Exposure/Impact History
Controllability Beliefs
Attitudes about Risk-taking
Catastrophic Potential
Probability of Dying
Health Impairments
Harm to Assets
Delayed/Future Impacts
Risk Magnitude Appraisal
Risk Acceptance
Risk Behavior
Eco-centric Worldview
Technology Skepticism
Safety Culture
Benefit for One-self
Societal Benefit
Safety & Risk: Cultural Traditions
Societal & Cultural Context
R I S K S
Source: Rohrmann 1998 & 2009

Emotional links to risk situations, opinions regarding environment and technology and attitudes like risk propensity all play a role in this process, which is embedded in the health & safety culture of a society. However, based on their knowledge, personality and social environment, each individual may develop a personal influence pattern for the relevance of the factors embodied in this model. Consequently, risk evaluations vary to a great extent across countries and cultures.

4 FINDINGS ABOUT SOCIAL AND CULTURAL DIFFERENCES

Initial remark: The comment in chapter 3 applies here as well.

4.1 Appraisals in different social groups

In the first of the three conducted projects, Project CRE, four social and professional groups were investigated for which significant cultural differences were expected: 'Technological', 'Monetarian', 'Ecological' and 'Feminist' orientation. The assumption was that the acceptance of risks is highest in case of technology and lowest in case of ecology background. The results confirmed this to some degree.

In ***Box 17***, data for the 6 technological hazards are shown. Interestingly, the ratings of the respondents with a Feminist orientation are roughly the same as the Ecological group, and the Monetarians have an intermediate view. The differences are strongest for Nuclear power plants - the hazard which was more discussed in Germany than any other technological risks.

In the second project, Project CRC, the samples were students, however, in 3 countries additionally a sample of experts and professional researchers could be established. In ***Box 18***, pertinent results gained in Australia and China are offered for 13 of the investigated hazards.

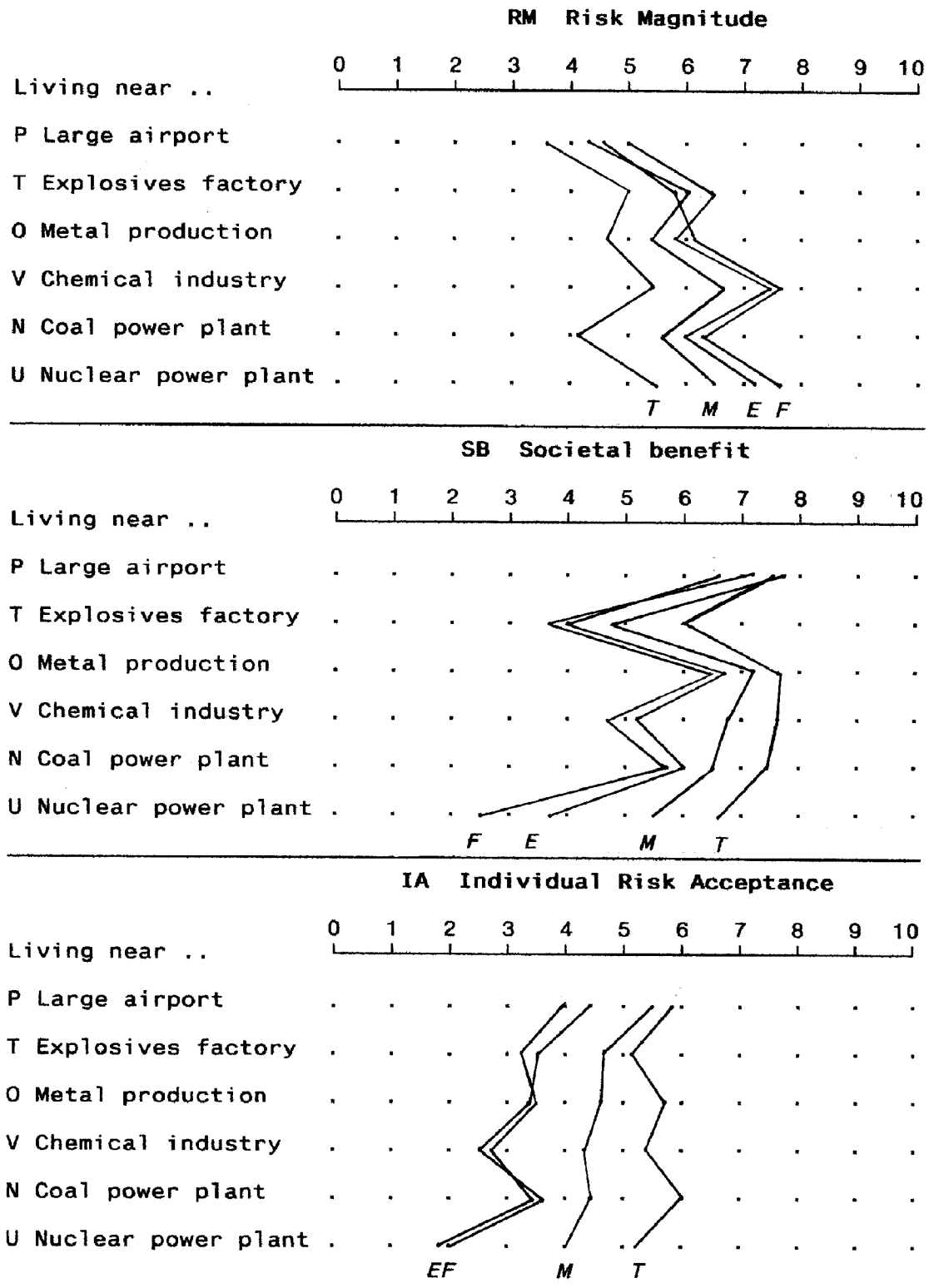
The table shows that in most regards students and scientist do not differ strongly, yet there are some exceptions in either the Australian or the Chinese data, or both: Urban cycling is seen as more risky yet also more beneficial for society by scientists; Gambling gets rated less harshly by students in terms of missing social benefits; and Smoking has a slightly higher individual risk acceptance in students' view.

In the third project, Project CRH, the three types of students, social sciences, Geography and technical sciences, could be systematically compared in their risk judgements; see ***Box 19*** (Rohrmann & Eichner 2012). The clearest differences occur in Living near a large airport and Living near a nuclear power plant - for both hazards social science students have the most negative and technology students the least negative appraisals while geography students have a moderate view.

This is in line with the cultural tradition that environmental agendas and actions flourish in sociological and psychological disciplines at the university - and similarly in related professions. In Geography subjects often pragmatism is influential; technology viewpoints

Box 17:

RATINGS FOR TECHNOLOGICAL HAZARDS BY DIFFERENT GROUPS - GERMAN DATA



Project: CRE;
Groups: T = 'Technological', M = 'Monetarian', E = 'Ecological', F = 'Feminist' orientation;
Sample: N = 40+77+40+60 = 217 respondents

are habitually shaped by some optimism that creation and utilization of technical ventures is effective. Altogether significant differences are rare though.

***Box 18*:**

Mean risk ratings: Selected comparisons Australia/China and Students/Scientist

Variable	*RM Risk Magnitude*				*SB Societal Benefit*				*IA Ind. Risk Acceptance*			
Country:	*AUS*	*CHI*	*AUS*	*CHI*	*AUS*	*CHI*	*AUS*	*CHI*	*AUS*	*CHI*	*AUS*	*CHI*
Group:	*Stu*	*Stu*	*Sci*	*Sci*	*Stu*	*Stu*	*Sci*	*Sci*	*Stu*	*Stu*	*Sci*	*Sci*
Hazard:												
Z1 Urban cycling	6.2	3.4	6.6	4.0	6.2	3.5	7.2	5.7	6.8	7.1	6.3	6.4
Z2 Car driving	3.9	4.4	4.5	5.1	3.9	4.6	3.7	5.3	7.9	7.7	7.8	6.8
G Smoking	8.8	6.6	8.9	7.1	2.0	2.1	1.3	2.0	4.7	2.8	5.2	1.9
J′ Unsafe sex	8.5	7.7	7.5	7.7	1.9	2.2	2.0	1.8	4.9	2.4	5.9	1.4
H′ Halluc. drugs	8.2	8.6	7.4	8.9	2.3	1.2	1.8	1.1	4.9	1.6	5.9	0.6
K Firefighting	6.6	5.2	5.8	4.8	8.4	8.2	8.3	8.7	7.1	6.0	6.6	5.3
$3 Giving up job	3.7	2.9	3.8	2.7	4.3	4.7	4.5	5.0	7.7	6.7	7.9	6.7
$1 Gambling	5.9	7.5	5.6	7.4	3.0	1.1	1.8	0.6	5.7	1.7	6.3	1.1
R Earthquakes	6.8	5.6	6.3	6.4		*(n.a.)*			6.1	4.5	6.6	3.2
S′ Floods	6.3	6.1	5.6	6.3		*(n.a.)*			6.2	3.9	6.2	2.9
P Airport	4.0	6.0	4.8	5.5	7.5	7.5	7.1	8.1	6.1	3.5	5.6	2.8
N Coal p.plant	5.4	5.9	5.4	5.4	6.9	7.2	7.2	7.9	5.3	3.8	5.4	3.2
U Nucl.p.plant	7.4	6.6	5.9	7.2	5.5	8.3	4.6	8.6	4.5	3.6	4.8	2.5
(Mean)	6.3	6.0	6.0	6.1	4.9	4.5	4.7	4.8	5.9	4.0	6.0	2.3

***Notes**: Sample sizes N=203/270. Student results based on equally weighted means of Psychology, Geography and Technology student samples.*

4.2 Disparities across countries

The 9 countries included in the three project differ immensely in their size, their cultural background and the homogeneity versus heterogeneity of their population - thus it is not easy to identify disparities in pertinent risk perception data. ***Box 20*** (further below; source: Rohrmann 2009) will be used to show some major outcomes.

For example, the risk rating for Urban cycling is far lower in China than in all other countries. Yet the acceptance of the hazard Car driving is substantial in every country, regardless of the stern accident data. The individual acceptance of Long-term smoking is exceptionally high in Japan. X-ray lab work is less worrying in 'western' countries, probably because of the higher safety standards there. The considerable differences regarding Gambling are hard to interpret because some countries are strict in banning it (China, Singapore) while in other countries it is part of the social culture - especially Australia but also Canada.

Box 19:

HAZARD RATINGS BY DIFFERENT GROUPS OF STUDENTS

Project "CRH" = Cognition of risks from hazards **Recife/Brazil sample RPR (N=160)**

Comparison of main data set and subgroup samples

[a] Recife data - Full sample (N=160) [b] Recife data - Social Subgroup (N=59)
[c] Recife data - Geography Subgroup (N=51) [d] Recife data - Technical Subgroup (N=50)

Risk Aspect

RM = Overall risk magnitude rating
PD = (Assumed) Probability of dying
CP = Catastrophic potential
FA = Feelings of anxiety about risk
IA = Individual risk acceptance
SA = Societal risk acceptance
NM = Necessity of risk management

	RM	PD	CP	FA	IA	SA	NM	
Hazard:								
Z2-a	4.7	4.8	-/-	3.9**	7.7**	7.4	6.0	Regularly driving in cars
-b	4.7	4.7	-/-	4.3	7.2	7.1	6.1	
-c	4.7	5.4	-/-	4.3	7.8	7.6	5.9	
-d	4.8	4.4	-/-	3.0	8.2	7.7	6.0	
G-a	8.9	7.6**	-/-	5.6	2.9	3.8	7.4	Long-term heavy smoking
-b	8.2	6.8	-/-	6.1	3.6	4.5	7.2	
-c	9.4	8.4	-/-	5.4	2.3	3.1	7.3	
-d	9.4	7.6	-/-	5.1	2.8	3.8	7.9	
J'-a	9.0	6.9	-/-	6.9	2.8**	3.3	7.8	Having unsafe/unprotected sex
-b	8.8	6.1	-/-	7.5	3.3	3.8	7.5	
-c	9.3	7.9	-/-	6.3	1.8	2.5	7.5	
-d	8.9	6.7	-/-	6.6	3.2	3.7	8.6	
P-a	4.8	3.3	5.3**	4.3	6.2	6.5	6.6**	Living near a large airport
-b	5.0	3.6	6.2	4.9	6.1	6.4	7.4	
-c	4.6	3.4	5.3	4.3	6.2	6.3	6.9	
-d	4.6	2.8	4.1	3.7	6.1	6.7	5.6	
U-a	6.8	5.2	7.5**	6.7**	3.8	4.5	8.3	Living near a nuclear power plant
-b	7.2	5.1	8.3	7.6	3.3	4.0	8.8	
-c	6.6	6.0	7.5	6.8	3.9	4.6	8.4	
-d	6.4	4.6	6.6	5.5	4.3	4.8	7.7	
{a}	*6.9*	*5.9*	*7.0*	*6.1*	*4.3*	*4.7*	*6.9*	*(Mean)*
{b}	*6.8*	*5.7*	*7.5*	*6.8*	*4.3*	*4.8*	*7.0*	
{c}	*7.0*	*6.3*	*6.9*	*6.0*	*4.1*	*4.5*	*7.0*	
{d}	*6.8*	*5.6*	*6.4*	*5.3*	*4.4*	*4.9*	*6.6*	

Notes: *Empty cells: variable not measured for activities or residential condition. Subgroup disparities: "**" is added if difference is significant on 1% level.*

Finally, as expected the rating of Nuclear power plants differ significantly: Most feared in Singapore, and acceptance is also low in Germany yet highest in Japan, in spite of Hiroshima, reflecting that this country is most dependent on this energy source.

Box 20:

RISK RATINGS: COUNTRY COMPARISON -- *Projects* CRC *and CRH*
China / Japan / Singapore / Australia / Canada / Germany -- Brazil~Recife

{1996} {1999} {1997} {1995} {1997} {1996} {*2007*}

Response scale: 0...10
Risk aspect: RM Perceived risk magnitude IA Individual risk acceptance

	Country:	***Chi***	***Jap***	***Sin***	***Aus***	***Can***	***Ger***	***B~R***	***Chi***	***Jap***	***Sin***	***Aus***	***Can***	***Ger***	***B~R***
	Sample: N=...	*270*	*196*	*153*	*203*	*141*	*235*	*160*	*270*	*196*	*153*	*203*	*141*	*235*	*160*
Hazard															
Z1	Urban cycling	3.5	5.6	6.9	6.3	6.2	6.1		7.0	6.0	5.6	6.7	6.8	6.1	
Z2	Regular car driving	4.5	3.4	4.2	4.0	3.8	4.4	4.7	7.6	6.6	7.7	7.9	8.2	6.5	7.7
C'	Dangerous beaches	7.2			6.6	6.9			3.3			5.6	5.6		
G	Long-term smoking	6.6	7.8	8.8	8.8	9.0	8.4	8.9	2.6	6.2	2.7	4.8	4.7	3.4	2.9
J'	Unsafe sex	7.6	7.8	8.6	8.2	8.4	7.8	9.0	2.3	5.8	2.7	5.0	5.0	3.3	2.8
I'	Intensive sun-bathing	4.9		7.3	7.7	7.2	7.5		3.0		3.7	5.3	5.4	4.1	
I	Overeating	4.9	6.5	7.3	6.5	6.5	7.2	8.0	3.9	6.1	4.2	5.7	5.7	4.2	3.8
H'	Hallucinogenic drugs	8.7	9.4	8.9	7.7	6.9	8.0	8.6	1.4	5.5	2.0	5.0	5.0	3.4	2.3
K	Firefighting	5.1	5.9	6.4	6.0	6.2	5.0		5.8	6.8	5.6	7.0	7.4	7.5	
E	X-ray lab work	6.0	5.7	6.3	5.0	4.7	5.1	6.9	5.4	6.5	5.4	6.7	7.0	6.6	5.0
L'	Underground miner	6.4	7.2	7.8	6.6	6.3	5.7	7.7	4.8	6.5	4.4	6.1	6.2	6.0	4.3
Z3	Mobile phone use		3.2			3.0	3.8	4.0		5.6	5.3		6.5		7.5
$1	Giving up job	2.8	4.3	4.5	3.8	3.9	4.3	5.0	6.7	5.8	6.6	7.7	7.7	6.9	5.3
$2	Gambling in casino	7.5	6.3	6.6	5.8	5.8	4.3	6.2	1.7	5.7	3.4	5.8	6.1	5.5	3.4
$5	Unsure investment		7.1	6.8		5.6		6.7		5.6	5.3		6.5		4.0
R	Earthquakes	5.7	6.8	7.8	6.8	5.7	6.2	7.0	4.3	6.4	3.8	6.2	7.2	5.0	4.2
Q'	Storms/hurricanes	6.2	6.9	7.9	6.6	6.0	6.7	7.3	4.0	6.2	3.6	6.2	6.8	4.8	4.0
S'	Floods	6.2	7.2	7.4	6.2	6.2	6.3	7.5	3.7	6.1	3.8	6.2	6.6	4.7	3.2
R'	Fire areas	6.7	6.8	7.7	6.4	6.0	5.2		2.9	6.1	3.5	6.0	6.6	5.0	
X'	Air pollution	7.1	7.4	7.9	6.2	5.9	6.7	7.2	2.5	5.8	2.9	5.0	5.6	3.6	3.9
X	Unhealthy climate	5.9		7.3	5.5				3.5		3.1	5.7			
P	Large airport	6.2	5.1	5.3	4.2	2.9	5.2	4.8	3.5	5.8	5.2	6.0	7.1	4.5	6.2
N	Coal power plant	5.8	4.9	6.7	5.3	4.9	5.0	4.5	3.4	5.9	4.0	5.4	5.6	4.6	5.7
U	Nuclear power plant	6.7	6.6	8.5	7.1	6.2	6.5	6.8	3.8	6.0	2.7	4.6	5.1	3.5	3.8
O'	Power lines		5.1		4.6	4.5	4.2			5.8		6.0	6.3	5.7	
V	Chemical industry		6.1	7.7	6.2	5.7	6.1	6.5		5.6	3.6	5.2	5.4	3.8	4.2
$3	Thieve places	6.0		7.4	5.8		5.0	8.0	2.4		2.7	5.0		4.3	2.5
$7	High-crime area		7.8			7.1		8.4		5.8			4.7		2.4
(Mean)		*6.0*	*6.4*	*7.2*	*6.2*	*5.8*	*5.9*	*6.9*	*3.9*	*6.0*	*4.1*	*5.9*	*6.2*	*5.0*	*4.3*
	Hazards: m =..	*23*	*26*	*24*	*25*	*26*	*24*	*25*	*23*	*26*	*24*	*25*	*26*	*24*	*25*

Source: Rohrmann 2009.

In the earlier presented *Box 18* two countries (Australia, China) are compared; this table included the aspect Perceived societal benefits (see above; pertinent data are provided in the middle of this table).

In ***Box 21*** parallel data are presented for three countries, restricted to 11 hazards; this table includes the appraisal "Feelings of anxiety about risk". The highest scores for fear

occurred in the Brazil sample (Living in a high-crime area, Flood areas) and the Australia sample (Smoking, Unsafe sex), yet Germany had also high anxiety scores (Nuclear power plants). Nonetheless, the overall rank order across all hazards is not overly different for these three countries.

Box 21:

RISK APPRAISALS IN DIFFERENT COUNTRIES

Selected data from 3 samples: Australa (N=170), Germany (N=151), Brazil (N=160)

Risk aspect:

RM = Overall risk magnitude rating **FA** = Feelings of anxiety about risk **IA** = Individual risk acceptance

Data:	***Aus***	***Ger***	***Braz***	***Aus***	***Ger***	***Braz***	***Aus***	***Ger***	***Braz***	
Hazard:										
Z2	4.0	4.4	4.7	3.3	2.9	3.9	7.9	6.5	7.7	Regularly driving in cars
G	8.8	8.4	8.9	7.8	7.1	5.6	4.8	3.4	2.9	Long-term heavy smoking
J'	8.2	7.8	9.0	7.7	7.4	6.9	5.0	3.3	2.8	Having unsafe/unprotected sex
I	6.5	7.2	8.0	5.7	5.5	5.7	5.7	4.9	3.8	Eating too much & very fatty food
H'	7.7	8.0	8.6	7.4	7.3	6.8	5.0	3.4	2.3	Consuming hallucinogenic drugs
$1	5.8	4.3	6.4	6.0	2.7	6.2	5.8	5.5	3.3	Regular participation gambling
$3$7	5.8	5.0	8.4	6.5	4.9	8.7	5.0	4.3	2.4	Living in a high-crime area *
S'	6.2	6.3	7.5	5.6	5.8	7.5	6.2	4.7	3.2	Area with frequent floods
P	4.2	5.2	4.8	4.2	4.3	4.3	6.0	4.5	6.2	Large airport nearby
N	5.3	5.0	4.5	4.8	4.3	4.5	5.4	4.6	5.7	Coal power plant nearby
U	7.1	6.5	6.8	7.3	7.5	6.7	4.6	3.5	3.8	Nuclear power plant nearby
	6.2	*5.9*	*6.9*	*5.9*	*5.2*	*6.1*	*5.9*	*5.6*	*4.6*	*(Mean, based on all hazards)*

Notes: *Rating scale: "0" to "10". For full hazard names cf. Box 7.*
The above country differences are significant, mostly on 1% or 5% level.
(*) At first this aspect was labelled "Living in an area where thieves operate".

In sum, the cross-national discrepancies are not coherent, they are dependent on the type of hazard investigated.

4.3 Linkage between intra-national and cross-national differences

For all three projects the propositions stated that disparities are expected on two levels, intra-national and cross-national, and that the findings in each country are shaped by their social structure.

The first project, Project CRE, had the strongest realization of intra-national features in its sample - four social and professional groups were investigated in each country, based on assumed cultural differences (see section 2.4 and 4.1 above). Given that the three countries (Germany, Australia, New Zealand) have a comparable background, namely European civilization, some similarities in risk perception could be expected, in spite of their distinctive

history. Altogether the data analyses revealed that the differences between the four groups were analogous, and greater than country differences for these 'western' nations (cf. Rohrmann 1994).

The second project, CRC, focussed on countries of very different background, comparing "Western" and "Eastern" countries, while the samples were mostly students, and in three cases also expert. Now country features dominated the results (cf. Rohrmann & Chen 1999, Rohrmann 2000, Rohrmann 2006).

The third project, Project CRH, added "Ibero-american" countries, based on a similar sampling approach. Again, cross-national effects were stronger than intra-national ones (cf. Rohrmann & Eichner 2012).

Nonetheless, such comparisons need to be interpreted with care, because nations outside Europe, like Australia and even more so Brazil or China, incorporate an enormous ethnological and sociological diversity (Eichner & Rohrmann 2012, Rohrmann 1994, Sjoeberg 1999) - thus, group differences may show up more influential than country differences if fully covered in the research design.

5 FINAL THOUGHTS ABOUT THE OUTCOMES

5.1 Analyzing and interpreting risk perception studies

As a 'social science' researcher, one strives to understand how people observe and evaluate risks in their environment. Multiple factors require deliberation - ranging from physical hazard facets to psychological and sociological features. The model in *Box 16* (shown above) tries to present the structure of core aspects. Most current 'ad hoc' judgements are rooted in long-established habits and norms (Eichner 1991, Rohrmann 1998, Weber & Hsee 2000), and significantly shaped by social contexts in people's world (cf. e.g. Renn 2010, Sjoeberg 1999). Furthermore, humans are not "machines", meaning, that 'objective' information and 'subjective' affects are always intertwined (Finucane & Holup 2006, Sjoeberg 2006). Risks are complex situations, and rational decisions about them (Dieckmann et al 2008, Rohrmann & Renn 2000, Renn 2008, Wardman 2006) are truly demanding.

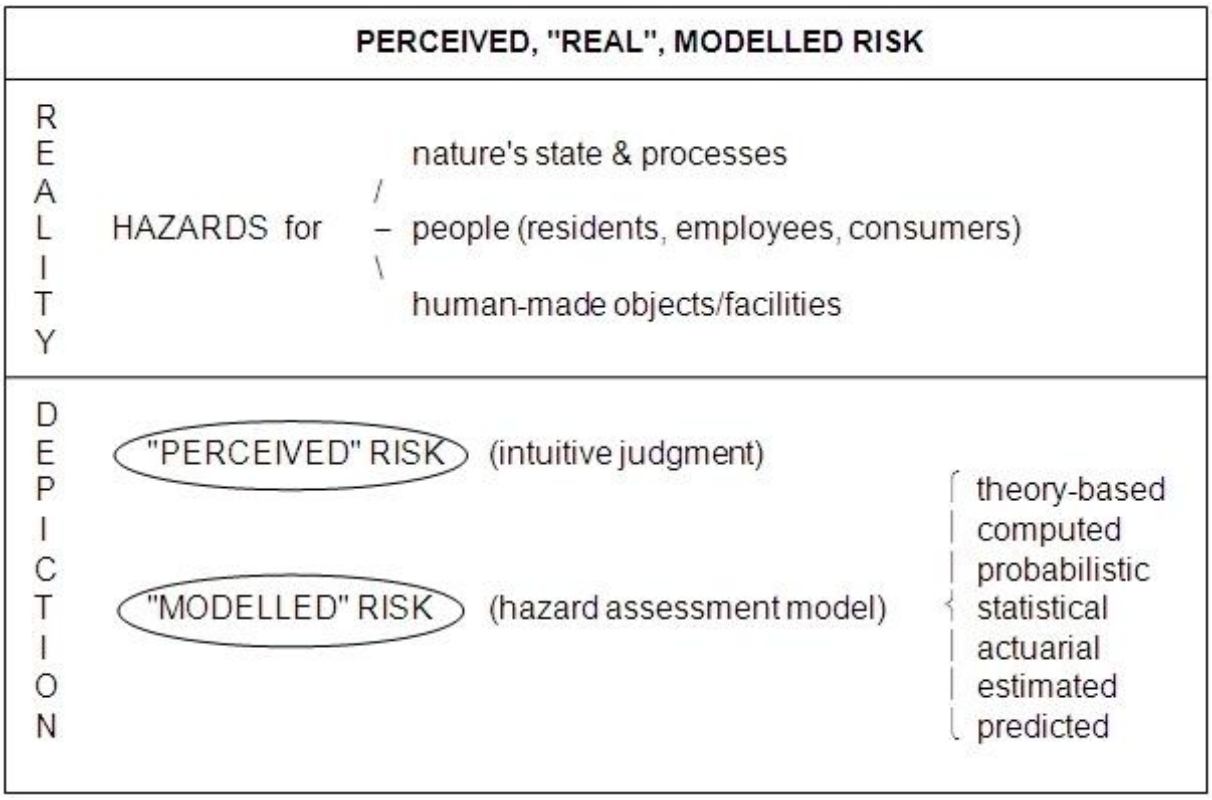
For almost all people the available knowledge is restricted, and decision processes are not standardized anyway. Indeed, each individual may have a personal influence pattern for the relevance of variables covered in the above process model. This begins with the intuitive risk definition a person employs and ends with the importance of general societal attitudes - e.g., technology scepticism - not specific to the risk source.

In sum, risk perceptions are interpretations of the world, based on experiences and/or beliefs. They are embedded in the norms, value systems and cultural idiosyncrasies of societies, and therefore vary across groups and countries.

5.2 Perceived versus "real" risk

The understanding of "risk" in natural and social sciences tends to clash. For example, quite often the term "real" or "actual" risk is used as counterpart to "perceived risk". Epistemologically this does not make much sense though (Hrudey & Light 1996, Rohrmann 1998, Slovic 1996). All statements about risk, whether rough guesses or highly quantitative data-based computations, are only depictions of the “reality” in question (cf. ***Box 22*** for an illustration).

Box 22:



It appears more appropriate to label results from Quantitative Risk Assessments (which can be seen as a model-based estimate of the “real” risk) as, e.g., “statistical” - which then may be contrasted to perceived risk, as investigated in social science research.

5.3 Impacts of country and of group disparities

Risk perceptions have a crucial impact on people's risk attitudes and risk behaviour (Rohrmann 2008). Therefore both group features and country features should be carefully considered when designing and executing risk communication and emergency management programs (Fischhoff et al 1997, Renn 208, Rohrmann 2009, Wiedemann & Schuetz 2010). Risk information has two different tasks - on one hand, to make people aware of hazard and their implications, and on the other hand, to counterbalance unnecessary worries. Disaster preparation aims at protecting people at risk. These agendas need to reflect that the effectiveness of procedures always differs socially.

5.4 What has been achieved and what warrants future research

After the projects reported here, and the many similar surveys in these and other countries, the gained knowledge about the perception of hazards for health and safety is extensive. In ***Box 23*** a summary of valuable research outcomes is outlined.

One crucial issue is to fully understand how people translate their appraisal of a present hazard into a decision about what to do and what not to do, and how to act to avoid or at least reduce a risk - thus an investigation should connect risk perception and risk behavior.

Box 23:

UTILITY OF RISK PERCEPTION RESEARCH

Findings about socio-psychological risk perception processes are significant for ...

> analyzing discrepancies between statistical risk data and subjective judgments
> understanding the influence of professional and societal orientations ('worldviews')
> separating differences between countries and those amongst social groups
> expounding why various people underrate or ignore existing hazards
> clarifying the roots of controversies about risky technologies
> identifying core needs for risk communication and disaster preparedness programs
> designing risk information in line with people's thinking about hazards
> recognizing reasons for shortcomings of safety campaigns
> considering cultural differences in conceptualizing and conducting risk communication

Some research from earlier periods may face validity problems. The reason is that for some hazards either the expert knowledge or the attitudes in the population (or both) have changed over time. Examples include: Nuclear power plants which were overrated while coal power plants' health impacts were underrated; smoking which is nowadays much more perceived as very risky; gambling which for many years was hardly realized as financial hazard; overeating which has become an essential topic in health programs. Thus some risk perception studies should be repeated even if the principal interpretation is still substantiated.

Furthermore, some specific cultures, such as Islam, as well as some types of countries, such as Africa, have only marginally been investigated.

Finally, the increasingly cross-cultural nature of risk perception research - providing knowledge about universal *and* culture-specific factors of subjective risk evaluations - is genuinely valuable in a world where more people than ever are exposed to physical and financial and social hazards.

May be risk perception research is less "popular" than it was 10 or 20 years ago? Yes, may be - yet there is no doubt that the further enrichment of our pertinent knowledge will be valuable for all people who deal with hazards.

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