RISK PERCEPTION, RISK ATTITUDE, RISK COMMUNICATION, RISK MANAGEMENT: A CONCEPTUAL APPRAISAL

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Abstract:

Human behavior in emergency management endeavours is influenced by risk perception, risk attitude, risk communication, and risk management facets. What is the relevance of these socio-psychological processes?

Risk perception refers to people's judgments and evaluations of hazards they (or their facilities, or environments) are or might be exposed to. Such perceptions steer decisions about the acceptability of risks and are a core influence on behaviors before, during and after a disaster. People's risk appraisals are a complex result of hazard features and personal philosophies.

Risk attitudes are people's intentions to evaluate a risk situation in a favorable or unfavorable way and to act accordingly. The underlying traits are risk propensity and risk aversion, i.e. cautiousness. High risk propensity can induce hazards; on the other hand, risk management activities may require some risk propensity. However, risk attitudes are neither necessarily stable, nor homogeneous across hazard types.

Risk communication is a social process by which people become informed about hazards, are influenced towards behavioral change and can participate in decision-making about risk issues in an informed manner. Such activities are part of almost all emergency management efforts. For effective risk communication, a sound understanding of risk perceptions and attitudes is indispensable.

Risk management are manifold procedures for reducing risks (either the hazard itself or its consequences) to a level deemed tolerable by society; this includes monitoring, control and public communication. For people exposed to a hazard (residents, employees, commuters, consumers etc), their preparedness is the critical goal, regarding both the occurrence or the impacts of an accident/disaster. This cannot be achieved without skilful risk communication.

In sum, successfully preparing populations for dealing with emergency situations requires that technological and administrative features of emergency management are enriched by socio-psychological considerations and measures. Given the reach of hazards and the diversity of exposed populations, cross-cultural and interdisciplinary research is essential.

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Introduction: Risk conceptualization.

Without question "risk" is a highly topical term. To illustrate this: an InterNet search for "risk" in February 2008 produced an enormous number of hits by three common search engines, namely 1290000000, 1220000000 and 849000000. There are many meanings of this concept, in terms of both denotations and connotations. One reason for this is that hazards, the sources of risks, are quite heterogenous.

How people behave in emergency management endeavours depends on their understanding and appraisal of present risk exposure and of risk mitigation measures. What "risk" means to them, and what steers their assessment of a risk situation is therefore an essential matter.

In most contexts the notion "*risk*" stands for a danger of unwanted and unfortunate events, not just uncertainty about the potential outcomes of an incident. Accordingly, "risk" can be defined as the possibility of physical and/or social and/or financial harm/detriment/loss due to a hazard within a particular time frame. "Hazard" refers to a situation, event or substance that can become harmful for people, nature or human-made facilities. A hazard is a physical entity while risk is not; it is an *inference* about the implications of a hazard for people (or nature, or assets) exposed to it (Drottz 1991, Fischhoff et al. 1984, Renn 1992, Rohrmann 1998, Taylor-Gooby 2002, Yates & Stone 1992). People at risk might be residents, employees in the workplace, consumers of potentially hazardous products, travelers/ commuters and/or the society at large.

These conceptualizations are based on a social-science perspective. By contrast, within natural sciences, "risk" is frequently defined as the probability of damage, e.g. in "quantitative risk assessment" (cf. e.g. Covello & Merkhofer 1993, Kolluru et al. 1995, Vose 2000) and especially in Probabilistic Risk Analysis (PRA). This creates conceptual problems because many hazards have low probability yet if they occur, the extent of damage may be enormous. It means that equating riskiness with the likelihood of a hazard is nonsensical if the potential impacts are severe (example: nuclear or chemical disasters). On the other hand, using just the severity (i.e., negative utility) as riskiness criterion is not appropriate either, because some hazards of high-frequency effects would rank low (example: earthquakes).

Consequently, integrative riskiness models were developed. An advanced access, based on psychological decision theory, is the "SEU" = Subjective expected utility" concept, in which the probability and the negative value of impacts become combined, and which utilizes estimated or assessed levels of the pertinent hazard facets (Arabie & Maschmeyer1988, Vose 2000, Vlek 1996) .

A further impediment in quantifying "risk" is that not all hazard impacts can be measured by counts (e.g., number of fatalities) or expressed in financial terms (e.g., damage in dollars) - instances are disrupted family ties, post-traumatic stress disorder, depression of disaster victims.

From a socio-psychological perspective, it is therefore important to be conscious of differences between physical and psychological phenomena, and to distinguish between people's judgments, attitudes and behaviors in respect to risk situations. The conceptualization of "risk" should be a multi-disciplinary undertaking which connects insights from domains like engineering, geography, economics and psychology in order to create suitable and valid characterizations.

Finally, the notion "risk" refers mostly but not always to *negative* issues - in some fields "risk" functions as a *neutral* term (equating to uncertainty about the outcomes of choices). Occasionally even *positive* connotations emerge, such as 'desired risk' (e.g., 'getting a thrill' by acting in a risky manner) (Breakwell 2007, Rohrmann 2003a). Clearly "risk" is a multi-facetted concept.

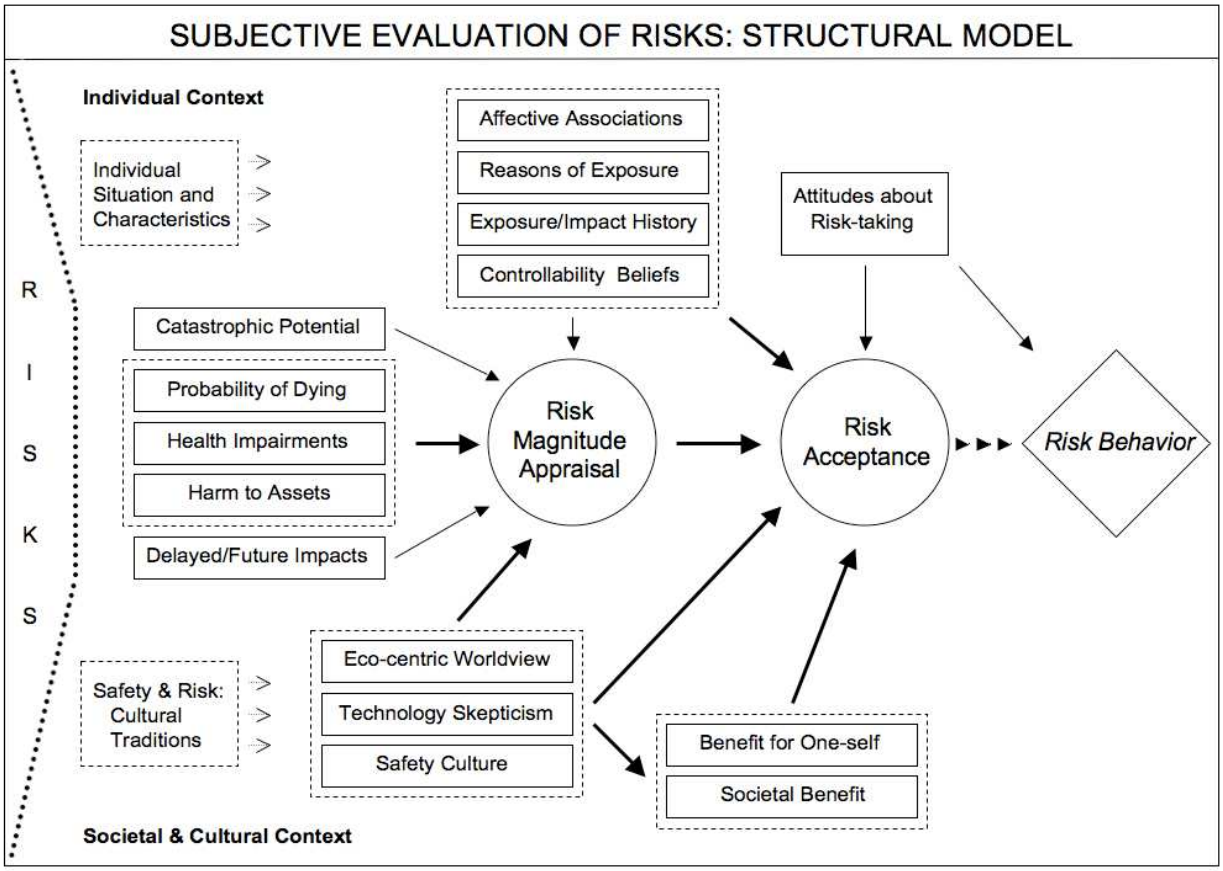
Risk perception facets.

People's judgments and evaluations of hazards they (or their facilities, or environments) are or might be exposed to are called "*risk perception"*. 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 (Finucane & Holup 2006, French et al. 2006, Rohrmann 1994, Rohrmann 2003, Slovic 2000). Every human is occupied with risk perception most of the time, whether driving a car or thinking about residence safety or worrying about fires in an environment and so on. It is notable that most people have views about every risk, regardless of whether they are exposed to it or not. Strictly speaking risks cannot be “perceived” (like a size or speed or the weather). Yet "risk perception" has nonetheless become the standard label of the respective research topic.

Risk perceptions steer decisions about the acceptability of risks and are a core influence on behaviors before, during and after a disaster. However, neither perceptions of nor attitudes towards risk should be taken as equivalents of *actual* behavior.

People's risk appraisals are a complex result of hazard features and personal philosophies. The conceptual risk perception model shown in *Box 1* reveals the multiple influences which affect responses to risk exposure (source: Rohrmann 1998).

Box 1:



Social-scientific research on risk perception (overviews in Boholm 1998, Renn & Rohrmann 2000, Rohrmann 1999) has explicated the strong influence of socio-psychological factors and the cultural quality of risk evaluations. How the magnitude of risks is rated, and to what extent people are prepared to accept a risk, is dependent on the type of hazard, on personal experiences, beliefs and attitudes, and on diverse societal influences. Judgments are more negative for technology-induced than for natural hazards, and involuntary than self-

chosen (controllable) risk exposure. Fear associations, unfamiliarity, catastrophic potential and long-term health impacts are stronger influences than assumed probability to die.

Clearly, 'technical' and statistical risk characteristics cannot explain risk acceptance data. While individual and particularly societal benefits counterbalance risk concerns for occupational and private risks, this is less true for large-scale technology risks. Regarding personal characteristics, attitudes such as environmental concern, scepticism about technology usage and 'post-material' value orientation are significant determinants (while socio-demographic factors have only restricted effects). Those attitudes are embedded in a wider cultural and political context; therefore, societal (sub-)groups differ widely in risk acceptance. Also, acceptance or defiance of risks is not determined by knowledge (or lack thereof) - value disparities are the key factor.

Risk perceptions can be quantified by socio-psychological scaling and survey techniques (denoted as the "psychometric approach") (Fischhoff et al. 1978, Rohrmann 2003a, Slovic 1992). In other words, while risk perception is subjective in nature, the data describing it are as objective as other scientific findings. Since 1978 (cf. Fischhoff et al.'s seminal work), risk perception surveys have been conducted in several dozen countries (overview in Rohrmann 1999 and Rohrmann 2003a).

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 (Hudrey & Light 1996, Lima et al. 2005, 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 2* for an illustration).

Box 2:

PERCEIVED, "REAL", MODELLED RISK			
REALITY	HAZARDS for	/ – \	nature's state & processes people (residents, employees, consumers) human-made objects/facilities
DEPICTION	"PERCEIVED" RISK	(intuitive judgment)	
	"MODELLED" RISK	(hazard assessment model)	{ theory-based, computed, probabilistic, statistical, actuarial, estimated, predicted }

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.

Risk attitude facets.

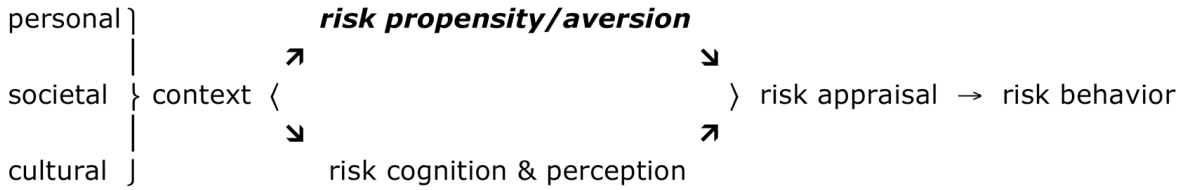
In order to gain an understanding of how humans think and feel about risks, several intertwined facets need to be deliberated. While risk behavior has been studied intensely in both psychological and economic terms and a large number of risk perception studies exist (as outlined above), far less research has been conducted regarding people's *risk attitudes.* These are intentions to evaluate a risk situation in a favorable or unfavorable way and to act accordingly.

The underlying traits are propensity and risk aversion, i.e. cautiousness (Rohrmann 2004a, Yates 1992). The potential role of these factors is shown in *Box 3*.

Risk propensity versus risk aversion can be conceptualized as two poles of a one-dimensional attitude towards risk-taking but also as two separate concepts. It is widely assumed that people differ considerably in their attitude towards risks, ranging from cautiousness to risk-seeking and even pleasure in risk-taking. However, there is no convincing evidence that this presumed dimension is a general trait. Recent research demonstrated that risk attitudes are neither necessarily stable, nor homogeneous across hazard types. Rather, humans tend to hold *domain-specific* attitudes regarding physical, financial and social risks (Gattig & Hendrickx 2007, Rohrmann 2004a, Weber et al. 2002).

Box 3:

A MODEL ON THE ROLE OF RISK ATTITUTES



What are the motivations of people when they decide about taking or avoiding risks? Factors include: Experience-seeking, self-enhancement, pleasure from being at risk, physical enjoyment, prestige-seeking, social pressure, financial gain, lack of time or means, and under-estimation of a hazard. These influences can be tracked down to a person's cultural background in terms of her/his ideological, professional and national affiliations.

Risk attitudes are linked to safety aims in two ways: Lack of cautiousness induces hazards; on the other hand, risk management activities may require some risk propensity.

Risk communication facets.

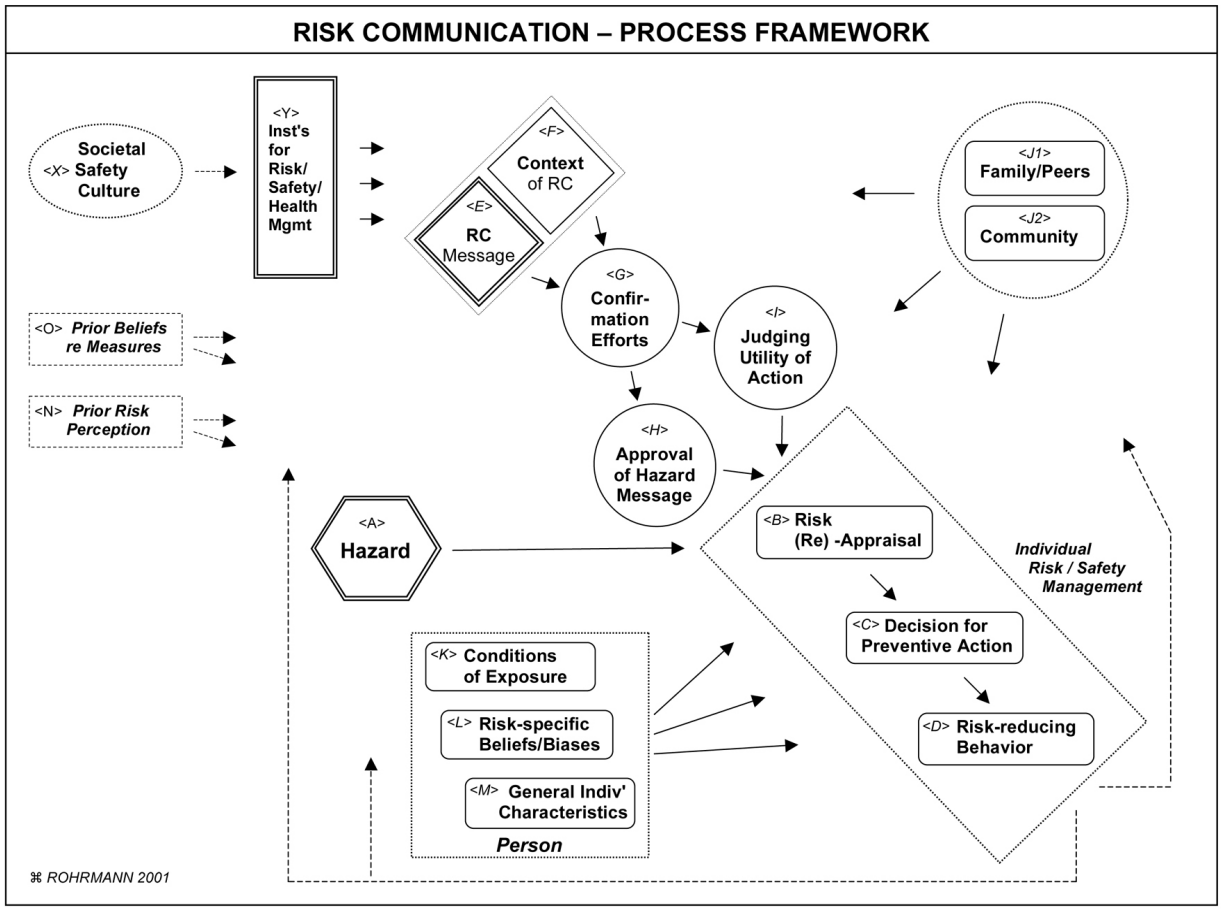
Any population exposed to hazards - natural ones such as earthquakes, hurricanes, wildfires or floods; or technological ones, such as explosions, chemical spills, train crashes and so on - wants and needs to be optimally informed about risk characteristics, preventative measures, and appropriate behaviors during emergencies. Authorities have to compose pertinent planning, prepare coping strategies and communicate the relevant information effectively to residents, people in the workplace and communities as a whole. The more disaster management requires active involvement of residents, the more vital risk information/ communication/education become. Furthermore, in the case of controversial risk sources (e.g., the positioning of an airport or a waste incineration facility), public discussion, participation of stakeholders and possibly joint conflict resolution are required.

All these situations involve social processes which are usually subsumed under the (umbrella) term "*risk communication*", and the exchange of risk information between

interested parties (individuals, groups, institutions) is at the core of it (Fischhoff et al 1997, Lundgren & McMakin 1998, Rohrmann 2000).

The model presented in *Box 4* outlines the components of risk communication pursuits and the related socio-psychological processes (source: Rohrmann 2000). The focus is on an individual rather than collective (community) level of activities. The core endeavour is to modify risk perceptions and risk attitudes towards protective risk behavior.

Box 4:



In short, the model expresses that the final outcome variable, risk-reducing behavior <D> regarding a hazard <A>, is determined not just by the communicated messages of the information/education program <E> but the result of a complex evaluation process <B-C and G-H-I>, including prior attitudes <N, O>, and influenced by personal characteristics <K, L, M> and manifold context factors, e.g., attributes of the information source and channel features <F> utilized by the respective authority/agency <Y>, as well as family/peers/friends and the community one belongs to <J>. The whole process is embedded into a culture's health and safety orientation <X>. As the feedback-loops in the figure indicate, risk-reducing behavior <D> is intended to mitigate the impacts of the hazard <A>. Moreover, often people will link their activities to their social network <J> or approach relevant authorities <Y>.

Models like this one can be elaborated and/or made specific to the problem type, the target audience, and the relevant attitudes and behaviors to be dealt with. Such a framework is essential for designing evaluations and developing pertinent instruments, as well as recognizing reasons for lack of success with risk communication campaigns (Alaszewski 2005, Kasperson 2005, Morgan et al. 2002, Rohrmann 2004b).

Evidently risk communication is the indispensable link between risk perception and risk management. Given the high relevance of effective disaster preparedness, risk communication programs need to be based on a sound understanding of the underlying socio-psychological processes and preconditions for successful communication.

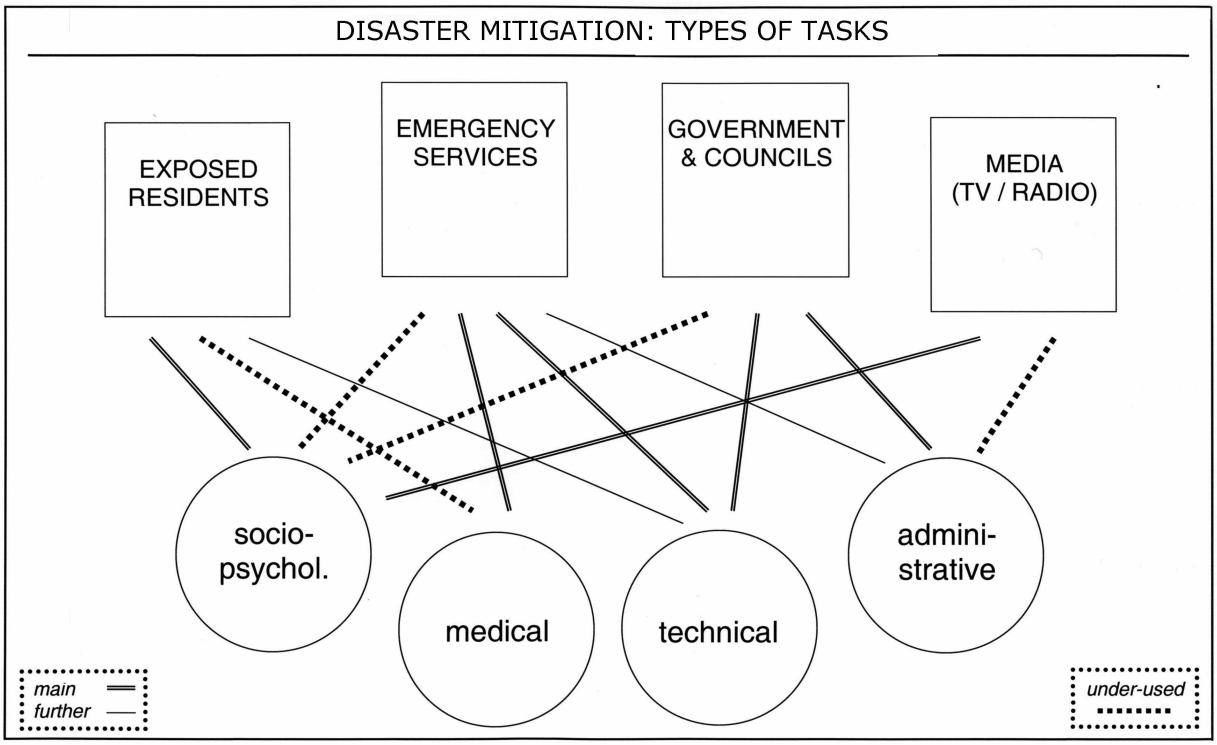
Risk management facets.

The activities of individuals or authorities to remove or mitigate the sources and/or impacts of hazardous events are usually labeled "*risk management*". The aim is to reduce risks (either the hazard itself or its consequences) to a level deemed tolerable by society and to assure control, monitoring, and public communication (Alexander & Sheedy 2004, Morgan 1990, Kolluru et al. 1995, Renn 1990, Rohrmann 2004b).

Many hazards can be eliminated or avoided, at least principally (e.g., house fires); others can not (e.g., earthquakes), and consequences rather than causes are to be dealt with. Moreover, the preconditions of risk events require meticulous attention. Consequently, risk management entails very different tasks, dependent on the nature of the hazard (Gregory et al. 2006, Morgan 1993). Furthermore, the exposed population, ranging from individuals to communities at large, and their specific vulnerability need to be reflected in any mitigation effort (Paton 2005, Rohrmann 2004b).

The involved 'actors', i.e., government and councils, emergency services, exposed residents and the media (TV, radio, print, electronic media) face a variety of tasks, which require administrative, technological, medical and socio-psychological means and resources; for the majority of hazards each of these is needed. In *Box 5*, the main links between actors and task types are indicated. The dotted lines refer to risk management circumstances in which particular perspectives would deserve higher attention than customary, for example: governmental authorities and emergency services should seriously consider socio-psychological issues, residents need reasonable medical knowledge regarding disaster impacts, and media could increase their reference to the risk management efforts of public authorities.

Box 5:



Arguing for the relevance of social-science reasoning may sound like "carrying owls to athens", given that most agencies have long broadened their perspectives and procedures - yet their resource allocation is at times biased towards "technology rather than psychology".

Outlook: Risk concepts in emergency management.

Successfully preparing populations for dealing with hazardous situations requires that technological and administrative features of emergency management are enriched by socio-psychological considerations and measures. The risk aspects discussed here are characterized by manifold links: Risk perception and risk attitudes steer people's risk behavior; risk communication programs need to be based on a sound understanding of the underlying risk perception processes in order to achieve their goals; and harmonizing technological pursuits with risk communication procedures is a precondition for effective risk management.

All these socio-psychological processes bear relevance for the risk management agenda, which usually consists of four phases: Risk Identification, Estimation, Evaluation and Treatment (Standards Australia 2004). *Box 6* demonstrates how our understanding of people's knowledge, thoughts and behaviors regarding risks can be considered in the risk analysis undertaken by authorities.

Box 6:

LINKS BETWEEN RISK MANAGEMENT & SOCIO-PSYCHOLOGICAL RISK RESEARCH

		M	Risk Identification	
	A	A		↖ *R PERCEPTION*
	N	N		↙ *R APPRAISAL*
R	A	A	Risk Estimation	
I	L	G		↙ *R ACCEPTABILITY & ACCEPTANCE*
S	Y	E		
K	S	M	Risk Evaluation	← *R ATTITUDES*
	I	E		
	S	N		↙ *R INFORMATION & EDUCATION*
		T	Risk Treatment	← *R COMMUNICATION*

Given the reach of hazards and the diversity of exposed populations, cross-cultural and interdisciplinary research is essential (Grothmann & Reussweig 2006, Rohrmann 2007, Weber & Hsee 2000, Zinn & Taylor-Gooby 2006). Critical issues include: Which are optimal combinations of technological and psychological preparedness regarding specific types of hazards (earthquakes, fires, terrorism etc), and how can technical, social and psychological barriers to involvement and implementation best be overcome? How can programs be tailored to the characteristics and needs of specific societal groups and 'ethnic' residents? What can be achieved by InterNet and WWW approaches for residents? How about the long-term efficiency of preparedness-enhancing campaigns? A further, overarching topic is ethical decision-making (Aven 2007, Hansson 2004).

Research results will provide the requisite knowledge for enhancing and refining hazard mitigation and disaster preparedness campaigns and help authorities to make empirically informed decisions about strategies and budget allocations. The utilization of such knowledge then requires an open-minded interdisciplinary collaboration of researchers and public authorities which are responsible for emergency management.

Literature

Alaszewski, A. (2005). Risk communication: identifying the importance of social context. Health, Risk & Society, 7, 101-105.

Alexander, C., Sheedy, E. (2004). The professional risk managers' handbook: A comprehensive guide to current theory and best practices. Wilmington, DE: Prmia Publications.

Arabie, P., & Maschmeyer, C. (1988). Some current models for the perception and judgment of risk. Organizational Behavior and Human Decision Processes, 41, 300-329.

Aven, T. (2007). On the ethical justification for the use of risk acceptance criteria. Risk Analysis, 27, 303-310.

Boholm, A. (1998). Comparative studies of risk perception: A review of twenty years of research. Journal of Risk Research, 1, 135-163.

Breakwell, G. M. (2007). The psychology of risk. Cambridge, United Kingdom: Cambridge University Press.

Covello, V. T., & Merkhofer, M. W. (1993). Risk assessment methods: approaches for assesing health and environmental risk. New York: Plenum.

Drottz-Sjoeberg, B. (1991). Risk perceptions and definitions of risk. In B. Drottz-Sjoeberg (Ed.), Perceptions of Risk (pp. 163-214). Stockholm: Center for Risk Research.

Finucane, M. L., & Holup, J. L. (2006). Risk as value: Combining affect and analysis in risk judgements. Journal of Risk Research, 9, 141.

Fischhoff, B., Bostrom, A., & Quadrel, M. J. (1997). Risk perception and communication. In R. Detels, J. McEwen, & G. Omenn (Eds.), Oxford textbook of public health (pp. 987-1002). London: Oxford University Press.

Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S., & Combs, B. (1978). How safe is safe enough? A psychometric study of attitudes toward technological risk and benefits. Policy Science, 127-152.

Fischhoff, B., Watson, R. S., & Hope, C. (1984). Defining risk. Policy Science, 17, 123-139.

French, D. P., Sutton, S., Kinmonth, A. L., & Marteau, T. M. (2006). Assessing perceptions of risks due to multiple hazards. Journal of Risk Research, 9, 657-682.

Gattig, A., & Hendrickx, L. (2007). Judgmental discounting and environmental risk perception: Dimensional similarities, domain differences, and implications for sustainability. Journal of Social Issues, 63, 21-40.

Gregory, R., Failing, L., Ohlson, D., & McDaniels, T. L. (2006). Some pitfalls of an overemphasis on science in environmental risk management decisions. Journal of Risk Research, 9, 717-735.

Grothmann, T., & Reussweig, F. (2006). People at risk of flooding: Why some residents take precautionary actions while others don't. Natural Hazards, 38, 101-120.

Hansson, S. O. (2004). Philosophical perspectives on risk. Techne, 8, 10-35.

Hrudey, S. E., & Light, A. (1996). Real versus perceived risk: What is the reality for environmental scientists? Alberta: University of Alberta.

Kasperson, R. E. (2005). Six propositions on public participation and their relevance for risk communication. In J. X. Kasperson & R. E. Kasperson (Eds.), The social contours of risk: Volume I. Risk communication and the social amplification of risk (pp. 19-28). London: Earthscan.

Kolluru, S., Bartell, R., Pitblade, R., & Stricoff, S. (Eds.). (1995). Risk assessment and management handbook. For environmental, health, and safety professionals. New York: McGraw-Hill.

Lima, M. L., Barnett, J., & Vala, J. (2005). Risk perception and technological development at a societal level. Risk Analysis, 25, 1229.

Lundgren, R., & McMakin, A. (1998). Risk communication: A handbook for communicating environmental, safety, and health risks. Columbus: Battelle Press.

Morgan, M. G. (1990). Choosing and manageing technology-induced risks. In T. S. Glickman & M. Gough (Eds.), Reading in Risk (pp. 5-15). Washington: Resources of the Future.

Morgan, M. G. (1993). Risk analysis and management. Scientific American, 248, 24-30.

Morgan, M. G., Fischhoff, B., Bostrom, A., & Atman, C. J. (2002). Risk communication: A mental models approach. Cambridge: Cambridge University Press.

Paton, D. (2005). Disaster preparedness: A social-cognitive perspective. Disaster Prevention and Management, 12, 210-216.

Renn, O. & Rohrmann, B. (Eds.) (2000), Cross-cultural risk perception. Dordrecht: Kluwer Publishers.

Renn, O. (1990). Risk perception and risk management. Part 2: From risk perception to risk management. Risk Abstracts, 6-10.

Renn, O. (1992). Concepts of Risk: A classification. In S. Krimsky & D. Golding (Eds.), Social theories of risk (pp. 53-82). London: Praeger.

Rohrmann, B. (1994). Risk perception of different societal groups: Australian findings and cross-national comparisons. Australian Journal of Psychology, 46, 150-163.

Rohrmann, B. (1998). The risk notion: Epistemological and empirical considerations. In M. G. Steward & R. E. Melchers (Eds.), Integrated risk assessment: Applications and regulations (pp. 39-46). Rotterdam: Balkama.

Rohrmann, B. (1999). Risk perception research: Review and documentation (Studies in Risk Communication 69; also published as WWW version: http://www.kfa-juelich.de/mut/hefte/heft_69.pdf). Juelich: Research Center Juelich.

Rohrmann, B. (2000). A socio-psychological model for analyzing risk communication processes. Australasian Journal For Disaster Studies . <http://www.massey.ac.nz/~trauma/issues/1999-1/rohrmann.htm>

Rohrmann, B. (2003). Perception of risk - Research overview. In J. Gough (Ed.), Sharing the future - Risk communication in practice. Christchurch: CAE, University of Canterbury, New Zealand. [a]

Rohrmann, B. (2003). The role of risk communication in processes in disaster preparedness. In J. Gough (Ed.), Sharing the future - Risk communication in practice. Christchuch: CAE, University of Canterbury, New Zealand. [b]

Rohrmann, B. (2004). Project RAS - Risk attitude scales (Research report). Melbourne: University of Melbourne, Dept. of Psychology. <www.rohrmannresearch.net/rac-report.pdf>. [a]

Rohrmann, B. (2004). Technological versus socio-psychological risk management. In Emergency-Management-Australia (EMA) (Ed.), Safer sustainable communities (Proceedings of the 2003 Australian Disaster Conference, on a CD-ROM). Canberra: EMA. [b]

Rohrmann, B. (2007). Exploring information for residents on websites of fire authorities - practical experiences. The Australian Journal of Emergency Management, 22, 10-15.

Slovic, P. (1992). Perception of risk: Reflections on the psychometric paradigm. In D. Golding & S. Krimsky (Eds.), Theories of risk (pp. 117-152). London: Praeger.

Slovic, P. (1996). Experts must respect and include citizens in decisions on risk. Environmental Health, 1/96, 7-8.

Slovic, P. (2000). The perception of risk. London: Earthscan.

Standards Australia and Standards New Zealand (2004). Risk management (AS/NZS 4360). Homebush NSW: Standards Association of Australia.

Taylor-Gooby, P. (2002). Varieties of risk. Health, Risk and Society, 4, 109-112.

Vlek, C. (1996). A multi-level, multi-stage and multi-attribute perspective on risk assesment, decision-making, and risk control. Risk, Decision and Policy, 9-31.

Vose, D. (2000). Risk analysis - a quantitative guide. Chichester, Wiley.

Weber, E. U., & Hsee, C. K. (2000). Culture and individual judgment and decision making. Applied Psychology: An International Review, 49, 32-61.

Weber, E. U., Blais, A., & Betz, N. E. (2002). A domain-specific risk-attitude scale: Measuring risk perceptions and risk behaviors. Journal of Behavioral Decision Making, 15, 263-290.

Yates, J. F., & Stone, E. (1992). The risk construct. In J. F. Yates (Ed.), Risk-taking behavior (pp. 1-26). Chichester: Wiley.

Zinn, J. O., & Taylor-Gooby, P. (2006). Risk as an interdisciplinary research area. In P. Taylor-Gooby & J. Zinn (Eds.), Risk in social science (pp. 20-53). Oxford: Oxford University Press.

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Conducted numerous empirical investigations; strong emphasis on interdisciplinary approaches and applicability of findings. Also work as consultant with governmental agencies, courts and companies. In 2006 establishing the "TIEMS-Rohrmann Student Scholarship Fund". Publication of about 100 articles/reports/chapters/books.