Environmental risk communication: A review and annotated bibliography

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Introduction

Risk communication—as a field of study and practice—emerged in the mid-1980s. One of the first published definitions of risk communication characterized the process as any purposeful exchange of information (via the transfer of risk messages) about health or environmental risks between interested parties. This exchange of information involves the process of conveying risk messages between interested parties about such things as (a) levels of health or environmental risk; (b) the significance or meaning of health or environmental risk; or (c) decisions, actions, or policies aimed at managing or controlling health or environmental risk (Covello et al. 1986).

Consistent with this early definition, two main motivations for engaging in a risk communication effort are the need or desire to 1) inform or be informed and 2) facilitate the involvement of the interested and affected parties in risk management (decision making) processes. The first motivation often arises out of government requirements to inform the public about certain hazards and risks (e.g., the U.S. Administrative Procedures Act, the Canadian and American Freedom of Information Acts, the U.S. National Environmental Policy Act, provisions under the U.S. Superfund Amendments, and others). The second motivation reflects a desire or requirement both to share power between experts and non-experts, and public and government groups, as an alternative to expert-driven regulatory control over risks.

Because of its linkages with both information processing and decision-making, risk communication can be thought of as having both *prescriptive* and *descriptive* components (Arvai 2000). The prescriptive component of risk communication can be viewed as the process that takes place *prior* to and *during* the setting of policy agendas or the making and implementation of risk-policy decisions. Prescriptive risk communication is the process for developing a shared understanding of the risks and benefits associated with a particular activity through the transfer of risk messages between individuals, institutions, and communities prior to making decisions about how, or even if, to proceed with proposed policies (Slovic 1993). This shared understanding is developed through an interactive process of information exchange between stakeholders such that the different points of view regarding impending or ongoing decision making processes (e.g., representation, objectives, alternatives, tradeoffs, etc.) become better understood by all of the parties involved. In other words, the objective of the prescriptive risk communication is to help foster the meaningful involvement of the interested and potentially affected parties in good decision making processes regarding risks (i.e., to more broadly inform decision and policy making). For especially complex decision problems, a prescriptive risk communication may include the incorporation of decision aiding tools (in addition to stakeholder participation and deliberation) to help people make better risk management decisions (Hammond et al. 1999). Combined risk communication and decision aiding approaches are particularly important because, as decision scientists have long demonstrated, both individuals and groups have significant difficulty with making complex decisions.

Descriptive risk communication usually follows once decisions have been made and are aimed at a wider audience to support and justify the choices made based on the outcomes of the prescriptive process that preceded it. Thus, the objective of descriptive risk communication is to provide supporting information about risk decisions, guidelines, and policies that have already been made. This supporting information may take many shapes. For example, descriptive risk communication is often presented in the form of

warnings that reflect the decisions of—for example—regulatory agencies (often based on extensive scientific information and deliberation within a group of experts) about the degree of risk associated with a particular activity. Because of the complementary nature of these two risk communication components, neither should be implemented without being preceded or followed by the other. Moreover, because both the prescriptive and descriptive components hinge on the processes of making and supporting choices, risk communication becomes more closely aligned with promoting thoughtful and defensible decision-making than it does with a solely expert-driven process of 'risk education.'

For example, many examples of research and practice in risk communication applied to a forestry context have focused on the descriptive (e.g., educational or persuasive) aspect of specific risk messages. Perhaps the most well known is that of Smokey Bear, though there are countless others; these include studies of behavior change in response to risk messages (Gardner et al. 1987) and information needs for thoughtful risk communication design (Simons and Arvai 2004). Other examples of risk communication in a forestry context focus on prescriptive deliberation (e.g., how the process might be structured to enhance stakeholders' understanding of the tradeoffs between risks and benefits as they relate to forest management). In this prescriptive context, for example, forest management efforts combine a large number of activities with varied economic (e.g., timber harvest), social (e.g., recreation), and cultural objectives as well as environmental or ecological concerns (e.g., restoring natural disturbance regimes). This interplay of factors requires a deliberative communication and decision making process that is able to identify multiple objectives, separate means (e.g., fuel reduction efforts) from ends (e.g., restoring natural biodiversity), and clarify key tradeoffs, including balancing social needs for stability (e.g., the economic returns from sustainable resource extraction) with a recognition of the importance of certain natural processes in ecological systems. Heavy fuel loads and high fire risks in many forested areas throughout the nation only complicate matters making thoughtful, decision-focused risk communication efforts all the more necessary.

Given the broad applicability of risk communication (be it prescriptive or descriptive), both researchers and practitioners advocate improved interaction between technical experts and stakeholders as a means of helping to overcome 1) the reluctance on the part of many lay respondents to take personal risk management action and 2) the persistent divisiveness and conflict that are common to many risk management debates. One of the most influential recent discussions of the role of enhanced deliberation about risks is found in the final report of the Committee on Risk Characterization, convened by the National Academy of Sciences (NRC 1996). The committee's final report argued convincingly for implementation of more comprehensive and participatory approaches to management that integrate risk assessment and risk communication to incorporate a wide range of stakeholder values in risk management decisions.

Unfortunately, relatively little attention has been paid to helping determine what components are required as part of risk communication processes that work to foster participatory, better informed, and on a broader scale, more widely supported risk management decisions. Instead, much of what is discussed among practitioners is based largely on conjecture. For example, many advocates of risk communication efforts that emphasize broad-based participation worry that too much structure will lead to biased decisions or unnecessarily constrain the breadth of public involvement or responsibility. On the other hand, most observers would argue that more is needed than

simply providing an opportunity for interested parties to respond to information or participate in collaborative risk management processes. There are reasons to believe such an approach, which is typical of many risk communication efforts, would have substantial shortcomings in helping people to make wise risk management choices at the individual or group levels.

It is clear that additional research is required in the context of this important topic. However, a significant amount information on which to base the design of thoughtful, decision-focused risk communication processes already exists. Much of this information is located in the annals of three related research areas: risk research (including risk assessment, risk characterization, and risk communication), stakeholder involvement, and decision science. At the nexus of these initial three research areas is the broader subject of risk management. Oddly, there have been relatively few articles that focused exclusively on risk management; instead, much of the writing on the subject has come at it indirectly from one or more of the other three research areas noted above.

The purpose of this document is to provide a comprehensive analysis of these literature bases and provide the US Forest Service with a detailed annotated bibliography that covers seminal works across these four research areas.

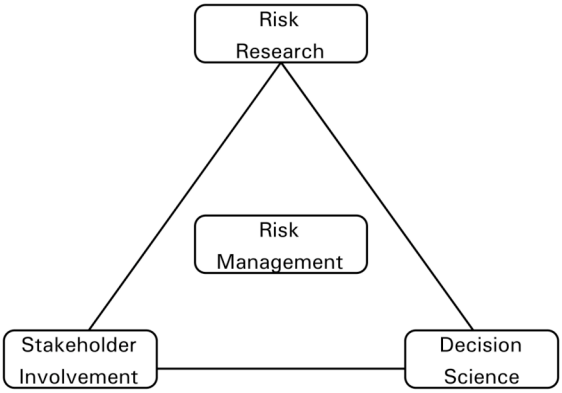

Figure 1. The relationship between risk research, stakeholder involvement, decision science, and risk management. Articles that relate directly to these thematic areas/headings (within each of the four boxes) will be addressed in the proposed work, as will articles that exist along a continuum between them. Each article contained in this review is "mapped" into this diagram.

To this end, we have included with each review a conceptual map indicating the location of the article within the space defined by the four areas of research noted above (Figure 1). The articles' placement within this space was not based on a scientific assessment based on a scoring system or predetermined criteria. Instead, it was based on a subjective assessment conducted by the individual reviewer followed by reliability check conducted by the other authors. The purpose of including this map is simply to orient the reader to the type of article that is the subject of the review (e.g., in the case where a information of specific type is desired to support a given research effort).

Overall, the annotated bibliography contains reviews of six types of written material. These include three types of journal articles (research articles, review articles, and case studies), books and book chapters, and agency reports. In total, this review of the literature contains 152 articles across the four research areas identified in Figure 1; as noted above, many of the entries are indirectly related to the topic of environmental risk management. In these cases, the relationship between the reviewed article, book, chapter, or report and the broader topic area is explained.

Finally, as demonstrated by the evolution of ideas that is revealed by the materials reviewed in this report, the field of risk communication continues to change. As a result, it would be unwise to suggest that this review will provide a long lasting picture of the state of our collective understanding regarding risk communication. However, we do hope that, as our thinking about risk communication does change, this review will provide some much needed context for readers whose interest in the field—either as researchers or practitioners—requires that they be able to thoughtfully evaluate these changes and respond.

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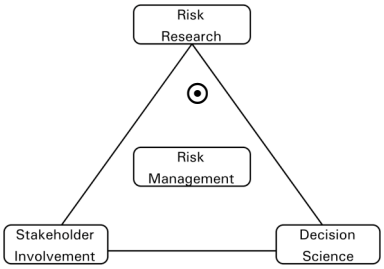
REFERENCE NO. 1

CITATION:

Alhakami, A. S., and P. Slovic. 1994. A psychological study of the inverse relationship between perceived risk and perceived benefit. Risk Analysis **14**:1085-1096.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

It has been shown in previous studies that there is an inverse relationship between people's perception of risks and benefits (e.g., the lower the perceived risk, the higher the perceived benefit, and vice versa). It has been consistently observed that this negative correlation between perceived risk and perceived benefits holds for a diverse set of hazards. The authors of this paper contend that while examining the correlation between perceived risks and perceived benefits has helped to identify this inverse relationship, there is a need for other measures of the phenomenon to explore its more intricate nuances. The alternative method offered in the article is the measurement of the absolute "distance" between a perceived risk and a perceived benefit, or in other words, the absolute difference between the two related aspects of the same item. For example, the mean absolute distance for cigarette smoking was 4.41, which was judged to be of high risk, 6.00 (on a 7-point scale), and of low benefit, 1.83 (also on a 7-point scale). In addition to creating this new measure of the relationship between risks and benefits, the authors attempt to identify those factors that determine the interdependence between risk and benefit judgments and why some items have a higher negative relationship (or greater distance) than others. In order to accomplish this goal the researchers surveyed 100 students from the University of Oregon. The survey consisted of two sections: the first section consisted of 40 different items for students to evaluate in terms of their risk and benefits; the second half of the survey measured participants' views about the affective meaning of the items. This section was composed of scales that looked at concepts such as good vs. bad, old vs. new, known vs. unknown, etc., in relation to the risk. This study identified three primary factors (each with a separate pole) that impacted an individual's perception of the risks and benefits of an item. Factor one was identified by adjectives such as fatal, severe, and dangerous on one pole and words such as good, fair, and safe describing the other pole. Factor two was coined "the familiarity factor," with words such as known, new, and voluntary describing one pole and terms like unfamiliar and compulsory describing its opposite. Factor three was termed "the potency factor," with powerful-powerfulness, active-inactive, and like terms on its opposite poles. It should be noted that this finding is essentially a confirmation of the concept of the psychometric paradigm with an additional factor, the potency factor.

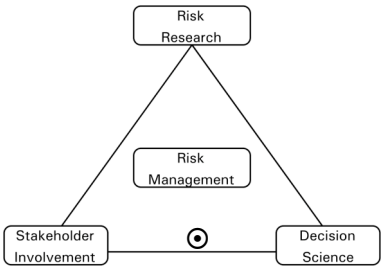
The major contribution of this article was the authors' suggestion, based on empirical data, that the items for which people hold positive attitudes were viewed as having high benefits and low risks, and items that people view as negative are seen as having low benefits and high risks. In other words individuals affective attitudes toward items influence greatly their perception of the risk-benefit relationship.

REFERENCE NO. 2

CITATION:

Ananda, J., and G. Herath. 2003. Incorporating stakeholder values into regional forest planning: A value function approach. Ecological Economics **45**:75-90.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

Forest management is a complex process that involves multiple objectives, multiple stakeholders, and complex social, ecological, economic, and political interactions. Decision-making about forest resources is often a difficult and controversial task, but involving the public in forest management decisions can help to resolve conflicts, increase public commitment, and reduce distrust between management agencies and various stakeholders. Many of the traditional frameworks for public processes fail to incorporate stakeholder values in decision-making. A values-based approach to eliciting public input can help planning agencies to determine what is important to the participating stakeholders. Multi-attribute value theory (MAVT) is a useful framework for decision analysis with multiple objectives. MAVT is grounded in von Neumann and Morgenstern's utility theory, and assumes a value function based on utility maximization. This paper explores a value-functions approach based on the MAVT, which was used to solicit and analyze stakeholder values for regional forest planning in North East Victoria, Australia.

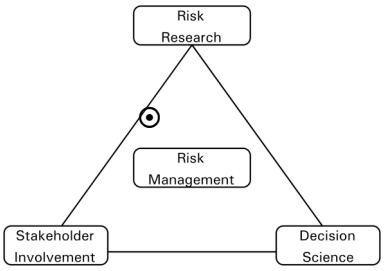
The Australian Regional Forest Agreement (RFA) program was implemented in response to conflict and debate over use and management of forest resources. Forest policy decisions in this area have been very controversial due to competing demands of the logging industry and conservation goals (e.g., several endangered species inhabit the native forests). Using the MAVT, the evaluation set out to quantify key forestry trade-offs of the study area by identifying key stakeholders, their objectives, and their values. The decision problem was to choose the best forest land-use option, which represents the values of the key stakeholders. Stakeholders from five major stakeholder groups (the timber industry, environmentalists, farmers, recreationists, and tour operators) participated in the MAVT study. Participants evaluated three hypothetical forest management plans across three attributes: 1) old-growth forest conservation, 2) hardwood timber production, and 3) recreation intensity. These attributes represent ecological, economic, and social objectives. The majority of participants preferred the forest management option that conserved a greater percentage of old-growth forest and reduced the amount of timber harvest. The results of the forest planning process indicate that MAVT can help incorporate value preferences effectively in the decision-making process.

REFERENCE NO. 3

CITATION:

Arvai, J. L. 2000. Evaluating NASA's role in risk communication process surrounding space policy decisions. Space Policy **16**:61-69.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

This paper highlights one of the central difficulties with evaluating risk communication efforts initiated by government agencies: that outcomes (e.g., participant or "audiences" responses during or following a risk-communication effort) may be negative despite the fact that the risk communication process was thoughtfully planned and implemented. This problem is especially prevalent in the case of highly stigmatized risks like nuclear power. To overcome this problem, the author proposes a series of categories that can be used to evaluate risk communication efforts based on certain benchmarks that ought to be achieved as part of the process. Adopting this approach de-emphasizes the supposed requirement in many instances for researchers to correlate an individual or group's behavior with those suggested or set forth in agency communications. The suggested categories suggested in the article are:

1. Comprehensiveness in process (i.e., are different stakeholders involved in all aspects of the risk management discourse, including planning?).
2. Content of risk messages/discourse (i.e., as part of the risk management process, do risk messages fully characterize the consequences of different policy alternatives?).
3. Degree to which participants' information needs are determined in advance (i.e., does risk communication proceed in an *ad hoc* manner or are the needs of different participants established prior to each step in the process?).
4. Level of agency credibility (i.e., do risk communication efforts proceed in a manner that presents a balanced view of alternative risk management options vs. promotion of a single option?).
5. Level of commitment to risk communication process (i.e., do all of a given agency's risk communication initiatives follow the same commitment to a high quality process?).

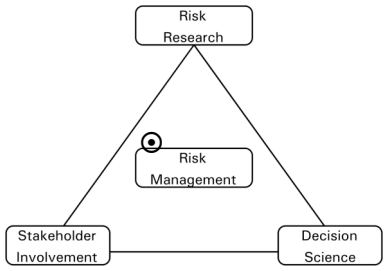
The risk communication effort surrounding NASA's *Cassini* mission to Saturn was used as a testbed for these ideas. The author suggests that a "traditional' evaluation of the *Cassini* risk communication effort based on outcomes would have overemphasized the controversy that developed. In contrast, a process-based evaluation based on the five criteria noted above provided a clearer picture of the areas where NASA were successful (e.g., establishing credibility through exemplary technical analyses; determining participants' information needs) versus those where additional emphasis would have been required (e.g., establishing comprehensiveness in process; addressing the implications of policy alternatives; establishing credibility by respecting stakeholders' concerns; establishing a long-term and agency-wide commitment to process).

REFERENCE NO. 4

CITATION:

Arvai, J. L. 2003. Using risk communication to disclose the outcome of a participatory decision making process: Effects on the perceived acceptability of risk-policy decisions. Risk Analysis **23**:281-289.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

The purpose of this article is to study people's responses to risk management decisions pursuant to how they are framed during a post-implementation risk communication process. Specifically, the content of the paper draws upon a series of rather high profile suggestions (e.g., from the National Research Council) that public participation during the risk management process can lead to more widely accepted risk-policy decisions. To study this untested idea, a two-treatment experiment was created. In one treatment, people received information about a risk-policy decision (a decision by a multi-national space agency to fit a spacecraft with a nuclear power source and then launch it into space) that was framed as the product of deliberation involving only a group of experts (e.g., scientists, engineers). In the second treatment, people received identical information about the risk-policy decision with one important twist: the decision was framed as the product of deliberation involving a group of experts (e.g., scientists, engineers) *and* a group of non-expert ("public") stakeholders.

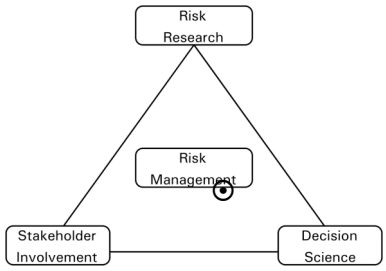
The results from this experiment showed that the group who received information that cast the decision as the product of the more broadly participatory decision making process (i.e., involving expert and non-expert representatives) felt—on average—more supportive of the choice than did participants in the "experts only" group. Likewise, subjects who received information that cast the decision as the product of a participatory decision making process perceived the risks associated with the decision to be lower and the benefits higher. Responses from these same subjects also showed that they were more satisfied with the decision making *process* (i.e., that a broad range of stakeholders were involved in making the decision) than they were with the *outcome* of the decision itself (i.e., the choice to launch the spacecraft containing the nuclear power source). As a result, the article ends with a cautionary note: that it may be premature to view the objective of participatory decision making approaches—and the risk communication efforts that describe them—as a means of making risk-policies more widely acceptable to the public at large. Rather, it may be better to view the benefits of these approaches in terms of their ability to help lead to higher-quality decisions that are the product of more widely accepted decision processes.

REFERENCE NO. 5

CITATION:

Arvai, J. L., and R. Gregory. 2003. A decision focused approach for identifying cleanup priorities at contaminated sites. Environmental Science & Technology **37**:1469-1476.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Drawing upon their experience as consultants, the authors of this manuscript make the observation that involving stakeholders in complex resource management decisions—such as setting DOE cleanup priorities—is not an easy task. Their observation is also consistent with the perspective of a broad literature on stakeholder participation and the decidedly mixed real-world results from other recent initiatives to clean up contaminated sites. In the authors' opinion, many of the failures associated with recent consultation initiatives surrounding the cleanup of contaminated sites appear to stem from the absence of an approach that permits participants to think carefully about the different pros and cons of policy options and then, once their own priorities are in order, to be involved meaningfully in the development of a recommended alternative. This "meaningful involvement" goes beyond simply inviting a cross section of people to respond to technical information about a specific problem. The authors argue that there must also be processes in place to improve the participants' ability to recognize key facets of the problem and make difficult choices about how a risk management effort should proceed; this process ought to entail the consideration of the technical components of a cleanup problem and the inclusion of stakeholders' values in a way that facilitates the creation of cleanup alternatives that directly and responsibly address their identified concerns.

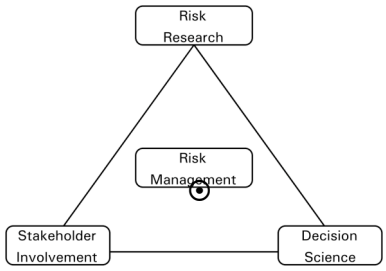
To this end, the objective of the experiment reported in this paper was to compare two alternative approaches for involving stakeholders in choices about the cleanup of contaminated sites. Both approaches inform non-expert members of the public about key elements of decisions relating to the cleanup of contaminated sites. The first approach (labeled "science-based") focused on the presentation of technical information and sought to improve the available knowledge base so that participants can make choices that are informed by detailed scientific data. The second approach (labeled "values-based) also provided scientific data but, in addition, presented values-oriented information that sought to improve the ability of non-expert participants to make difficult tradeoffs across a variety of technical and non-technical concerns. The authors hypothesized that that participation in either the science- or values-based conditions would help subjects to make more informed choices, as measured by their (self-reported) level of knowledge, their degree of comfort with decisions, as well as the degree to which their choices reflected their concerns. It was also hypothesized that decisions made by subjects in the science-based condition would reflect their affective judgments more strongly than those in the values-based condition; by contrast, subjects in the values-based condition would make decisions that more closely reflected their stated priorities about how cleanup efforts should proceed. The results obtained supported both of these hypotheses.

REFERENCE NO. 6

CITATION:

Arvai, J. L., R. Gregory, and T. McDaniels. 2001. Testing a structured decision approach: Value-focused thinking for deliberative risk communication. Risk Analysis **21**:1065-1076.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

This article contends that it is not merely the quality of information that affects the quality of a risk communication effort (in terms of its ability to inform thoughtful risk management decisions). Alongside information quality, the degree to which the risk management task is structured will also plays a large—if not larger—role in enhancing the quality of risk-management decisions. In support of this contention, the article discusses an experiment that compares two groups of subjects' responses to risk information. Both groups received identical information in terms of its technical content but took part in different types of facilitated workshops where the end goal was to inform a resource-management decision (changes to water flows through a system of dams so as to enhance salmon stocks). One group—labeled Alternative Focused—was led through a facilitated process of simply evaluating the technical information provided (dealing with the effects of water flows in fish populations, electricity generation, etc.) followed by a two-decision task: a vote for their preferred option (from a set of five) and the degree to which they would accept increases in their monthly electric bill (in dollars) to address the specified risk management problem. The second group of subjects—labeled the Value Focused group—was also led through a facilitated process of evaluating the technical information along with a series of tasks designed to help them structure the risk management choice they were about to make. This decision structuring process entailed helping subjects to 1) clarify their objectives as they related to the risk management context, 2) evaluate the five alternatives in terms of how well they were predicted to meet their stated objectives, and then 3) select both the option and payment amount that they predicted would perform the best with respect to meeting their stated objectives.

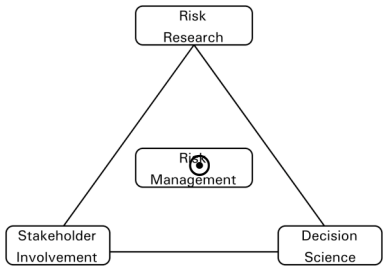
The authors hypothesized that participating in the structured, Value Focused risk-communication approach would lead subjects to make more thoughtful, better informed, and hence 'higher quality' decisions as determined by 1) the number of decision-relevant issues (i.e., objectives) addressed (assessed through content analysis) and 2) their responses to a series of self-rating questions (e.g., regarding their level of comfort with their decisions, their level of satisfaction with their decisions, and the degree to which their choices addressed their key concerns). The results obtained by the authors provided support for both hypotheses: the value-focused decision structure led—by the standards set forth in the study—to more thoughtful and better informed risk management decisions.

REFERENCE NO. 7

CITATION:

Arvai, J., T. L. McDaniels, and R. Gregory. 2002. Exploring a structured decision making approach as a means of fostering participatory space policy making at NASA. Space Policy **18**:221-231.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

This article discusses the application of a structured decision approach within a federal agency responsible for making decisions that involve risky elements (NASA). The article takes as its starting point two related sets of recommendations. The first are the recommendations made in 1996 by the National Research Council's Committee on Risk Characterization (Reference No. 106), which argued convincingly for the implementation of more participatory approaches to improve policy making by incorporating a wide range of stakeholder values and concerns in policy decisions. The second are from the agency—NASA—itself, which aims to become more responsive to the values and objectives of its stakeholders. Specific strategies for making these recommendations a reality are not addressed by either group.

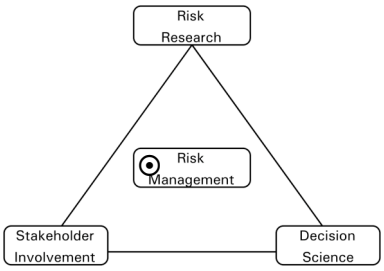
To address this gap, this paper discusses how the use of a structured decision approach for involving expert and non-expert stakeholders in policy making can improve the quality of stakeholder involvement and the resulting decisions (across process- and outcome-based metrics). The approach discussed in the paper is based on a decision-aiding model, which has been applied successfully in a variety of contexts (e.g., see Reference No. 99). While the approach is discussed only in general terms (e.g., examples of problem definition, value elicitation, and tradeoff analysis), the narrative is supported by results from two recent experiments. One compared the quality and type of participants' input in a conventional stakeholder workshop with that of a more structured participatory process. The results from this experiment showed that a structured decision approach (like the one discussed) leads to more thoughtful and better informed decisions. A second experiment showed that structured, participatory decision processes can help to legitimize space policy decisions after they have been implemented, leading to future benefits for the agency.

REFERENCE NO. 8

CITATION:

Beebe, G. S., and P. N. Omi. 1993. Wildland burning: The perception of risk. Journal of Forestry **91**:19-24.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

This article takes as its starting point the relative paucity of studies of natural hazards that focus on wildland fire. The authors suggest that a review of research involving salient natural and technical hazards—and how people respond to them—may be helpful when applied to the context of wildland fire. For example, the article alludes to the tradeoffs required in fire management when balancing the need to protect property (via aggressive suppression) and the value of prescribed natural fires. Moreover, the article highlights the added complexity of these tradeoffs when residential and commercial development extends deeper into potentially volatile wildland environments. Though not defined in the language of psychology (e.g., studies of affect) and risk analysis (e.g., studies of stigma), the authors make note of the additional concern associated with biased reporting in the media of spectacularly destructive fires and how this information may lead to either positive of negative responses from a fire management standpoint. For example, such reporting may encourage property owners at the urban-wildland interface to undertake management efforts aimed at risk reduction (e.g., clearing their property of fuels through prescribed burns or other mechanical means). On the other hand, biased reporting may also lead to an overestimation of risks that may lead to widespread opposition to burning, even under prescribed conditions.

The authors also delve into studies of risk perception. Specifically, they note that members of the general public estimate risks with varying degrees of accuracy. For example, they note the tendency to overestimate risks that are feared, irreversible, and catastrophic. They also note that the level of perceived risk can often be correlated with the memorability of past events. These two factors may conspire to create more benign risk appraisals (as exposure to fire seems reversible in that structures are rapidly rebuilt and vegetation regrows; similarly infrequent exposure reduces the degree to which these events are memorable). The authors discuss a variety of other factors that have previously been shown to have explanatory power in the arena of risk research (e.g., misattribution of probabilities, emotional attachment or aversion to certain stimuli, the desire for zero risk) in the context of several recent fires in California.

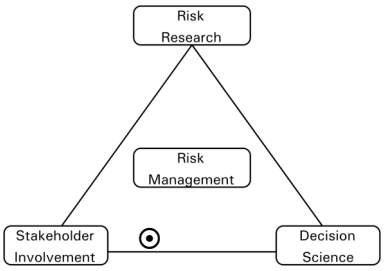
The article also includes a discussion of public participation. Specifically, the authors suggest that in order to build public support for fire management—and specifically, prescribed burning—forest managers must do a better job of involving citizens in the decision making process. However, beyond rather abstract admonitions (e.g., managers need to become more “skillful” when engaging the public in risk management; education efforts must improve), no specific guidance as to how to achieve this goal is provided.

REFERENCE NO. 9

CITATION:

Beierle, T., and J. Cayford. 2002. The quality of stakeholder-based decisions. Risk Analysis **22**:739-749.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

This article investigates the quality of decisions from stakeholder-based environmental decision-making processes. As stakeholder participation has increased over the past decade, there has been little analysis of the quality of decisions such processes produce. With increased stakeholder involvement in environmental decision-making comes the realization that these decisions are "political" as well as scientific. In order to resolve environmental problems, the interests and values of the public must be addressed. Some analysts are concerned that the emphasis has shifted too far in the political direction; that stakeholder processes sacrifice the quality of decisions for political expediency. The author attempts to address the void in our knowledge about how the trend towards increased stakeholder involvement in decision-making is affecting environmental policy.

The data presented in this article is analyzed from a "case survey" of 239 published case studies of stakeholder involvement in environmental decision-making processes in the United States over the past thirty years. The cases include local, state, and federal efforts; encompass pollution-related and natural resources cases; and deal with both single-site and broader policy issues. The cases also describe a wide variety of participatory processes, increasing in intensity, from public hearings to formal stakeholder negotiations. The author describes a systematic analysis of how stakeholder processes have affected the quality of environmental decisions for the following criteria:

1. Are decisions more cost effective than likely alternatives?
2. Do decisions increase joint gains among parties over likely alternatives?
3. Do participants contribute innovative ideas, useful analysis, or new information?
4. Do participants have access to scientific information and expertise?

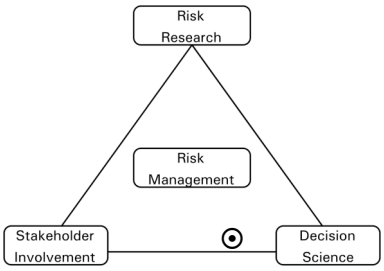
Across the four questions of decision quality analyzed here, the majority of the cases point towards increased quality of decisions from stakeholder-based processes. For the cases that were able to be scored for each criteria, the more intensive stakeholder-based processes are credited with increasing cost effectiveness (50% of 17 cases), increasing joint gains (69% of 70 cases), contribution of innovative ideas, useful analysis, or new information (76% of 121 cases), and having adequate information through both internal capacity and external resources (74% of 149 cases). Most cases contain evidence that stakeholders are making better decisions, contributing new ideas and information, and utilizing technical resources in the decision-making process. The data suggests that more intensive forms of stakeholder-based processes are more likely to produce higher-quality decisions.

REFERENCE NO. 10

CITATION:

Borsuk, M., R. Clemen, L. Maguire, and K. Reckhow. 2001. Stakeholder values and scientific modeling in the Neuse River Watershed. Group Decision and Negotiation **10**:355-373.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Coastal areas are particularly vulnerable to pollution, and the Neuse River estuary in North Carolina is just one example of a stressed coastal system. In response to public concern over the obvious degradation of the system, the North Carolina legislature mandated a 30% reduction in nitrogen load. The overall effect of this reduction on each component of the system is unknown. The authors of this paper propose a decision-analytic approach to model the estuary and promote communication between scientists and stakeholders in order to develop a better understanding of what effects the 30% reduction might have on the system. The authors first held a series of stakeholder discussions to identify their concerns with the coastal system. A lengthy list of objectives dealing with the ecosystem, human activities, public involvement, model characteristics, and model capabilities were compiled through a series of community surveys and interviews. The authors then began to construct a probability-network model (due to the uncertainty within the system) to link attributes addressing stakeholder interests or values with proposed management actions. A few of the variables included in the model are nitrogen load, algal productivity, water clarity, human health impacts, and long-term fish health. The model is not yet complete, but once completed it may be used to predict the response (in the form of a probability distribution) of each variable to a specific management condition. By instituting a policy of adaptive management through ongoing monitoring, the model can then be updated when necessary in response to changes within the system in response to the initial 30% nitrogen load reduction.

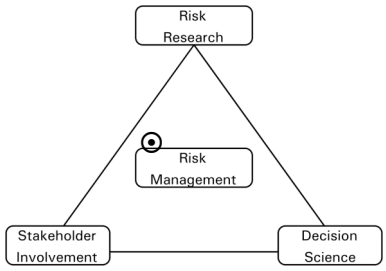
This decision-analysis approach to water-quality management flows from the identification of stakeholder values to the development of a model that is sensitive to the wide range of needs and interests within and around the system. The model is meant to be a dynamic tool to inform future policy and management decisions within the Neuse River estuary. The authors point out that the way the objectives were interpreted and represented in this specific study may be different from the way objectives may be utilized in a different modeling effort (i.e., biophysical modeling vs. socioeconomic modeling). They also state that a more comprehensive program – extending far beyond their modeling effort – would be necessary to fully address all of the objectives and concerns of the stakeholders.

REFERENCE NO. 11

CITATION:

Bostrom, A., B. Fischhoff, and M. G. Morgan. 1992. Characterizing mental models of hazardous processes: A methodology and an application to radon. Journal of Social Issues **48**:85-100.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

People are constantly faced with making decisions about environmental hazards. Some decisions involve immediate personal behaviors (e.g., how to dispose of used motor oil), and other decisions involve long-term public actions (e.g., whether to oppose a hazardous waste incinerator). In some cases, people may have translated these decisions into well-formulated decision problems, with explicit options, outcomes, and uncertainties. In order to process these problems, people need quantitative measures of the parameters of their decision-models. In order to provide this information, risk communicators must have an understanding of what people currently believe about these parameters. But oftentimes, people need to know more, like what a specific hazard is and how it works. One approach to better understand where these gaps lie is to use an influence diagram. An influence diagram has a hierarchical structure, linking concepts and relationships of a risk. By characterizing lay people's beliefs in terms of deviations from this model, risk communication messages can try to fill in the gaps and correct misconceptions. Four steps are necessary to complete this "mental models" approach: 1) create an expert influence diagram, 2) elicit lay people's relevant beliefs, 3) map those beliefs into the diagram, and 4) identify gaps and misconceptions.

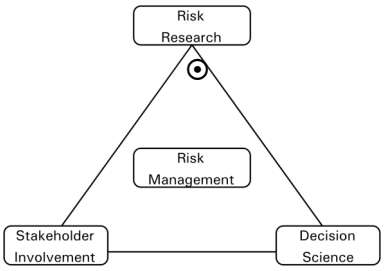
The authors present the findings of a study using the mental models approach applied to understanding risks associated with radon. Twenty-four respondents were interviewed; in the first stage, respondents were asked to simply describe everything they knew about the risks from radon risks. Respondents were next asked to elaborate on comments they had made and instructed to answer a series of more specific questions about radon risk. This stage of the interview included picture-sorting tasks (e.g., a photo of a lung) where the goal was to separate photos based on whether they did or did not have anything to do with radon risks. Interviews were next transcribed, coded, and compared with an expert influence diagram (i.e., mental model). Results showed that subjects had a greater understanding of exposure processes than effects processes. These results were used to argue for an improved risk communication program dealing with risks from radon.

REFERENCE NO. 12

CITATION:

Bouyer, M., S. Bagdassarian, S. Chaabanne, & E. Mullet, 2001. Personality correlates of risk perception. Risk Analysis **21**:457-465.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Past studies of risk perception have focused primarily on factors linked to the hazard and the perceiver. The study reported in this article focuses on two specific factors: anxiety level and worldview. Anxiety level in the study referred to two forms of anxiety: enduring anxiety (a long-lasting but not permanent state of anxiety, that is a character trait of an individual) and transitional anxiety (anxiety due to a specific situation that is temporary). The worldviews examined in the study were egalitarian, hierarchic, individualist, and fatalist. The objectives of the study were to 1) identify types of hazards that are greatly affected by anxiety, and 2) to explore variations of the effect of worldviews (as a function of the type of hazard considered) in the subsequent perception of risk from the hazard. To address these objectives, the study utilized three questionnaire types, one that focused on anxiety and its effect on risk perception, a second that focused on worldview, and a third instrument that looked at risk perception in general. The types of hazards that participants were asked to respond to were placed into one of ten categories: common individual hazards; pollutants; public transportation and energy production; outdoor activities; deviance, sex, and addiction; domestic hazards; urban violence; medical care; weapons; and psychotropic drugs.

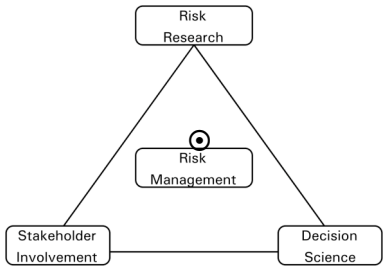
The researchers found that enduring anxiety could be linked to only perceptions of one hazard category, that of psychotropic drugs. However, transitional anxiety influenced the perception of risk across four categories: common individual hazards; pollutants; public transportation and energy production; and outdoor activities. Despite having a significant effect on the perception of risk from various hazards, the researchers found that anxiety does not play a significant role in people's overall evaluation of risk. This suggests that people's assessment of risks are not the result of a temporary psychological state, but rather the reflection of fundamentally stable views that should be considered in public policies regarding risk management.

REFERENCE NO. 13

CITATION:

Breyer, S. 1993. Breaking the Vicious Circle: Toward Effective Risk Regulation. Harvard University Press, Cambridge, MA.

REFERENCE TYPE: Book



SYNOPSIS:

Associate Justice of the United States Supreme Court Stephen Breyer argues that there exist three significant obstacles to more efficient risk management: tunnel vision ("the single-minded pursuit of a single goal…to the point where it brings about more harm than good"), random agenda selection (the pursuit of zero risk in cases where hazards have already been reduced to insignificant levels takes much-needed attention away from other, more pressing issues), and inconsistency (the lack of an overarching regulatory plan to prioritize health risks). In order to address these three obstacles, Justice Breyer argues that in order to effectively prioritize the management of a variety of risks in light of limited resources, a new—simpler—approach is required: The risks that kill the most people ought to be given priority over those that kill fewer people. This approach would provide much needed consistency and would eliminate tunnel vision and the single-mindedness of striving for zero risk; risks would be effectively "downgraded" once they have been reduced to acceptably low levels (i.e., when they are superceded in terms of the number of lives lost by other risks).

In order to implement this "new" approach to risk management, Breyer advocates the creation of scientific panels—small groups of civil servants with training in the sciences and insulated from the political process. This group would concentrate its resources on only those programs that offer the greatest potential to save the most human lives. For example, one of their tasks would be to establish *de minimus* risk levels below which risk management programs ought not to continue. A prime example—cited by Breyer—of this approach deals with Superfund sites. At a certain *de minimus* risk level, Superfund cases might be settled freeing funds from the program to be spent on other risk management initiatives (e.g., to pay for vaccinations, cancer screening, etc.).

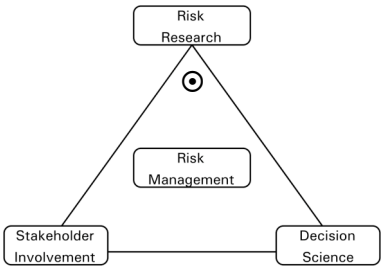
In order to be successful, Breyer argues that this elite group—similar to Ruckelshaus' citizens juries but comprised of scientists and economists instead—must possess 1) interagency jurisdiction (giving it the authority to transfer resources from program to program), 2) a high level of prestige (so that it can both attract qualified experts and be highly respected), 3) significant political insulation (so that outsiders can not meddle with the group's work), and 4) "authority" (which entails both legal standing and public confidence).

REFERENCE NO. 14

CITATION:

Chess, C. 1999. A model of organizational responsiveness to stakeholders. Risk: Health, Safety, & Environment **257**:257-267.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

This paper proposes a model of organizational responsiveness based on two hypotheses: 1) risk communication may be associated with an organizational adaptation to threat in the external environment; and 2) the organizational links between risk communication functions and risk management functions affect the extent to which organizations are responsive to risk stakeholders. The author chose to investigate these hypotheses because of the ongoing concern whether risk communication efforts really change how an entity behaves. In other words, is risk communication symbolic? Or, do organizations and agencies really respond with not just words, but with action? In regards to the first hypothesis, the model proposes that risk communication may be used to reduce organizations' perceptions of threat. It also suggests that the greater the perceived threat by stakeholders, the more motivated an organization will be to initiate risk communication and address the threat. In regards to the second hypothesis, the model proposes that a loose coupling between risk communication and management reduces the likelihood that a company will display a strong connection between what they say and what they actually do. The author tested the model by applying it to two case studies of chemical manufacturers' risk communication efforts.

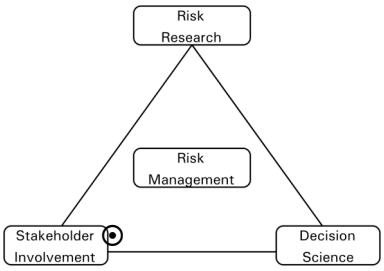
The results supported both hypotheses regarding both the level of perceived external threat and the degree of coupling between risk communication and risk management. Organizational action or change only occurred in the case study where perceptions of organizational threat and the degree of coupling were both relatively high, providing the manufacturer with both a reason to change and the capability to adapt. In cases where the coupling between risk communication and management were low, the manufacturer only took symbolic action by attempting to influence outside stakeholders but not changing internal behavior. This model is just a first step toward understanding and studying risk communication and organizational responsiveness. The author admits that additional work may be needed to truly understand the relationship between participatory processes and substantive outcomes. The most helpful finding of this study may be that providing managers or decision makers with only communication responsibility, but not authority to take action or initiate change may result in a loose coupling between risk communication and management and lead to public participation efforts that are purely symbolic in nature.

REFERENCE NO. 15

CITATION:

Chess, C. 2000. Evaluating environmental public participation: Methodological questions. Journal of Environmental Planning and Management **43**:769-784.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Public participation is more popular now as a means of informing decisions than it has ever been in the past. This paper reviews the literature regarding the evaluation of public participation programs, specifically within the environmental decision-making context. The author points out that many agencies question the value of participatory decision making, but evaluating public participation has proven to be difficult due to the wide range of participatory forms as well as the complexity of the issues. First, the author addresses the need for evaluation, stating that it is necessary because it allows agencies to mark their progress toward environmental quality and other goals. Second, she describes the following three types of evaluation: 1) *summative evaluation*, which tracks the extent to which public involvement has progressed toward the stated goals or objectives, 2) *formative evaluation*, which occurs during the participatory process in order to allow corrections to programs already in progress, and 3) *impact evaluation*, which focuses on long-term results and is meant to inform major policy and management decisions. Third, the author points out that both process and outcome goals should be evaluated; however these goals are often difficult to define in environmental public participation programs. She suggests three different forms of evaluation that are designed to overcome the problem of contradictory or dynamic goals. These include user-based, theory-based, and goal-free evaluations. Fourth, she demonstrates – using the literature – that there is little agreement on who should carry out these evaluations, whether they should be outside efforts (complete separation between evaluator and program participants) or participatory efforts (where the participants become the evaluators). Regardless of who carries out the evaluation, the literature shows that the most popular methods for evaluating tend to be purposive sampling (over experimental or random sampling), and both qualitative and quantitative methods are thought to be appropriate.

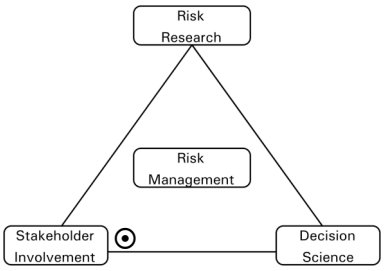
In summary, the author suggests that agencies would benefit from both formative and summative evaluations of their participatory programs, and that they should explore a variety of criteria when performing the evaluation. She also points out that participation in the evaluation process may vary depending on the goals of the evaluation. As is common in many review articles, the author finds little agreement on the best way to approach evaluations of environmental public participation programs. However, this article provides a clear discussion of the strengths and weaknesses of various approaches and makes a case for the need of quality evaluations when including the public in complex decision processes.

REFERENCE NO. 16

CITATION:

Chess, C. and K. Purcell. 1999. Public participation and the environment: Do we know what works? Environmental Science & Technology **33**: 2685-2691.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Past studies have suggested that the effective inclusion of stakeholders in agencies' decision-making processes can help facilitate decisions that are widely accepted by the impacted public, and that are useful and durable in nature. Despite this emphasis on stakeholder involvement there are still questions concerning which form of citizen participation is most effective. This article explores the effectiveness of several modes of stakeholder involvement—1) public meetings, 2) workshops and 3) citizen advisory committees (CACs)—by reviewing the relevant literature. The researchers ascertain the quality of these efforts in terms of their achievement of the subsequent outcome and process goals. A focus on outcome goals as a judgment criterion defines public participation as successful only when the final decision or outcome is successful. On the other hand process goals define the success of stakeholder involvement by the degree to which the participatory process was seen as favorable by stakeholders, facilitators, and the agency.

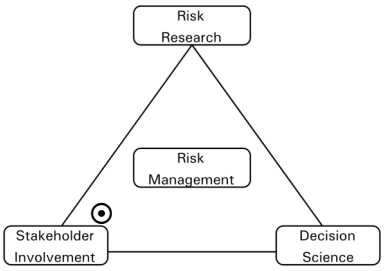
The researchers review a number of studies that concentrate on 1) public meetings, 2) workshops, or 3) CACs, and apply the criteria described above to determine their level of effectiveness. The researchers' findings are mixed; for example 1) public meetings were found to be poor in terms of process goals but excelled at outcome goals, often having a significant effect on agencies' final decisions. However, 2) workshops were found to excel in terms of process goals, but to fail in regards to outcome goals. Finally, 3) CACs seemed to do poorly on both outcome and process measures; the researchers contend that this is mostly due to agencies' poor implementation of CACs and not inherent methodological flaws. The researchers end the article with the admonition that the success of stakeholder-involvement processes vary from situation to situation; a "one size fits all" approach will not work, but there are some rules of thumb for public participation. (a) Clarify the goals of the public participation, (b) begin participation early and invest in advance community outreach and planning, (c) modify the participatory mode to meet either outcome or process goals, (d) use various modes of public participation for a single decision, and (e) collect stakeholder feedback on their participation.

REFERENCE NO. 17

CITATION:

Chess, C., and K. L. Salomone. 1992. Rhetoric and reality: Risk communication in government agencies. Journal of Environmental Education **23**:28-33.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Government agencies and industries are increasingly confronted with the task of reconciling the different ways in which laypeople and experts perceive environmental risk. There is a substantial body of literature that describes past risk communication efforts and practices of governmental agencies, and furthermore, provides suggestions on how agencies should actually communicate risk to the public. However, there has been relatively little exploration of the relationship between government agencies' philosophical commitment to proactive, two-way risk communications and their actual risk communication practices. The study described in this article attempts to fill this gap by surveying 137 government and industry programs in the New Jersey area that had conducted risk communication campaigns aimed at the public. The study goal was to gauge the strength of their commitment to proactive, two-way risk communication. In addition, the researchers also surveyed the perceptions of agency employees regarding their current risk communication practices. The researchers conducted a similar nationwide study of state health agencies. The data collected by the researchers demonstrate that the majority of the agencies express a definite philosophical commitment to many aspects of successful environmental risk communications as defined by the National Research Council, such as 1) the importance of two-way communications, or 2) the idea that involving people who are potentially affected by risk management decisions leads to better solutions. Despite this strong philosophical commitment to successful risk communication practices, the agencies' employees viewed most of their own risk communication programs as severely lacking. According to employees of state health agencies most of their risk communication efforts consisted of responding to individual risk concerns but very little on proactive measures such as meeting with environmental advocacy groups. Many of the government agencies in New Jersey identified a lack of financial and personnel resources as a stumbling block to improving risk communication campaigns.

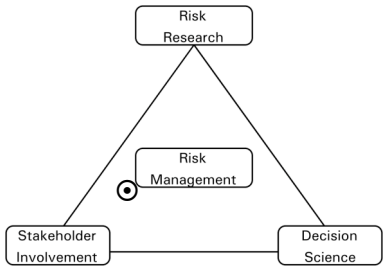
The researchers suggest that this incongruence between agencies' commitment to successful risk communication and their actual risk communication practices may be due to several factors such as 1) risk communication research may be ahead of actual practice, or 2) there is a lack of agency resources to address the gap between beliefs and practice. The researchers go on to suggest that this problem may be addressed by various actions on the agencies' part, such as 1) allocating sufficient resources to make risk communication a priority or 2) making successful risk communication an integral part of agencies' organizational structure.

REFERENCE NO. 18

CITATION:

Chess, C., A. Saville, M. Tamuz, and M. Greenberg. 1992. The organizational links between risk communication and risk management: The case of Sybron Chemicals, Inc. Risk Analysis **12**:431-438.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

There is a substantial body of literature exploring how organizations, such as corporations, should communicate risk with the public. However, there is a lack of studies that explore the organizational shifts needed to tailor risk communications programs to the standards outlined in the literature and set by such governing bodies as the Chemical Manufacturers Association. The study described in this article addresses this gap in the literature by exploring what steps an organization can follow to develop effective external risk communication. In order to reach this goal the researchers conducted an in-depth case study of a corporation that had been identified by external sources as performing exemplary risk communication (e.g., guidelines set by the National Research Council, such as communications being a two-way process), Sybron Chemicals, Inc., located in New Jersey. This case study involved in depth interviews with company personnel at various levels (from the CEO to floor workers), a brief questionnaire and the review of background documents. Sybron began to develop a successful risk communication program after two negative incidents, the accidental release of toxic chemicals into the surrounding community that led to an unnecessary evacuation of surrounding residents, and a chemical flash fire that injured two workers.

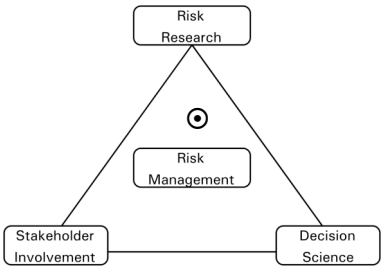
The researchers identified several key steps taken by the company resulting in an exemplary risk communication program. 1) Risk communication programs must be directly linked to risk management efforts within the organization. 2) External concerns about risk must be amplified within the organization and have a direct impact on risk management practices. This process can be implemented by the diffraction of the responsibilities for risk communication among personnel that are directly responsible for risk management, and the organization developing a policy of amplifying bad news concerning risk from external and internal sources. 3) Finally, the organization needs to develop institutional mechanisms that facilitate learning about successful risk communication practices, avoiding a dependence on charismatic or talented individual managers. The researchers are careful to note in the article that the study's findings are based on a single case study of a relatively small corporation and additional quantitative and qualitative research is needed to further explore the study's results.

REFERENCE NO. 19

CITATION:

Chess, C., K. L. Salomone, B. J. Hance, and A. Saville. 1995. Results of a national symposium on risk communication: Next steps for government agencies. Risk Analysis **15**:115-125.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

This article provides an overview of the 1994 “Addressing Agencies’ Risk Communication Needs: A Symposium to Discuss Next Steps” two-day symposium. The article briefly reviews the central issues of the conference and provides a number of specific suggestions for government agencies to improve their risk-communication efforts.

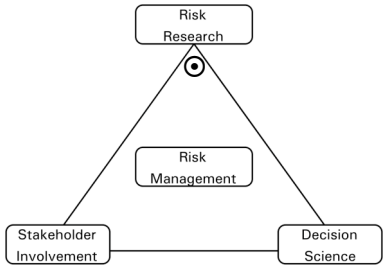
The first topic explored in the article is the concept of bringing outside perspectives into the agencies’ decision-making processes. Recurring themes in this discussion are the need for agencies to build partnerships with communities that their decisions impact and their reluctance to do so. Along the same lines of this subject is the need for agencies to understand diverse communities. In order to reach the different communities which their actions impact, agencies need to tailor their risk communication efforts to each community, being sensitive to social and cultural differences. In addition, agencies must be cognizant of the variation found within communities and ethnic groups. The symposium not only focused on the crafting of risk communication campaigns but also on the evaluation of these campaigns. This portion of the symposium focused on the necessity of empirically documenting risk communication efforts, and the need to reconcile the differences in evaluation methodology found between practitioners and researchers. Evaluation processes must be scientifically rigorous and provide data that is useful to practitioners. A significant barrier to efficient evaluation processes and risk-communication efforts in general is the question of organizational issues. Symposium participants stated the need for increased case study research of organizations with successful risk-communication efforts as a way to help asses what aspects of an agency may hinder or help their own risk-communication operations. The final topic explored in the article is the future of research and practice in the field of government-agency risk communication. The primary suggestion from this discussion was the need to develop participatory research methods, that is, the development of research projects that involve communities, researchers, and practitioners. There is also a need for greater methodological rigor in risk-communication studies, such as the use of comparative case studies and the triangulation of research methods.

REFERENCE NO. 20

CITATION:

Chess, C., M. Tamuz, and M. Greenberg. 1994. Organizational learning about environmental risk communication: The case of Rohm and Haas' Bristol plant. Society and Natural Resources **8**:57-66.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

The chemical industry has made efforts to increase its credibility by reaching out to community residents regarding the risks within and around their plants. In an attempt to facilitate more positive perceptions of chemical plants, many companies have trained individual managers to explain risk, work with the media, and interact with the public. However, little attention has been given to creating organizational change regarding risk-communication practices. The authors selected the Rohm and Haas' Bristol chemical plant in Pennsylvania as a case study for how organizations learn to communicate about environmental risk. They conducted extensive interviews of 14 company personnel ranging from hourly workers to the CEO, and reviewed more than 130 background documents. The interviews and document analysis revealed that the Bristol plant began developing an extensive community relations program in the early 1980's in response to a series of conflicts regarding health and safety risk within and around the plant. The authors identified four types of learning exhibited at the Bristol plant as they developed and improved their relations with the community: 1) they learned from experience, including past crises and the experience of other organizations; 2) they learned from interpreting experience, past events were often interpreted differently by various units within the organization making the lessons more powerful; 3) they learned by collecting information to provide feedback on their communication efforts; and 4) they learned through unplanned events and relationships that were a natural result of change within the organization.

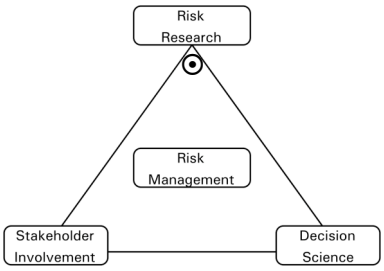
The authors contend that corporate efforts focused solely on individual managers' communication skills are inadequate when dealing with communities. Efforts at improving risk communication and community relations must come from within the organization as a whole, not simply from one or a handful of individuals. Organizational learning must occur at different levels of the plant, creating a decentralized approach to collecting information and providing a more accurate picture than could be provided by one individual manager. Finally, although learning does not necessarily imply improvement, the Bristol plant's learning process does provide insight for other companies hoping to build environmental credibility with their local community.

REFERENCE NO. 21

CITATION:

Chess, C., K. L. Salomone, and B. J. Hance. 1995. Improving risk communication in government: Research priorities. Risk Analysis **15**:127-135.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Risk-communication practices among government agencies are often insufficient despite a growing interest in and need for effective ways to communicate with the public about environmental risk issues. The authors of this paper conducted a study to explore the weaknesses within current agency risk-communication practices in order to identify where additional risk-communication research may be needed to improve current practice. The authors wanted to develop a methodology that would identify research priorities based on a range of perspectives from within the risk-communication field. They first conducted qualitative interviews with 12 agency practitioners and 12 academic researchers, all leaders in the field. The open-ended interview questions were aimed at identifying respondents' perspectives on agency risk-communication problems and successes, research topics necessary for improving current practice, and suggestions for other researchers and practitioners to include in the study. Forty-eight research topics and eighteen issue statements regarding current agency efforts were identified during the interviews and then included in a questionnaire which was sent to 65 researchers and 80 practitioners (54 and 66 responded respectively). The questionnaire required participants to indicate on an 8-point scale to what extent they agreed or disagreed with each research topic and issue.

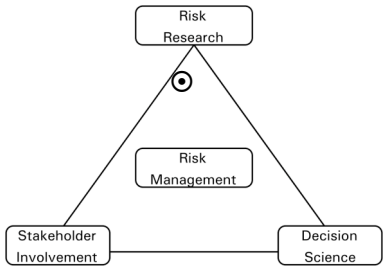
Eleven of the 14 research topics were rated as high priority and fell into one of three categories: 1) involving communities in agency decisions, 2) communicating with different social and cultural groups, and 3) evaluating risk-communication efforts. In regards to the issue statements, respondents agreed that there is a need for improvement in agency communication programs, and that lack of management commitment to risk communication, staff expertise, and unclear goals are major obstacles to successful communication programs. The authors point out that there is no one-size-fits-all-agencies research agenda, but there was a surprising level of agreement among researchers and practitioners regarding the importance of the above-mentioned general research topics. The results of this study clearly identify a starting point for researchers and practitioners to work towards improving agency risk-communication programs.

REFERENCE NO. 22

CITATION:

Chipman, H., P. Kendall, M. Slater, and G. Auld. 1996. Audience response to a risk-communication message in four media formats. Journal for Nutrition Education **28**:133-139.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Consumer fears about food safety have increased over the past few decades, largely due to highly publicized incidents regarding hazards from pesticide residues. This trend identifies the influence that the media has over public risk perceptions and behavior, but there has been little research regarding the merits of different media approaches. This study investigates the effectiveness of four media formats at conveying a risks/benefits/options message regarding the use of chemicals in food production. These four formats include a video news release (VNR), video public service announcement (PSA), print news release (PNR), and newsprint column (NC). Two research questions were asked: 1) When comparing the four media formats what differences are there in the participants' assessments of the message? and 2) Do print formats generate greater cognitive effort and response than video formats? The authors hypothesized that participants who are not very concerned about chemicals in food production (low-concern) would prefer video formats, while participants who demonstrated high levels of concern about the problem (high-concern) would prefer print formats. A message was created and pre-tested to ensure conceptual comparability, and then transposed into the four different message formats. Eighty-six women participated in 2 ½ hour evaluation sessions which consisted of completing a background questionnaire, viewing and evaluating each of the four formats, completing a post-message evaluation, and participating in a 1-hour focus-group discussion.

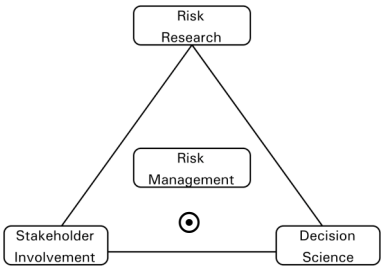
The Likert-type scale responses indicated that women were concerned about pesticide use in agriculture but also believed that it was necessary to maintain lower food prices. The VNR and NC formats received the highest overall ratings, with the VNR being rated as most interesting and the NC ranking highest for content. In regards to the authors' hypothesis, no difference was found between the video formats but high-concern participants did respond more favorably to the print formats (perhaps due to the need for greater motivation when reading the print formats as opposed to viewing the video formats). In general, all of the formats were viewed as relatively unbiased and believable. In regards to the cognitive response research question, no significant differences were found between the print and video formats and their ability to generate cognitive effort. The focus group sessions helped clarify why participants responded so favorably to the VNR and NC formats. The PSA was viewed as too short and rather uninteresting, while the PNR only received favorable responses from those who liked the high number of credentialed sources cited.

REFERENCE NO. 23

CITATION:

Clark, M. J. 2002. Dealing with uncertainty: Adaptive approaches to sustainable river management. Aquatic Conservation: Marine and Freshwater Ecosystems **12**:347-363.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Rivers, and most other environmental systems, are complex and difficult to manage in a sustainable manner. This article addresses the need for a new, well-defined structure for river management consisting of four components that have all been used in previous management efforts. These include sustainable management, coping with uncertainty, adaptive management, and decision support. To this end, the author identifies three simple attributes that can be used as criteria to measure sustainability within an sustainable river-management framework. These attributes are natural capital (aiming to preserve and enhance environmental values), minimum net-negative impact (identifying mitigation efforts through environmental assessments and cost-benefit analysis), and minimum management intervention (measuring to ensure levels of intervention within the system). The author also identifies coping with uncertainty as more important to a river-management framework then attempting to eliminate it. The challenge in achieving this component is convincing the public that uncertainty is inherent and acceptable. The author also makes the argument adaptive management (AM) as the ideal model for management because it directly addresses uncertainty in the system by incorporating flexibility into the management plan. He suggests that AM challenges the most common objective of traditional management, which is to work toward a single optimal state within the system. Finally, the author identifies the need to utilize decision-support techniques within the management framework as a means to assessing probabilities, acknowledging uncertainty, and achieving transparency and accountability. Decision support systems help identify the need or problem, aid the gathering of decision-relevant information, and encourage the cooperation of various stakeholders in identifying options and developing the final plan or strategy.

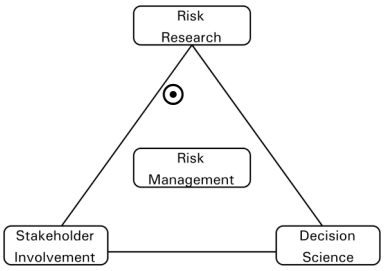
The author claims that these four components are all being used in varying capacities by river-management agencies, but that there is a need to integrate the components for truly adaptive and sustainable river management. The author believes that sustainability and uncertainty can both be addressed through an adaptive approach to management. However, in order to implement an adaptive management policy, it will be necessary to utilize decision support tools and models to ensure the participation of a variety of stakeholders and the inclusion of socio-economic as well as biological and physical objectives for management.

REFERENCE NO. 24

CITATION:

Cortner, H. J., P. D. Gardner, and J. G. Taylor. 1990. Fire hazards at the urban-wildland interface: What the public expects. Ecosystem Management **14**:57-62.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Growing knowledge about how people view fire risks can be used to inform the development and evaluation of risk-management policies at the urban-wildland interface. The authors concern themselves primarily with three areas of this "growing knowledge": how public attitudes have changed over time, peoples' preferences for fire-management options, and citizens' views about their own obligations in a risk management context. With respect to the public attitudes, the authors cite several surveys that demonstrate a shift in attitudes from a suppression-at-all-costs mentality (in the 1970s and early- to mid-1980s) to a more liberal view of fire management that makes room for prescribed burns and the ecological value of fire. The authors credit successful public education efforts for this shift.

With respect to people's preferences for fire-management options, the authors present a very interesting finding—that people recently exposed to wildfires have a lower level of concern about future fires, and assign a lower probability to them, than do homeowners living in an unexposed community. Regrettably, the authors essentially present these findings as a matter of fact and do not add much to our understanding of these wake-up call and letdown responses (which have been the focus of research in other contexts, e.g., hurricanes). Also in their discussion of people's preferences for fire-management options, the authors present data from a survey that asked for homeowners' preferences for several specific options (e.g., fuels treatments, enhanced education efforts, etc.). However, the ranking of preferred options is not fully described nor are its implications for management.

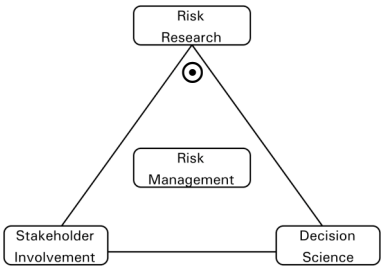
Overall, the authors take the presented results as a sign that education efforts are, for the most part, achieving their intended objective and ought to be continued as a means of inciting further change in people's attitudes. This, however, is yet another untested supposition. The results are also used to justify the need for 1) improved design and evaluation of community education efforts, and 2) the need for improved incentives to make fire management options more acceptable. While these are indeed fine suggestions, it is unclear how the results presented support them.

REFERENCE NO. 25

CITATION:

Covello, V.T., D. von Winterfeldt, and P. Slovic. 1986. Risk communication: A review of the literature. Risk Abstracts **3**: 171-182.

REFERENCE TYPE: Journal Article [Review article]



SYNOPSIS:

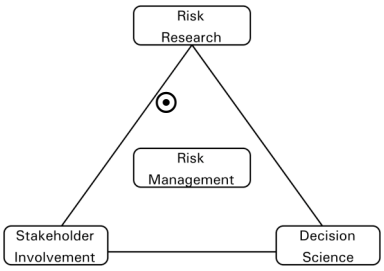
This article reviews the early literature regarding efforts to communicate with non-experts about health and environmental risks. The authors define risk communication as any purposeful exchange of information between interested parties. They conclude that many of the problems associated with communicating information about risk arise from four major areas. These include 1) message problems (i.e., the complexity of highly scientific risk information); 2) channel problems (i.e., problems with the means by which scientific information is transmitted); 3) source problems (i.e., the experts' lack of experience when communicating with non-experts); and 4) receiver problems (i.e., the perceptions and limitations of those receiving the information). Regarding the first and second points, message problems begin because the risk information is often very complex and technical making it difficult to interpret and communicate clearly, becoming a channel problem. The authors suggest that source problems occur because those communicating the information often disagree about the assumptions underlying the risk information. In some contexts, the communicators also lack public trust and credibility. The ability to communicate effectively during a disaster or emergency is also complicated by time pressures, the ability to coordinate with other agencies and organizations, and the conflicting objectives of government officials or agencies and those receiving the information. Finally, receiver problems arise when those receiving the information are not interested, or on the opposite extreme, hold such strong opinions or beliefs that they are unwilling to change their behavior or consider the new information being provided. In addition, those receiving the information are often resistant to change because of the losses they may incur, the belief that the communicators are simply trying to intrude in their personal life, and their tendency to rationalize and believe that the risks do not apply to them.

Overall, the authors conclude that the roots of risk-communication problems are embedded in broader social issues, and communication can only be effective when the appropriate strategy is utilized and an interactive, participatory approach is pursued. This review, although helpful at defining some of the basic difficulties of effective risk communication, is slightly outdated. Despite its status as one of the seminal works on the subject, the risk communication literature is now much more developed and more specific regarding the ways in which to address these problems and how to be most effective when communicating about risk.

REFERENCE NO. 26

CITATION:

Covello, V. T., P. M. Sandman, and P. Slovic. 1991. Guidelines for communicating information about chemical risks effectively and responsibly. In D. Mayo, and R. Hollander, editors. Acceptible Evidence: Science and Values in Risk Management. Oxford University Press, New York, NY.



REFERENCE TYPE: Book [Chapter]

SYNOPSIS:

This chapter provides guidelines for communicating risk information with non-experts about chemical plants. The chapter was written in response to a need for effective, responsible, and ethical means for communicating with the public about chemical risks. First, the authors describe seven principles for effective risk communication. These include 1) accepting and involving the public as a legitimate partner, 2) planning carefully and evaluating your performance, 3) listening to the audience, 4) being honest, frank and open, 5) coordinating and collaborating with other credible sources, 6) meeting the needs of the media, and 7) speaking clearly and with compassion. The authors also suggest that those receiving the information respond well to communication that includes a description of the action that will be taken, provides risk comparisons to put the issues in perspective, and is delivered by someone that they trust. The acceptability of any risk depends on each individual's values, specifically factors like fairness, familiarity, and voluntariness. Second, the authors provide guidelines for explaining risk-related numbers and statistics. They suggest that communicators use quantity comparisons (i.e., translate tons of ash into full swimming pools), find a variety of ways to express the same values or statistics, and personalize the statistics by using examples and anecdotes or talking about oneself. Third, the authors provide guidelines for describing and explaining risk comparisons. They advise that the reasons for the comparison be made clear, that the communicators ask to be trusted, and that the comparison not prejudge the risk as acceptable. The authors also provide a ranking system for risk comparisons, suggesting that some comparisons are more appropriate than others and the less desirable comparisons are only appropriate for very specific situations. Finally, the authors provide examples of the common problems encountered when explaining risk numbers. These include data uncertainties, delays in releasing information, and demands for zero risk from those receiving the information. The authors suggest that the best way to deal with these problems are to be as open and honest as possible to avoid creating mistrust and roadblocks in the future.

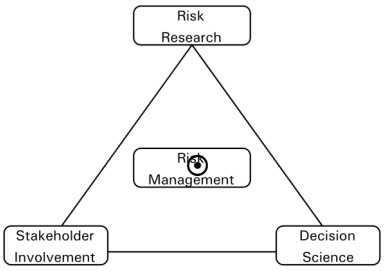
Risk communication has become increasingly important and it is necessary to really think about a communication approach before tackling complex issues involving risk. There are no easy prescriptions for effective risk communication, but the advice offered in this chapter is extremely helpful for those tackling this challenge. This information is still applicable when dealing with difficult risk-communication situations today and also applies outside of the realm of chemical risks.

REFERENCE NO. 27

CITATION:

Canadian Standards Association. 1997. Risk Management: Guideline for Decision-Makers. Canadian Standards Association, Ottawa, Ontario.

REFERENCE TYPE: Agency Report



SYNOPSIS:

Risk Management: Guideline for Decision-Makers (Report No. CAN/CSA-Q850-97) is, in effect, a National Standard of Canada. Produced by the quasi-government agency—the Canadian Standards Association—and written by a series of respected risk-management practitioners, it is an excellent source of information for agencies wishing (or required) to undertake a thorough risk-management process. The information presented, in the form of several guidelines, is applicable to a wide variety of risk issues and virtually any type of agency or group (e.g., government, NGO, corporate, etc.).

The publication is intended to assist decision-makers with managing risk issues in a comprehensive manner; this includes acquiring, analyzing, evaluating, and communicating information that is necessary for risk-based decision making. The unique aspect of the guideline is its emphasis on stakeholder involvement in risk-management during *every* stage of the process. Rather than viewing stakeholders as relevant to the risk management process at the stage of selecting or implementing an alternative, this publication makes explicit the role of stakeholders at the very earliest stages of risk management—referred to by the CSA as "initiation." Including *initiation* (identifying the problem and its associated issues), the document describes six steps in a comprehensive risk-management process; the others are *preliminary analysis* (a cursory analysis of the risk), *risk estimation* (detailed risk assessment, including lay/local knowledge and formal analysis of tradeoffs between risk and benefit), *risk control* (identifying risk-management options), and *action* (implementation and monitoring).

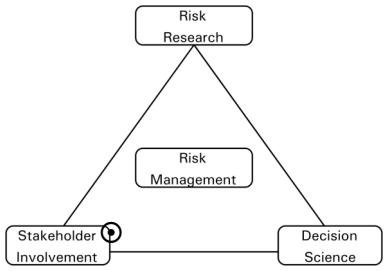
Beyond providing a much needed step-by-step description of the (six) steps in the risk-management decision process (and their relationship with each other), this publication makes another important contribution. It builds upon the discussion presented in the National Research Council's publication *Understanding Risk: Informing Decisions in a Democratic Society* (Reference No. 106). While also a presenting a very useful discussion of needs in risk management, the NRC volume does not provide much in the way of details about what a comprehensive risk-management effort might look like. *Risk Management: Guideline for Decision-Makers* goes along way toward filling this void.

REFERENCE NO. 28

CITATION:

Daniels, S. E., and G. B. Walker. 1996. Collaborative learning: Improving public deliberation in ecosystem-based management. Environmental Impact Assessment Review **16**:71-102.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Natural resource management philosophies and practices have slowly been transitioning from a traditional multiple-use approach to an ecosystem-based approach. Embedded within this approach is the need for not only high-quality science, but also social learning through high quality public participation. The authors define social learning as the process of framing issues, analyzing alternatives, and debating choices in the context of inclusive public deliberation. The challenge is therefore not to resolve or eliminate conflict, but rather to learn about complex issues in an environment where conflict is inherent. The authors contend that learning-centered public participation is actually a form of negotiation that depends on appropriate and effective communication between the involved parties. The authors propose collaborative learning (CL) as a model for public participation. CL is a hybrid of soft-systems methodology and alternative dispute resolution, meant to improve natural resource policy decisions through systems-based public involvement. CL stresses 1) improvement rather than resolution, 2) emphasizes situation rather than conflict, 3) focuses on concerns rather than positions, 4) targets progress rather than success, 5) seeks feasible change rather than desired future condition, 6) encourages systems rather than linear thinking, 7) recognizes that considerable learning must occur before improvements are possible, and 8) emphasizes communication and negotiation as the means through which learning can occur.

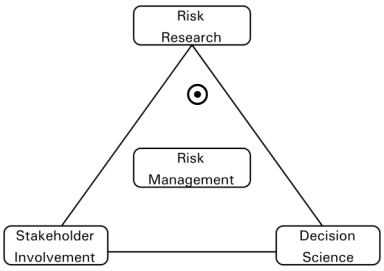
The authors conducted CL workshops as part of the Oregon Dunes National Recreation Area (ODNRA) planning process. The workshops were intended to provide a public forum where people with varied interests could test ideas and develop collaborative suggestions for improvement within the ODNRA. Workshop participants were led through a number of steps organized into three stages. Stage I: Inform stakeholders groups and involve them in process design. Stage II: Provide a common knowledge base about major issues, identify concerns about ODNRA management, and generate suggested improvements. Stage III: Organize the improvements based on different strategic visions and debate the improvements. Three specific improvements were developed as a result of the workshops. These included support for a more sophisticated off-road vehicle management plan, a more aggressive beachgrass eradication program, and more emphasis on local community development. The authors then developed a survey to send to the workshop participants to assess their attitudes regarding ODNRA management and the workshops themselves. The survey results were encouraging regarding both the workshops and the future use of CL in addressing natural resource management issues. Specifically, participants indicated that the CL process increased their understanding of the situation and allowed their concerns to be expressed and meaningfully discussed. The process also resulted in improvements that were actually implemented and although participant relationships improved moderately, strategic behaviors still persisted within the various parties.

REFERENCE NO. 29

CITATION:

Derby, S.L., and R.L. Keeney. 1981. Risk analysis: Understanding "How safe is safe enough?" Risk Analysis **1**:217-224.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

As modern society advances we face increasing hazards from the use of new and existing technologies. The hazards associated with various types of technology, from nuclear power to saccharine, often evoke the question of "How safe is safe enough?" This landmark article examines multiple facets of this question and provides a quick introduction to the concept of risk analysis. The authors begin this process by clarifying that the question, "How safe is safe enough?" is not a problem with a simple answer, but a statement that refers to the level of risk that is socially acceptable given the use of a specific technology alternative. In other words, the problem can be seen as a question of determining what is considered to be acceptable risk. According to the authors, acceptable risk is the risk associated with the best technology alternative and it depends on many factors. In order to choose the best technology alternative the authors suggest that the following prescriptive process be followed that explicitly considers the risk and benefits associated with each alternative and identifies how safe a chosen alternative should be:

1) Define the alternatives.
2) Specify the objectives the alternatives are to meet. In addition, determine how to best measure the effectiveness of each alternative at achieving the specified objectives.
3) Identify the consequences (risks and benefits) associated with each alternative.
4) Quantify the values for the various consequences.
5) Analyze the alternatives to select the best one.

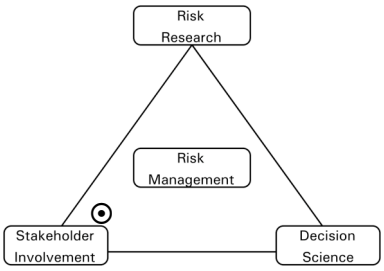
Despite the obvious utility of these steps, the authors point out that they are not a panacea for determining what is the best technological alternative for a given situation. The authors identify the following stumbling blocks that coincide with each step of the above-mentioned process: 1) Often it is not obvious what all of the alternative courses of action are. 2) Objectives and their appropriate measures are not clear for most problems. 3) For most complex problems there is a great amount of uncertainty, not all of the risks and benefits will be known in advance. 4) It can be very difficult to structure and quantify the values and preferences appropriate for evaluating various consequences. The authors also identify social, political, and ethical questions as complicating factors in the process.

REFERENCE NO. 30

CITATION:

Faber, D., & D. McCarthy. 2001. The evolving structure of the environmental justice movement in the United States: New models for democratic decision-making. Social Justice Research **14**:405-421.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

The majority of the research concerning stakeholder participation has focused on the need for government agencies and corporations to develop environmental decision-making processes that include those communities and organizations that are impacted by the decisions and policies they make. In order to include multiple stakeholders in an organized fashion, agencies and corporations have often relied on representatives from organized community and environmental groups that claim to represent a wider constituency. However, the literature lacks studies that examine the decision processes of these supposedly representative groups. This article critiques mainstream environmental movement groups, such as the Sierra Club, for their lack of democratic decision-making structures that truly represent the opinions and interests of their members. The author suggests that several factors have contributed to this condition: 1) The majority of the leadership of mainstream environmental groups is culturally homogenous (white, middle- or upper-class professionals) and unable to link environmental problems to the wider issues of economic inequality and racism. 2) Many of these groups have developed organizational structures that resemble corporations and have developed ties with industry groups, trade associations and government agencies, alienating many of the constituents they claim to represent. 3) Finally, these groups have not focused on the importance of civic participation and social capital in making their organizations more inclusive and responsive to constituents' needs.

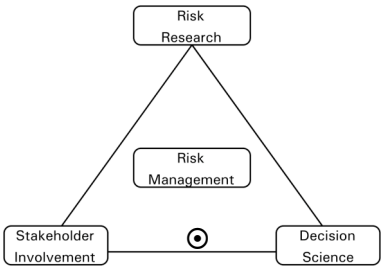
In order to remedy this situation and develop democratic decision models within environmental groups the author suggests that there is a need to focus on the reinvigoration of environmental citizenship guided by the three principles of ecological democracy: 1) *Grassroots democracy and inclusiveness*: The inclusion of people from all walks of life in environmental decision-making processes. 2) *Social and economic justice*: Environmental groups should connect environmental problems to the need for basic human and civil rights for all citizens. 3) *Sustainability and environmental protection*: There should be a focus of preserving nature for present and future generations. The author asserts that those groups under the banner of the environmental justice movement, such as People Organized in Defense of Earth, represent these principles in their organizational structures and roots. Unlike most mainstream environmental groups, environmental justice groups employ democratic decision-making processes that rely on participatory and representative boards. The author conjectures that the biggest challenge facing these groups is the need to form national ties while retaining a focus on community organization.

REFERENCE NO. 31

CITATION:

Failing, L. and R. Gregory. 2003. Ten common mistakes in designing biodiversity indicators for forest policy. Journal of Environmental Management, **68**: 121-132.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

The framework for developing and using biodiversity indicators in forest policy decision-making has many gaps, and this paper sets out to provide a decision-oriented, risk-management perspective to designing indicators. There is a need for clarification of the respective goals of scientists and the public as a part of a democratic, risk-management process. The authors identify ten common "mistakes" in developing and using forest biodiversity indicators when making forest-management choices. These "mistakes" often make good sense from the standpoint of doing careful science, but can lead to failures when implementing biodiversity initiatives and aiding forest-management decisions. The authors argue that indicators should also be designed to be relevant to policy, to be used as decision criteria to help decision makers discriminate among policy options.

The ten mistakes in forest biodiversity indicators are as follows:

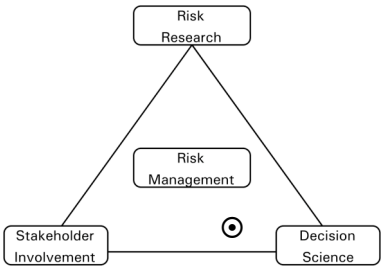
1. Failing to define endpoints. Appropriate indicators and management strategies are dependent on the objectives of the decision context.
2. Mixing means and ends. The policies and management strategies (means) used to achieve endpoints and objectives (ends) are often confused, and inappropriate trade-offs, performance tracking, and prescriptive management strategies often result.
3. Ignoring the management context. Biodiversity must be clearly defined and used in context as a means to inform specific management decisions, in specific ecosystems, using specific indicators.
4. Making lists instead of indicators. A concise summary of biodiversity implications of a policy can be compared with bottom-line impacts and be used in making trade-offs.
5. Avoiding importance weights for individual indicators. By failing to assign importance weights to indicators, decision makers are faced with long lists of "equally important" indicators. This can cause decision makers to be overwhelmed by the process of factoring them into the decision process.
6. Avoiding summary indicators or indices because they are considered overly simple. If constructed carefully, a summary indicator can lead to better decisions.
7. Failing to link indicators to decisions. Do the indicators address how the decision might affect biodiversity?
8. Confusing value judgments with technical judgments. Both technical and value judgments are important to setting priorities and making informed trade-offs.
9. Substituting data collection for critical thinking. What is easy to count isn't always what counts.
10. Oversimplifying: ignoring spatial and temporal tradeoffs. It is important to be specific about scale in definition and use of indicators.

REFERENCE NO. 32

CITATION:

Failing, L., G. Horn, and P. Higgins. 2004. Using expert judgment and stakeholder values to evaluate adaptive management options. Ecology and Society **9**:13-32.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

In an effort to address uncertainty and complexity in environmental risk management, recent research has focused on participatory methods for decision making as well as investigations into adaptive management. Adaptive management is an approach that recognizes the uncertainty in a system by integrating planned manipulations or experiments with long-term monitoring as a form of management. This paper provides an example of a structured decision process being used to evaluate adaptive management alternatives for implementing an experimental flow-release program on the Lower Bridge River in British Columbia. The authors tested a multi-attribute decision process where the adaptive management program was treated as one policy alternative, and expert judgments were combined with stakeholder values to identify additional policy alternatives for long-term flow release from a reservoir. The experimental framework ensured that impacts would be expressed as probabilities and presented in a simple framework exposing key trade-offs, that the value of information would be reported as expected improvements in future performance, and that value-based input would be sought regarding the costs and benefits of each alternative. Two fisheries experts provided probability judgments regarding the expected productivity of each management alternative and the ability of each alternative to predict the correct state of nature. These probabilities were then presented alongside both experimental and non-experimental management alternatives to stakeholders in the form of a decision tree.

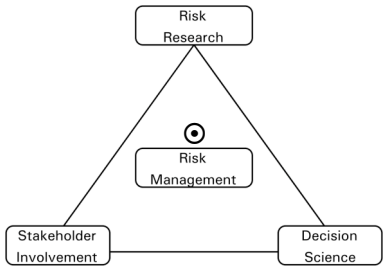
The majority of stakeholders – after considering the probabilistic success of each alternative as presented in the decision tree – strongly supported the experimental (adaptive) management program. The authors felt that a strength or benefit of this approach was that it integrated technical judgments into a single metric of performance (expected biomass) among the alternatives. This metric allowed decision makers to compare adaptive approaches against other non-experimental alternatives. The approach also allowed decision makers to explore their values and risk tolerances by exposing the different risk profiles for each alternative. Overall, this approach successfully translated quantitative probabilistic analysis into terms that could be understood and used by non-experts in the decision process. In regards to adaptive approaches as management tools, this structured approach highlighted the need to treat adaptive management as one policy option that is only appropriate when the costs and benefits can be weighed against other non-experimental alternatives.

REFERENCE NO. 33

CITATION:

Finucane, M. L. 2002. Mad cows, mad corn, and mad communities: the role of socio-cultural factors in the perceived risk of genetically-modified food. Proceedings of the Nutrition Society **31**:31-37.

REFERENCE TYPE: Journal Article [Review article]



SYNOPSIS:

This paper presents evidence for the importance of social and cultural factors in defining risk and the way that people perceive risk in regards to new technologies like genetic engineering (GE) and genetically modified (GM) foods. The author contends that effective risk communication and management must begin with an understanding of public perceptions, which is largely based on socio-cultural factors. The debate over GM food is an example of the disparity between experts and lay people in the way that they perceive risk, and specifically the way that GM foods are perceived across cultures. Scientists view risk as a function of probability, whereas the non expert's view of risk is subjective. In general, lay risk perceptions are socially constructed based on an unknown risk factor and a dread risk factor. In regards to GM foods and the use of GE in agriculture, there is large disagreement regarding the benefits of the technologies and the risks to consumers, largely based on social or non-technical factors of risk. In particular, the author contends that the values and needs of those countries or cultures perceived as high risk should guide the formation of policy regarding GM foods. Risk perceptions and the level of acceptance for emerging technologies are also largely affected by a lack of trust and unwillingness on the part of consumers to rely on the policies and decisions of experts. Risk perceptions vary across cultures because each group chooses to focus on some risks while ignoring others. These varying risk perceptions often correspond with very specific worldviews, which can in turn be used to inform risk communication strategies and identify what type of communication is most effective for each specific group.

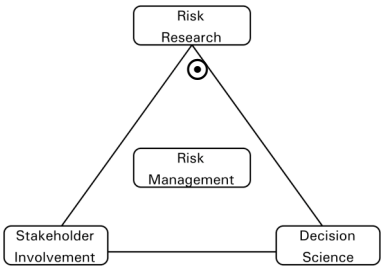
In summary, the author believes that failing to understand these non-technical differences between cultures will lead to poor communication and a breakdown in the decision making process. In the GM debate, as well as in other risk debates, what is important to different people and different cultures is also very important to the implementation and success of the product or program. Risk analysis (i.e., assessment, communication, and management) without public involvement is doomed to fail because non-expert wisdom will be overlooked and broad public support will most likely be lacking. For successful analysis, the author believes that a framework for understanding cross-cultural differences needs to be developed with respect to the technical and ethical issues raised by new technologies like GE.

REFERENCE NO. 34

CITATION:

Finucane, M. L. and P. Slovic. 1999. Risk and the white male: A perspective on perspectives. Framtider **18**:24-29.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

This article explores the policy ramifications of the "white male effect" (a term used to describe a select group of white males that perceive an inordinately low amount of risk from everyday hazards; see Reference No. 35), and its possible impact on the future of risk communication, management and research. The authors begin the piece by examining possible explanations for the "white male" effect, and in broader terms the difference in risk perception between men and women in general. Their position, which is supported by numerous studies, is that biological factors do not adequately explain these differences. Instead, they are more adequately addressed but looking at sociopolitical factors, such as worldviews, level of trust in government, and other similar factors. For example, the following sociopolitical traits are associated with the white-male effect: a high level of education, high household income and conservative political beliefs, a high level of trust in institutions and authorities, hierarchal and egalitarian worldviews, and a reluctance to democratize the risk-management process. Based on this position the authors suggest that risk perceptions are related to individuals' ability to influence decisions about the use of hazards. In addition the authors' suggest that the "white-male" effect may actually apply to other demographic groups that exhibit characteristics similar to the white males described. This theoretical stance leads the authors to posit several interesting questions for future study:

1. Is it possible that women in positions of power or that live in a matrilineal society view risk in a manner similar to men characterized by the "white male" effect?
2. Does the type of hazard studied in risk perception research account for the "white male effect"; would there be difference if there were a focus on household risks instead of technical risks?
3. Is the "white male effect" the partial result of the socialization process of children, and does it depend on certain cognitive and emotional stages being reached?

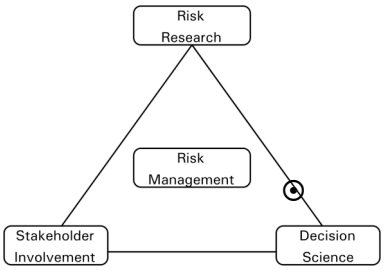
The authors close the paper with several suggestions for the future of risk management and communication in light of the "white male" effect and the importance of sociopolitical factors in the perception of risk. First, there should be a diverse range of people involved in risk-communication and -management processes. Second, there is a need to consider the system of categorization when partitioning a sample; for example, a low perception of risk from everyday hazards, may be correlated to other factors besides race. Third, the acknowledgement of diverse perspectives is needed to begin the process of making efficient and effective social decisions in terms of risk management and assessment.

REFERENCE NO. 35

CITATION:

Finucane, M. L., A. Alhakami, P. Slovic, and S.M. Johnson. 2000. The affect heuristic in judgment of risks and benefits. Journal of Behavioral Decision Making **13**:1-17.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Traditional descriptive decision research has focused mainly on cognitive strategies such as tradeoff analysis in decision-making. Recent studies have focused on the role of affect as a critical component in human judgment and decision-making processes. Despite the increased level of interest in affect there has yet to be the development of a cohesive theory to articulate the role of affect in judgment. In order to begin this process the authors of this article suggest, that conscious and unconscious images are marked by positive or negative affective feelings, which help guide judgment and decision processes. They use this basic tenet for a series of experiments exploring the role of affect in the inverse relationship between perceived risk and perceived benefit. The authors label this assertion the “affect heuristic”, due to the fact that the use of this pool of marked images to make decisions is easier than weighing the various pro or cons of a given situation.

The inverse correlation between perceived benefits and perceived risks appears to be a suitable domain for this study. According to an analytic or cognitive view, risk and benefit should held as distinct concepts; however, previous research has suggested that individuals’ perception of the risks and benefits associated with an item are guided by their affective feelings toward the item. For example, an individual may perceive an item as having low risk and high benefit due to a positive feeling toward the item, and vice versa for items that they perceive negatively. Unfortunately, the methodology employed by these previous studies did not exclude the possibility that cognitive processes and not affect was the primary tool used to establish this inverse relationship. In the two brief experiments reported in the article the researchers manipulated time pressure, and risk and benefit information to induce participants to rely on the affect heuristic to make a decision concerning the perceived risks and perceived benefits of an item. The reduction of time to make a decision was shown to force participants in that condition to rely on the affect heuristic to make a quick decision, and the provision of negative or positive, risk or benefit information concerning an item was shown to lead to an inverse judgment of the unmentioned attribute (risk or benefit).

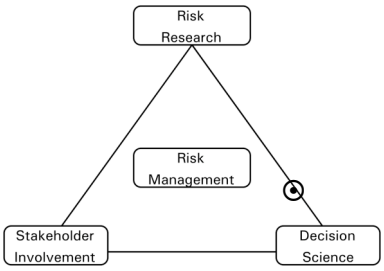
The results of the two studies led to two lines of evidence suggesting that risk and benefit are linked in people’s mind and subsequent decision are impacted by the affect heuristic: first a strong inverse relationship does in fact exist between risk and benefit judgments for items with different levels of risk and benefit, and second, the influence of information about one attribute of a hazard (risk or benefit) on the judgment on the other unmentioned attribute. For example, the provision of information suggesting that the benefits associated with a given technology is high, leading individuals to assume that the risks associated with the technology are low, even though they were given no information about the risk attributes of the technology.

REFERENCE NO. 36

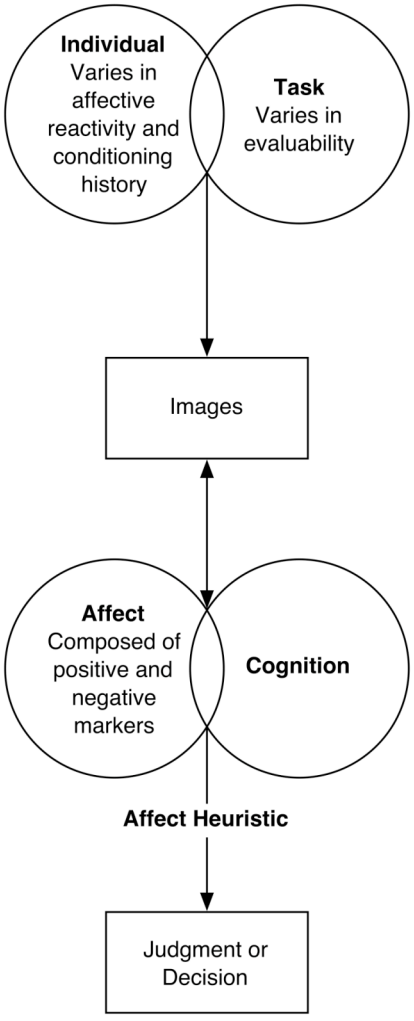
CITATION:

Finucane, M. L., E. Peters, and P. Slovic. 2003. Judgment and decision making: The dance of affect and reason. Pages 327-364 in S. L. Schneider, and J. Shanteau, editors. Emerging Perspectives on Judgment and Decision Research. Cambridge University Press, Cambridge, UK.

REFERENCE TYPE: Book [Chapter]



SYNOPSIS:



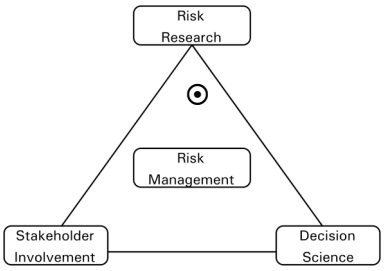
This chapter presents a theoretical framework for understanding the ways that affect can influence judgment and decision-making. According to the authors, affect is a feeling of "goodness" or "badness" (with or without consciousness) representing a positive or negative quality of a specific stimulus. The affect theoretical framework outlined in the chapter is based on previous research of the topic, which can be distilled into four major points: 1) Affect, attached to images, influences judgment and decisions. 2) More defined affective impressions reflect more defined meanings (i.e., greater evaluability) and carry more weight in judgment and decision making. 3) Individuals rely on affective impressions to make judgments and decisions to different degrees and react to affective stimuli differently. 4) Finally, it is difficult to give affective perspective to specific quantities, such as lives saved or amount of ice cream, without a context for comparison. Considering this previous research, the authors assert that affect should be theoretically framed as a heuristic (a mental shortcut used to make judgment for complex decision processes or when mental resources are limited) (See figure to the left of text). The affect heuristic operates in the following manner: when faced with a complex decision, people consult a pool of mental images that have been tagged by affective markers to different degrees (negative and positive). They then consult the affective impression retrieved from this "affective pool" and use it to guide a decision or judgment. This process is much easier than weighing the pros and cons of a situation or retrieving from memory many relevant examples. The affect heuristic can be used in isolation or in conjunction with other cognitive processes to make decisions.

REFERENCE NO. 37

CITATION:

Finucane, M. L., P. Slovic, C. K. Mertz, J. Flynn, and T. A. Satterfield. 2000. Gender, race, and perceived risk: The "white male" effect. Health, Risk & Society **2**:159-172.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

This article is another in a series that focus on the “white male” effect. The objective of this study was to more deeply explore the sociopolitical factors that relate to gender or race in terms of their influence on risk perception. The data for the study was collected using a national telephone survey that examined peoples’ risk perceptions over a wide range of hazards, and also different demographic variables, such as worldviews, trust and socioeconomic status. The data from the survey were weighted so that the ethnic/racial groups in the non-white group would be representative of the U.S non-white population. The study’s findings confirm previous work on this topic. In general males perceive less risk from everyday items than females, nonwhite males and females are more similar to each other in their perception of risk than white males and white females, and nonwhite females perceived more risk than any other group. In addition the authors confirmed previous descriptions of the identifying factors of the “white-male effect,” specifically: a high level of education, high household income, conservative political beliefs, a high level of trust in institutions and authorities, hierarchal and egalitarian worldviews, and a reluctance to democratize the risk management decision-making process.

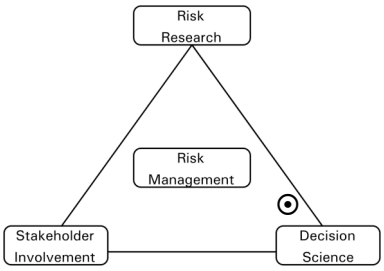
A major contribution of the article is the identification of the significant amount of variability among non-white groups in terms of their perception of risk, and the suggestion that this variability is in need of greater study. In addition the authors suggest that future risk-communication and management efforts need not only to be sensitive to inter-ethnic/race variability in risk perception, but also be aware of intra-ethnic/race variability in the perception of risk.

REFERENCE NO. 38

CITATION:

Fischhoff, B. 1985. Risk analysis demystified. NCAP News **4**:30-32.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

This paper provides an overview of the goals of risk analysis, the benefits of the technique, and the danger of trusting the results of an analysis done for the wrong reasons or in the wrong way. The author defines risk analysis as not one specific technique, but a variety of techniques used to model an environmental situation and identify the amount of risk that it contains. The type of model that is created and used for risk analysis depends on the specific context. For example, a model used to measure the effects of spraying pesticides may only contain two dimensions, one estimating the probability of exposure and another estimating the health effects associated with exposure. The author lists three reasons why risk analysis is an appropriate approach for identifying and understanding risk. One, risk models can encourage clearer thinking by forcing experts to identify only the relevant scientific information. Two, the models should force scientific experts to be explicit about what they believe by providing solid evidence for their conclusions. Three, the models should be more open to peer review than a simple verbal argument for risk measures.

Despite the benefits of this approach, the author warns that risk analysis may also be used by some for personal profit, to facilitate the mystery surrounding the technical data, as a panacea for the risk problem, and as a means for disguising assumptions with complex, technical language. In order to determine if the risk analysis is being used for the right reasons, the author suggests that several questions be asked: 1) Why is it being advocated? 2) How well is it being done? 3) What perspectives were involved in the analysis? 4) What factors were omitted from the model? 5) Are uncertainties quantified? 6) Have sensitivity analyses been conducted? 7) Does the analysis make recommendations regarding what policies should be adopted?

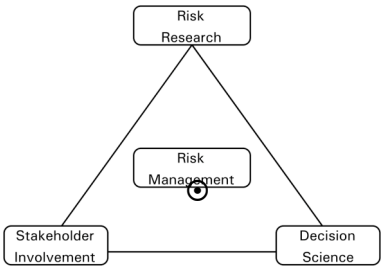
The author concludes the paper by stating that risk analysis may be a positive or negative step toward greater scientific understanding of risk depending on whether or not it is brought under social control. That control includes making it accessible to both experts and non-experts, monitoring its use, and ensuring that it is subject to the conditions of the scientific process.

REFERENCE NO. 39

CITATION:

Fischhoff, B. 1985. Managing risk perceptions. Issues in Science and Technology **2**: 83-96.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

In this commentary, the author reviews the risk-perception and judgment and decision-making literature to expose some of the stumbling blocks that confront risk managers in their attempt to manage public risk perceptions. The author also suggests a simple framework for more effective risk communication considering the challenges that risk managers encounter.

The author identifies several psychological pitfalls that limit the public's perception of risk: 1) *People Simplify*: People often over-simplify risk issues; for example, individuals want to see risk as a dichotomous variable (risky or not risky), when it is often continuous. 2) *Once people's opinions are set, it is difficult to change them*: People are reluctant to find information that challenges their viewpoint. In addition, individuals' prefer information that presents an issue as black and white to an ambiguous presentation with shades of gray. 3) *People remember what they see*: Unfortunately people tend to see and remember dramatic and sensational events more than they remember events that may be more common. For example, people are more likely to remember a single spectacular nuclear accident at a reactor than the reactor's three-year record of no incidents. 4) *People cannot readily detect omissions in the evidence they receive*: Often the information that the public receives concerning various risks is true but only reports part of the story. 5) *People disagree about how risk should be defined*: Laymen and experts often have different ways of viewing the same risk. An expert may be interested in fatalities associated with a specific risk, while a layperson may be more concerned about the voluntary or involuntary nature of the risk. 6) *People have difficulty detecting inconsistencies in risk disputes*: It is often difficult for the public to determine the fine differences between different arguments for and against risky technologies. 7) *People have difficulty evaluating expertise*: Individuals often rely on expert opinion to guide their perception of risk; however it can be difficult for the layperson to tell if an expert is presenting an objective point of view or a value laden opinion.

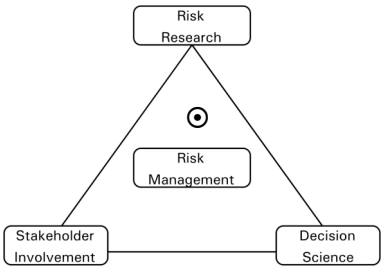
The author suggests that risk managers and communicators should adhere to the following four steps when communicating with the public about risk: 1) Describe the different options for addressing the risky object (technology, product, place, etc.). 2) Identify the public's information needs and use the best available techniques for addressing them. 3) Create a comprehensive protocol for organizing and reporting the manager's decision-making process. 4) Listen to what the public is trying to say.

REFERENCE NO. 40

CITATION:

Fischhoff, B. 1995. Risk perception and communication unplugged: Twenty years of progress. Risk Analysis **15**:137-145.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Fischhoff begins his look at the history of risk communication by comparing the biological truism of "ontogeny recapitulates phylogeny" to the process that organizations may encounter when attempting risk communication campaigns. Organizations can begin the risk communication process anew repeating the mistakes of others, or they can learn from problems that have been encountered in the past. Fischhoff attempts to examine these past mistakes and to provide a step-by-step guide of what to avoid when attempting to implement successful risk communication. This article looks at each of the "developmental stages" of risk communication and how successful risk communication is a cumulative result of learning from the mistakes of the previous stage. The following is a brief look at each of Fischhoff's "developmental stages": 1) using figures that accurately reflect the risk being discussed; 2) sharing these figures with the impacted public; 3) when sharing figures with the public, doing so in a manner that they can understand; 4) showing the public that they have faced similar risks in the past; 5) showing the public that the presented risk is not so bad, it also has some benefits; 6) when communicating with the public, be respectful and treat them "nice"; and the final stage, 7) making the impacted public, partners in the risk communication process. Fischhoff contends that the final stage represents the most effective method for communicating risk to the public. There is a need to include the public in all aspects of the risk communication process. Stage 7) implies that the public should not only be the recipient of the risk communication campaign but should help to craft it.

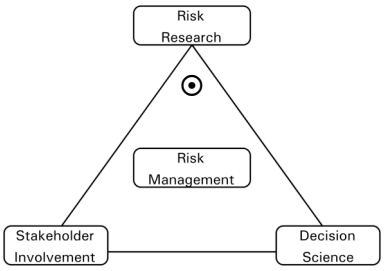
While this article is relatively dated, the information presented by it is still applicable to present risk-communication efforts. In addition, the article does both an excellent job of providing the pitfalls that need to be avoided to implement successful risk-communication strategies, as well as providing valuable direction on how to accomplish them. This article is a seminal piece in the risk communication literature.

REFERENCE NO. 41

CITATION:

Fischhoff, B., A. Bostrom, and M. J. Quadrel. 1993. Risk perception and communication. Annual Review of Public Health **14**:183-203.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

In order to make thoughtful risk management decisions, individuals must understand both the risks associated with the proposed action and the limits to their own understanding of the situation. This article addresses public risk perceptions, specifically in regards to health issues, and suggests some methods for improving risk communication. First, the authors address quantitative assessments of risk and how well individuals actually understand the magnitude of a risk. They state that individuals tend to be internally consistent (i.e., repeatedly providing the same judgments) when evaluating risk, but are subject to biases like anchoring and adjustment as well as overconfidence in their judgments. Individuals also tend to have difficulty evaluating risks depending on the type of response that is being elicited. The authors suggest using multiple response modes to avoid common evaluative biases. They also discuss the difficulties of defining risk because it can have a variety of meanings to different people. Second, the authors address qualitative assessments of risk. Specifically, they address the need to account for the conditions under which a risk is being observed and the details which individuals may infer during evaluation. Third, the authors address mental models which are intuitive theories about a risk which allow individuals to make predictions. These predictions can be inaccurate if their individual model is missing important information about the risk or contains misinformation. Mental models can be elicited from individuals to help risk communicators identify what information to include in their communication efforts with a specific group of stakeholders. In addition to mental model analyses to inform communication, other techniques include calibration analysis (identifying the appropriate degree of confidence in individual beliefs) and value of information analysis (identifying the sensitivity or impact of different pieces of information on a decision).

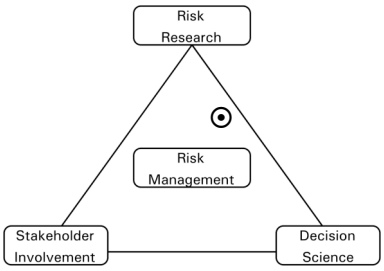
The authors conclude by stating that understanding individual risk perceptions and communicating effectively about risks are both highly complicated endeavors. Even the most carefully prepared communication effort may not eliminate the anxiety associated with risk-based decision making, but it may aid individuals to get further along in the decision process than they would without effective communication. The issues addressed in this article can be applied to a variety of risk issues outside of the arena of public health.

REFERENCE NO. 42

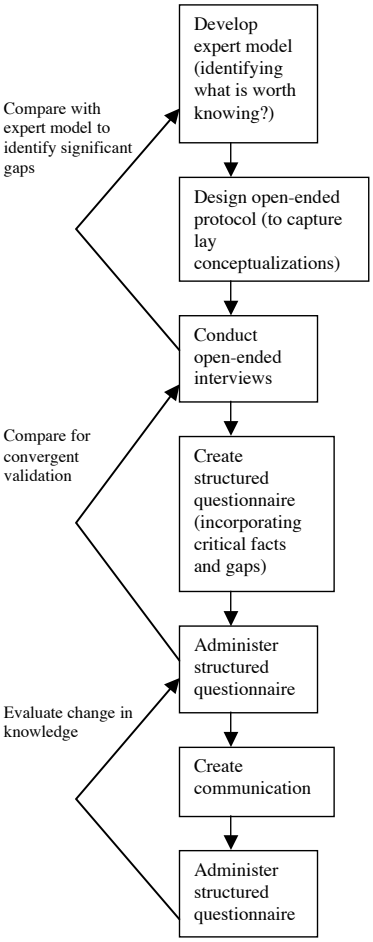
CITATION:

Fischhoff, B., D. Riley, D. C. Kovacs, and M. Small. 1998. What information belongs in a warning? Psychology & Marketing **15**:663-686.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:



One of the most daunting tasks facing risk communicators today is the design of effective warning labels on products that may pose a risk to consumers if used inappropriately or even appropriately. The traditionally small size of warning labels, the need to reach multiple audiences with a single message, and people's tendency to completely disregard warning labels all pose substantial barriers to the design of effective warning labels. An additional significant consideration in warning label design is what information belongs in a warning. This article is an attempt to address this problem. The authors begin the article by suggesting five conceptual steps to identify what information should be included on a warning label: 1) Determine what information is necessary for understanding how a risk is created and controlled. 2) Determine consumers' current beliefs regarding those facts. 3) Design a message that fills the gap between what consumers know and what they need to know. 4) Evaluate the effectiveness of these messages with consumers that consider the message and its usefulness. 5) Develop and evaluate a warning label (or system) that draws consumers' attention. Despite the theoretical importance of this process, the authors concede that in practice it has been traditionally very difficult to address these various steps. Considering the difficulty associated with the above process, the authors suggest that the use of "mental models" is a possible alternative method for risk-communication development of warning labels (see figure to the left).

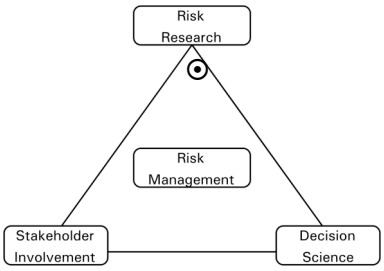
The authors use the rest of the article to report the results of using "mental models" to determine the information needed for warning labels for two harmful chemicals which the public is often exposed to: methylene chloride (paint stripper) and perchloroethylene (dry cleaning fluid). Use of the mental models process led the researchers to suggest that it would be possible to develop a relatively simple, well-designed warning label that could substantially reduce exposure to paint stripper. However, the same mental model method indicated that there seems to be little interest or need for warnig labels for dry cleaning fluid. These two results show the usefulness and fluidity of mental models in developing warning labels.

REFERENCE NO. 43

CITATION:

Fischhoff, B., S.R. Watson, and C. Hope. 1984. Defining Risk. Policy Sciences. **17**:123-139.

REFERENCE TYPE: Journal Article [Review]



SYNOPSIS:

Managing risks of technologies is a major topic in scientific, industrial, and public policy arenas. The meaning of the term “risk” is confusing and often controversial. For each risk situation, there are several possible definitions of risk, and the definition chosen can affect the outcome of policy decisions, allocation of resources, and distribution of political power. In this essay, the authors set out to identify several of the dimensions of this controversy, and demonstrate an analytical approach to defining risk in a way that is suitable for many problems and value systems.

There are several sources of controversy about risk definition. First, the distinction between “objective” (scientific) risk and “subjective” (public perceptions) of risk is controversial in how it characterizes both the public and experts. Second, risks of a technology often have many more dimensions than just the consequences associated with the technology. Next, for all relevant dimensions of technology, a summary statistic is necessary. This statistic can often be expressed in many different ways, and with different units and measures. Fourth, it is important to set temporal bounds on the effects of a technology. In addition, bounds need to be set as to what extent the risks are restricted to those directly associated to the technology. Finally, recognizing that concern over threats to health and safety are among the consequences of a risky technology. Concern is controversial in that it is difficult to determine what constitutes an appropriate level of concern.

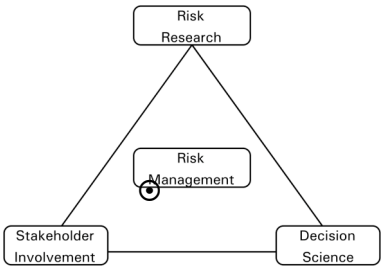
The authors suggest the first step in defining “risk” is to determine which consequences to include. These consequences should reflect society’s values rather than those of any single interest. Once the consequences have been chosen, risk indices must be constructed. Drawing from multi-attribute utility theory, the authors propose a flexible framework that emphasizes a full range of options, but does not specify a correct solution. This scheme can be adapted to many problems and value systems. The authors apply this scheme to define risks of electricity generation. In the analysis, six energy technologies are considered: coal, hydropower, large-scale wind power, small-scale wind power, and nuclear power, as well as energy conservation. The analysis includes defining five attributes of the technologies, evaluating the consequences of each technology across the attributes, assigning weights as to the importance of the attributes, and making tradeoffs between technologies. Finally, the risk for each technology can be computed and compared using weights and technical scores for each of the technologies.

REFERENCE NO. 44

CITATION:

Florig, H. K., M. G. Morgan, K. M. Morgan, K. E. Jenni, B. Fischhoff, P. S. Fishbeck, and M. L. DeKay. 2001. A deliberative method for ranking risks (I): Overview and test-bed development. Risk Analysis **21**:913-921.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

This article describes both a method for ranking risks developed by the authors and an experimental approach to assess the validity of the method. The authors developed and tested their risk-ranking method in response to a growing interest in, and need for establishing consistency when gathering public input for setting risk management priorities. Previous risk-ranking efforts have devoted little attention to the methods employed in performing the rankings. This is problematic if the rankings are meant to be used as a means of making risk-management decisions and informing policy, and not just as a means of encouraging communication and dialogue among interested parties. The authors believe that a good ranking method must be defensible and based on empirically validated procedures. It should make use of available theory, encourage the consideration of all relevant information, result in internally consistent rankings, ensure high quality participation, and describe the level of agreement or disagreement among participants.

The authors developed an experimental test bed to directly measure the effectiveness of their risk-ranking method. Participants in the study were provided with risk information regarding a fictitious middle school. The first step of the method involved categorizing risks so that they could be directly linked to risk-management interventions and therefore be easier to translate into policy decisions. The method produced 22 risk categories for the school. The second step involved developing risk attributes based on three independent factors: unknown risk, dread risk, as well as societal and personal exposure. The method resulted in values for 12 attributes including mortality rates, illness and injury, time between exposure and consequences, quality of understanding, uncertainty, and ability to control exposure. The third step was to prepare risk-summary sheets to help participants learn about each risk and make informed ranking judgments. The fourth step was to perform the rankings, by first making individual judgments, then group judgments, then final individual judgments. The fifth and final step was to describe the issues that were identified and the resulting rankings.

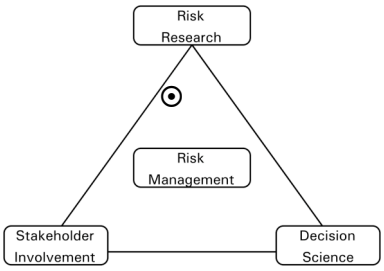
The authors used this experimental approach to measure and evaluate how well the method encouraged thoughtful participation and resulted in internally consistent rankings that were also deemed valid and appropriate by the participants. Their findings from this and several other studies have allowed them to refine the method and evaluate each individual component. The authors believe that risk ranking methods—and this one in particular—offer a potentially powerful means for gathering public input and setting risk-management priorities.

REFERENCE NO. 45

CITATION:

Flynn, J., P. Slovic, and C. K. Mertz. 1993. The Nevada initiative: A risk communication fiasco. Risk Analysis **13**:497-502.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

This paper reviews an advertising campaign by the American Nuclear Energy Council (ANEC) intended to garner support for building the nation's first nuclear waste repository at Yucca Mountain in Nevada. The ads were designed to inform and educate the public regarding the risks surrounding the potential repository. One ad demonstrated the safety of transporting nuclear waste by showing a storage cask being hit by a speeding locomotive. Another ad used scientists to ensure the public that living near the repository would be safe stating that studies showed no risk of explosions or cancer for those living near the location. This study was designed to measure the success of the ad campaign by surveying Nevada residents who had seen or heard the advertisements. The results indicated that approximately 72% of those surveyed had seen the campaign, however less than 15% stated that the campaign led them to be more supportive of the repository. Approximately 74% of the respondents said they would oppose the repository if allowed to vote on the initiative. The majority of negative responses to the ad campaign were based on distrust in the information provided (i.e., belief by those surveyed that the ads were dishonest, false, misleading, etc.). After this survey was completed, information from confidential ANEC documents was leaked stating that the intent of the campaign was not to inform and educate, but rather to sway public opinion toward acceptance of the repository. This information led to a negative backlash by the media, further damaging the campaign and decreasing their credibility in the eyes of the public.

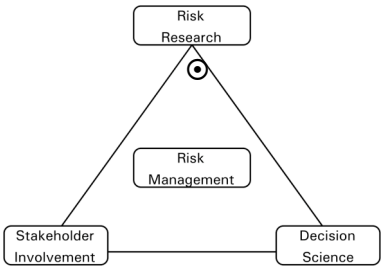
The authors conclude that attempts to change public risk perceptions of industry hazards (i.e., oil, chemical, nuclear) often fail because they focus solely on scientific assurances meant to increase the public's knowledge of the issues. However, public perceptions are also driven by trust, concerns about equity and fairness, and the desire for local and state government to play a role in major policy decisions. The ANEC advertising campaign provides a key lesson for risk communication, that communicators must confront and incorporate the psychological, social, cultural, and moral values of the public when addressing their perceptions and concerns. Relying solely on scientific evidence or rationality will never fully address public concerns, nor sway their perceptions when addressing risk-based policy and management initiatives.

REFERENCE NO. 46

CITATION:

Flynn, J., P. Slovic, and C. K. Mertz. 1994. Gender, race, and perception of environmental health risks. Risk Analysis **14**:1101-1108.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

The majority of early risk-perception research focused on the qualities of a hazard—whether exposure is voluntary or controllable, its distribution in the population, etc.—in determining the degree of risk individuals associated with the event; however, this article concentrates on the influence of the individual's personal characteristics—primarily race and gender—on their perception of risk. The researchers collected data for the study from a national survey examining people's attitudes, perceptions, beliefs, values, and knowledge concerning environmental health risks such as nuclear waste, climate change, etc. In addition the survey included demographic questions on participants' race and ethnicity, gender, education level, political beliefs, and socioeconomic status. The study sample included 1512 participants; 1275 individuals identified themselves as white and 214 identified themselves as non-white.

Despite the dated nature of the research, the study led to several significant findings that are still the focus of current research projects. In general, males perceived less risk than females from the environmental health risks examined in the study. The researchers posit that this may be due to biological and social factors, such as the fact that most women are socialized as nurturers and maybe more sensitive to risk that threatens human health. Also the researchers found that nonwhite males and females are more similar to each other in their perception of risk than white males and white females. The study also identified two outliers in terms of environmental health risk perceptions: nonwhite females and a group of white males. Nonwhite females tended to have higher mean risk ratings than any of the other demographic groups (white males, white females, nonwhite males). In addition, a select group of white males perceived an inordinately low amount of risk from the hazards they were presented with in the survey. A high level of education, high household income, and conservative political beliefs identified this group of white males. A high level of trust in institutions and authorities and a reluctance to democratize the risk management decision-making process also characterized this group. The researchers labeled this phenomenon as the "white male effect."

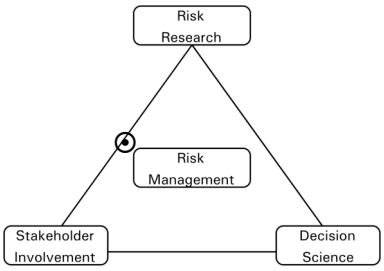
In conclusion, the researchers suggest that the actions of white males identified by the "white-male effect" may have a significant effect on broader context of the management and communication of risk. These individuals may see less risk in the world because they create and control much of the factors responsible for risk in our modern society. In addition, their attempts to communicate about risk to other groups, such as nonwhite females, may be hindered by their inability to comprehend perceptions of risk that clash with their own.

REFERENCE NO. 47

CITATION:

Freudenberg, W. R. 1996. Risky thinking: Irrational fears about risk and society. Annals of the American Academy of Political and Social Science **545**:44-53.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Over the last century, science and technology have achieved many remarkable successes. Often times, public reaction to science and new technology is viewed by the scientific community as unreasonable or irrational. In the mid-1990s, several legislative bills were proposed to require “risk-based” decision-making processes, which would ignore public concerns and focus solely on scientific assessments if the levels of risk involved. In this article, the author describes three significant problems with these proposed “risk-based” decision-making processes.

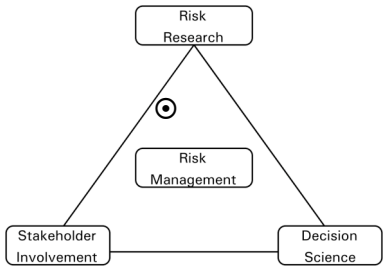
The first problem is that there is a fundamental misunderstanding as to why the public reacts to technological risks the way it does. Trustworthiness in technology, organizations, industry, and government is an essential ingredient to accepting risks associated with new technologies. Second, technological controversies often involve many blind spots and unknowns. It is difficult to assess all the possible attributes of a technology, and the public may assess the technology using a different set of attributes. Finally, while risk assessment can offer facts about technical questions, it cannot address values. Such scientific assessments are often misused for “diversionary reframing,” a technique in which the public is accused of being opposed to science, diverting attention away from their actual concerns. Tactics such as diversionary reframing lead to increased distrust towards science and technology, and a decrease in credibility of the social institutions involved. A failure to understand the weaknesses of relying exclusively on risk assessments in decision-making can lead to lasting damage to the public credibility of science and technology.

REFERENCE NO. 48

CITATION:

Freudenberg, W. R., and J. A. Rursch. 1994. The risks of "putting the numbers in context": A cautionary tale. Risk Analysis **14**:949-958.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

An important component of risk communication that often invokes cautionary warnings from practitioners is the practice of making risk comparisons. Despite the difficulty with using risk comparisons to influence individual judgments about risk, members of the technical community continue to employ and advocate these techniques. This study is one of only a handful of efforts that have empirically examined the effectiveness of risk comparisons that weigh involuntary (i.e., hazardous waste facility) against voluntary (i.e. smoking cigarettes) risks. Subjects in this study were told that a proposal to build a new hazardous-waste incinerator in their community had been approved by state and federal regulators, and according to the company the new facility posed no environmental or health hazards. Subjects were then asked a series of three questions: 1) If it came to a vote would you allow the facility to be built or would you vote to prevent it? 2) If a company representative said that the odds of a really serious accident or health risk were incredibly small, only one in a million, would that increase your support, make no difference, or decrease your support? 3) If a company representative said that a one in a million risk was equal to smoking less than a couple dozen cigarettes, how would that statement affect your support for the facility?

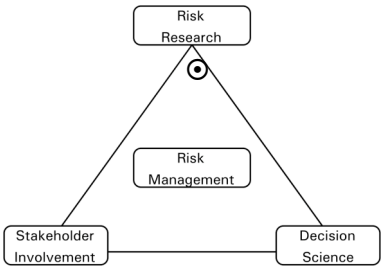
A majority of the subjects (63.9%) initially expressed opposition to the facility, and when given the probabilistic risk information (one in a million) a majority (54.9%) of the subjects said that it would make no difference on their vote with an additional 36.6% stating it would make them more likely to support the facility. When provided with the risk comparison information, the majority of subjects again stated that it would not affect their vote; however, 19.3% of subjects said it would make them more likely to oppose the facility (as opposed to only 8.5% indicating increased opposition when given the probabilistic information). The authors believe that distrust is the most likely explanation for the subjects' behavior in this study. They state that with each technological advance in our society, we become more and more dependent on individuals who are unknown to us, and whom we tend not to trust. Risk-comparison information that is meant to inform individuals about a technological risk is therefore being provided by an official that we do not trust, creating additional opposition to the proposed activity or event. The authors believe that it is distrust, not self-interest or misinformation that causes the risk comparison to result in increased opposition. The authors believe that risk comparisons can be useful for informing and educating the public, but only when the comparisons are presented by individuals that are trusted and respected by the community.

REFERENCE NO. 49

CITATION:

Gandy, O. H. 2001. Racial identity, media use, and the social construction of risk among African-Americans. Journal of Black Studies **31**:725-738.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Numerous factors influence an individual's perception of risk, such as media use and racial identity. Media usage, specifically watching television, has been linked to risk perception via the mean world hypothesis. According to this hypothesis, the more time an individual spent watching television the more that person would come to see the world in "television terms." For example, considering the high level of violence on television the individual would see the world as a mean and violent place, high in risk. In addition, high levels of television viewing have been correlated with an elevated sense of social mistrust, which also has an impact on an individual's perception of risk. Racial identity, like media usage, has been associated with risk perception. Past studies have suggested that African-Americans perceive more risk from everyday hazards than other groups due to a general sense of powerlessness. However, it has also been shown that racial identity is a fluid (not all members of a racial group identify with their shared racial identity to the same degree) and situational (the importance of an individual's racial identity varies in different contexts, such as home, work or school) variable. Thus, the influence of racial identity on the perception of risk can vary greatly depending on the surrounding context. This article reports the results of a study that examined the impact of media use and racial identity on African-American risk perception. Both of these variables have been linked to risk perception in past research, as shown above; however, this study is unique in its attempt to determine the influence of racial identity as an intervening variable between media and the perception of risk. In order to do this the study looked at the perception of a single risk, domestic violence toward women in the African-American community. The study population was composed of 3,090 African-Americans in several urban communities exposed to a public service announcement on the radio about domestic violence. The participants were asked to fill out a questionnaire that examined their media usage, perceptions of domestic violence, level of education, and a measure of the strength of their racial identity.

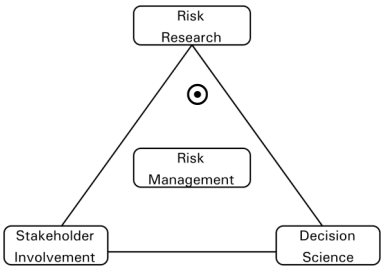
The results of the study did not lead to any significant conclusions concerning the influence of racial identity as an intervening variable between risk perception and the media. The author suggests that this may be an indication that mass media may not play as big of a role in the perception of risk as previously thought. However, the study did find a significant link between an individual's level of formal education and their perception of risk. Participants with a high level of education perceived less risk from domestic violence for women of their race as opposed to women of different races. Despite the inconclusive results, the author suggests that there is the need to examine the influence of racial identity on the understanding of stories about risk, causes, and alternatives.

REFERENCE NO. 50

CITATION:

Gardner, P. D., H. J. Cortner, and K. Widaman. 1987. The risk perception and policy response toward wildland fire hazards by urban home-owners. Landscape and Urban Planning **14**:163-172.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

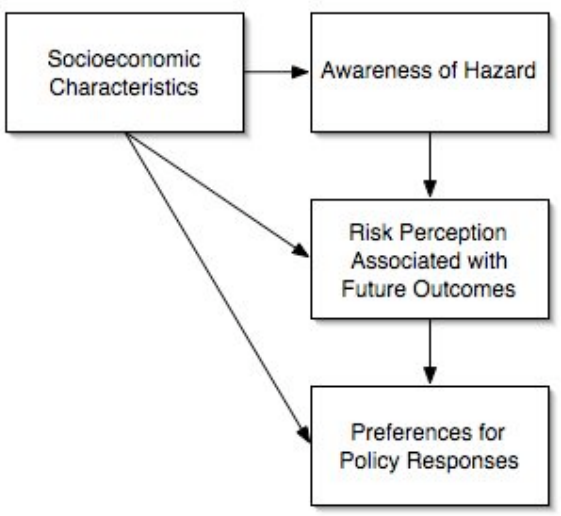


Figure 1

The research reported in this article attempts to validate a simple model (Figure 1) designed to explain people's responses to fire risks at the urban-wildland interface. In order to test the model, four sets of questions were asked to two groups of respondents: 66 homeowners in San Bernardino County who had recently been exposed to a fire and a separate 47 homeowners living in an unexposed community. Survey questions assessed homeowner's perceptions of the probability of a future fire, their awareness of the fire problem in their area, preferences for alternative management options, and a series of demographic questions (aimed at addressing the socioeconomic component of the model).

A stepwise multiple regression analysis revealed a statistically robust relationship between the "Awareness" variable and its corresponding node (Risk Perception) in the unexposed and exposed communities. As might be expected, those with a greater awareness of fire hazards recognized the risks associated with future outcomes—regardless of the community sampled. A general pattern emerged to explain the link between risk perceptions and preferences for risk-management options. The authors also hypothesized that people who perceived elevated probabilities associated with future exposure would prefer options that would mitigate or minimize future potential damage. Support for this hypothesis was found in both samples. However, in the exposed community, the Awareness variable also demonstrated an influence on homeowners risk management preferences.

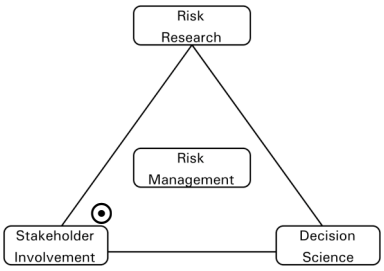
Several of the demographic variables demonstrated an influence at each step in both communities. No consistent pattern was detected, however, for *how* these variables enter the various regression models.

REFERENCE NO. 51

CITATION:

Glicken, J. 2000. Getting stakeholder participation 'right': A discussion of participatory proccesses and possible pitfalls. Environmental Science & Policy **3**:305-310.

REFERENCE TYPE: Journal Article [Review]



SYNOPSIS:

The trend towards increased public participation in risk assessment and decision-making leaves risk managers with the challenge of designing effective and meaningful public participation processes. This article discusses general characteristics of public participation in ecological risk assessments, defines stakeholders and participatory processes, and discusses the variety of information that can be provided by the public in risk assessments.

The changing nature of public participation in ecological risk assessments has been discussed by the National Research Council in a variety of publications. In 1983, the NRC focuses on the partnership between science and government for informing public risk decisions. In 1996, the NRC recognizes the role of non-experts in the process of risk analysis and risk decision-making. This inclusion of non-experts also introduces non-technical information into the decision-making process. This information does not supplant technical information, but rather supplements it. An iterative process can then be established with social values being useful to structure data collection and analysis. Increased public participation leads to the inclusion of new types of information into participatory processes. The author defines three types of information: cognitive (technical expertise), experiential (based on common sense and experience), and value-based (moral and normative, derived from social interests) which arise during decision-making processes. Scientists and technical experts present cognitive information, but the inclusion of experiential and value-based knowledge in decision-making processes elevates the importance of stakeholder participation.

In order to design a participatory process, risk managers need to draw from a suite of tools and methodologies that can be combined and applied in a manner that best suits the situation at hand. The participatory process must be as carefully managed as the scientific and technical analysis; technical and non-technical communities must be engaged in a dialog together; the risk manager must treat the public participation seriously and place equal weight on experiential and value-based knowledge; communication must be ongoing; and key stakeholder groups must be identified and engaged. The author concludes with a discussion of six steps that are designed to lead risk managers through appropriate and effective stakeholder processes. These steps include:

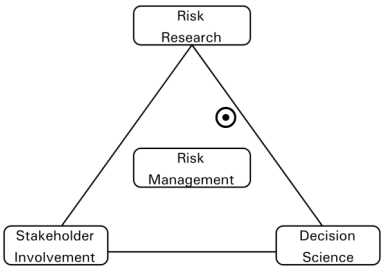
1. A clear statement and communication of purpose,
2. An identification of the appropriate stakeholders,
3. The selection of appropriate information-elicitation tools,
4. The rigorous use of these tools,
5. The application of appropriate analysis techniques, and
6. Documentation of the process and results.

REFERENCE NO. 52

CITATION:

Gregory, R. 1989. Improving risk communication: Questions of content and intent. Pages 1-9 in W. Leiss, editor. Prospects and Problems in Risk Communication. University of Waterloo Press, Waterloo, On.

REFERENCE TYPE: Book [Chapter]



SYNOPSIS:

This paper provides a somewhat outdated – due to the age of the publication – review of risk communication as a means of bridging the gap between expert and non-expert risk perceptions. The author discusses risk communication within the context of exposure to ionizing radiation because at the time radiation risks were not well understood in regards to risk evaluation and public policy formation, therefore providing a good example of the need for effective risk communication. The author states that effective risk communication must address both the physical impacts (i.e., economic and environmental) as well as the perceptual impacts (i.e., what the public believes may happen) of a risk. The author believes that the most appropriate way to measure or place value on risk impacts is to combine techniques from risk analysis, risk perception, and damage assessment. However, developing an integrated approach is much more complicated than just throwing together the various evaluation techniques. The author suggests that risk communication be used to both inform participants in a policy or management decision and combine the various techniques available for evaluation as listed above. He suggests that in order to achieve both these goals, risk communication approaches must 1) recognize the multi-dimensionality of risk, 2) link individual risk perceptions with the analysis of various policy or management alternatives, 3) recognize that different groups have different concerns or values, and 3) incorporate standardized methods for evaluating each individual communication effort.

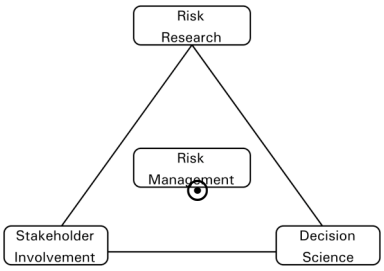
Although this paper does not present anything that has not already been tested or explored in more recent years, it does provide a picture of where risk communication efforts were just over a decade ago. At the time of this publication, risk communication approaches were still being refined in order to facilitate two-way dialogue between experts and non-experts and encourage the development of alternatives that incorporated a variety of perspectives (i.e., technical and social, expert and lay person).

REFERENCE NO. 53

CITATION:

Gregory, R. 2000. Using stakeholder values to make smarter environmental decisions. Environment **42**:34-44.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Risk management efforts require both targeted analysis (e.g., through input from the natural, physical, and social sciences) and meaningful stakeholder involvement. This combination of analysis and discourse has been touted in a variety of high profile reports such as the recent Presidential Commission on Risk. Yet despite the recognized need for analysis and discourse, there is very little in the way of specific guidance regarding how to best meet this dual objective (beyond rather abstract suggestions such as "involve 'right' participants, be a good listener, avoid the use of jargon, etc.). The goal of this manuscript is to provide some specific guidance for structuring analytic-deliberative discourse so that by the time a risk-management decision is made, it will have incorporated high quality input from technical experts and non-expert stakeholders (and as a result, will—hopefully—be met with broad-based approval).

The article begins by discussing the basic structure for making smarter, multi-stakeholder risk-management decisions. In doing so, the article draws heavily on theory—in a readable format—from two related disciplines: behavioral decision research and prescriptive decision analysis. According to the author, a well-structured decision making approach involves five steps: *framing the decision* (identifying the key contextual elements of the decision problem), *defining key objectives* (determining how people will be affected by a decision in the context of their values), *establishing alternatives* (identifying alternative actions that might be undertaken), *identifying consequences* (establishing how objectives will be affected by the alternatives), and *clarifying tradeoffs* (identifying the important conflicts across the desired objectives and using this information to narrow down the list of available options).

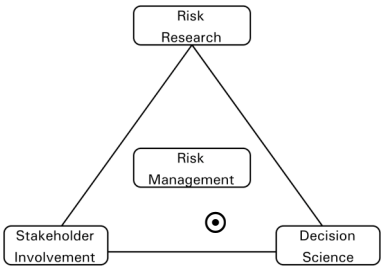
The article closes by highlighting how these five steps were applied in the context of a case study: restoration of the Tillamook Bay Estuary as part of the National Estuary Program. Beyond providing an overview of the five steps in the context of this case study, the article does an exemplary job of discussing—in understandable terms—the process of eliciting objectives. In doing so, a careful and relevant distinction is made between *means* (objectives that lead to other, more fundamental objectives) and *ends* (objectives important in their own right). This is important because many disagreements in a risk management process stem from *means* objectives that conflict. By focusing deliberations on *ends* objectives, much of this conflict can be eased without requiring the sleight-of-hand techniques common in many examples of consensus-based decision making.

REFERENCE NO. 54

CITATION:

Gregory, R. 2002. Incorporating value tradeoffs into community-based environmental risk decisions. Environmental Values **11**:461-488.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

A rich literature exists on how to successfully engage the public in complex environmental risk management decisions. However, despite the limitless advice on how to conduct effective participatory decision processes, the majority of these processes appear to fail. This paper points to the abundance of failed attempts as a shortcoming in the ability of participatory approaches to clearly address difficult value trade-offs. The author focuses on the following six reasons for why value trade-offs are often so difficult.

1) They often involve choices among options that affect multiple value dimensions.
2) They often involve impacts or consequences that are extremely uncertain.
3) They involve evaluative contexts that are often unfamiliar and difficult to understand.
4) They require a balance of careful thinking (cognitive effort) and high accuracy from participants.
5) They require an integration of both affective and process considerations.
6) They may require learning over time before trade-offs can be made.

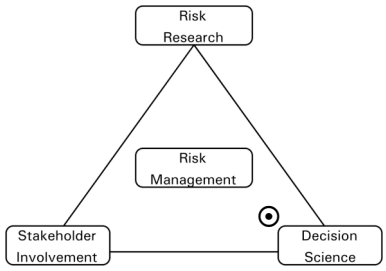
The author suggests using structured decision processes to encourage meaningful and defensible tradeoffs. Specifically, he describes a variety of useful structuring techniques to overcome the trade-off challenges as listed above. A short list of these techniques includes creating a means/ends network for objectives, conducting a value-of-information assessment, utilizing expert judgment processes, simplifying the decision, using influence diagrams and knowledge maps, broadening the legitimate range of concerns, and utilizing adaptive strategies and monitoring. In summary, participatory management efforts have frustrated practitioners for many years because of the apparent inability or unwillingness of participants to make the necessary tradeoffs across conflicting objectives. The author maintains that these failures are a result of the decision context, not of the participants' ability. He advocates use of a structured, deliberative process to aid participants in thinking through their values, evaluating the risk information that is provided, and assessing the trade-offs among alternatives. This type of approach will most likely require additional time and expense, but should be more likely to result in long-term policy and management solutions that address the needs and interests of a diverse range of stakeholders.

REFERENCE NO. 55

CITATION:

Gregory, R., and L. Failing. 2002. Using decision analysis to encourage sound deliberation: Water-use planning in British Columbia, Canada. Journal of Policy Analysis and Management **21**:492-499.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

This article presents the decision-analysis techniques the authors have been utilizing while assisting British Columbia Hydro with a comprehensive stakeholder-based review of their facility operating plans. The goal of the project was to prepare guidelines and outline techniques for conducting stakeholder consultations and technical analyses at all of the hydroelectric facilities, train the analysts and facilitators who would be conducting the deliberations, and lead the facilitation at several sites. The authors wanted to encourage the expression of a diversity of values and objectives rather than seek consensus among the participants. The Water Use Plan (WUP) Guidelines that were developed consisted mainly of straightforward decision-analysis techniques, but three elements that were key to the overall success of the project were 1) defining value-driven attributes that help to distinguish the attractiveness of alternative policies, 2) getting both technical experts and community participants to agree to the use of expert judgment elicitations in cases where data quality is low, and, 3) providing a framework for adaptive management that allows for monitoring and learning as implementation proceeds.

To encourage the development of decision-relevant attributes the authors identified a short list of criteria needed for a "good" attribute including measurability, operationality, understandability, comparability, sensitivity, representativeness, scale and nesting, relevance, and flexibility. The authors found that expert judgment elicitations were acceptable to all of the participants when they were viewed as a method for drawing meaningful conclusions from existing data, not as a replacement for data collection. The steps of their expert judgment elicitations involved identifying the appropriate experts, decomposing the problem, testing for judgmental bias, eliciting probabilistic judgments across several experts, comparing results and allowing for reassessment by the experts, and finally documenting the results. In order to develop a framework for adaptive management, the authors found the following questions to be helpful for focusing technical and stakeholder deliberations. What is the plausible range of values for the outcomes of interest under each hypothesis about the "state of nature"? Will a change across the range of plausible improvements in evaluation criteria lead to a management change? Does the experiment have sufficient predictive ability to rank the results of the test conditions? Are the evaluation criteria clearly stated and related to attributes?

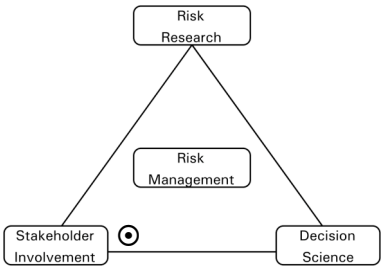
The authors conclude the paper with a discussion of the implementation concerns for improving deliberation through decision-aiding structures. They state that implementation depends largely on helping participants to recognize common values and interests, as well as developing a common language for discussing the impacts of the various alternatives. The result of a decision-aiding approach should be more informed judgments, not necessarily agreement on a single best policy or management alternative.

REFERENCE NO. 56

CITATION:

Gregory, R., and R. Keeney. 1994. Creating policy alternatives using stakeholder values. Management Science **40**:1035-1048.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

Important public decisions often require that difficult tradeoffs be made because of the conflicting objectives of the various parties involved in the decision. Recently, there has been a call for greater public participation in such decisions, which demands a higher level of accountability on the part of the decision makers. This paper describes a technique for informing tradeoffs by obtaining stakeholder values and using them as a basis for creating better policy options. The three general steps of this approach, which require early input from stakeholders, are to 1) set the decision context, 2) specify the objectives to be achieved, and 3) identify alternatives to achieve these objectives. The approach is based on the idea that more completely defined objectives based on stakeholder values will result in better policy alternatives. This approach was utilized in East Malaysia to evaluate the impacts of a proposed mine site in the Sabah Maliau Basin. The general approach required that the stakeholders, analysts, and decision makers work together to address each step of the process. A three-day workshop resulted in five major objectives categories, including environmental impacts, economic benefits and costs, social impacts, political impacts, and international prestige. These objectives led to the development and consideration of six policy alternatives based on expressed stakeholder values, as opposed to only two alternatives that the participants had originally considered.

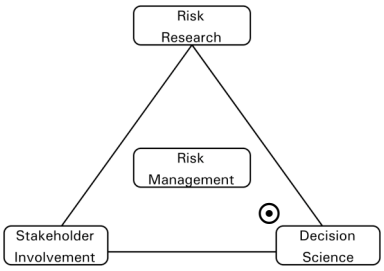
The authors felt that a key strength of this approach was the creation of several alternatives based on stakeholder values, as opposed to the two original alternatives that were not value-based. This approach also involved a variety of key interested parties which ensured that a wide range of values were addressed, and it encouraged open communication among the participants which may serve as a foundation for future resource-management decisions.

REFERENCE NO. 57

CITATION:

Gregory, R., and R. L. Keeney. 2002. Making smarter environmental management decisions. Journal of the American Water Resources Association **27**: 1601-1612.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

In this article the authors provide resource managers with a practical approach to making environmental management decisions. The authors suggest that many resource managers have been exposed to ideas from the decision sciences, but have chosen to ignore them due to four primary reasons: 1) Many natural or physical scientists view the social sciences as being based on different standards of logic from their own fields or being too situation-specific. This perspective ignores the subjective aspect of many decisions made by natural scientists. 2) Natural scientists are often exposed to either complex theoretical models from the social sciences or to oversimplifications of social science concepts. Both representations of social-science theory lead a natural scientist to disregard their need to employ social science techniques to address decision-making problems they may encounter. 3) Most natural scientists have been exposed to the cost-benefit analysis decision model. This technique that uses dollars as the focal metric, is not appropriate for many problems that face resource managers that require multiple metrics. 4) With the increased inclusion of stakeholders in many decision processes, many managers are under the impression that simple group discussions will lead to satisfactory decisions; however, this ignores the need for structure in group deliberations. There is a need for managers to use sound, practical decision making models to address the environmental policy choices they face. The authors suggest the use of the PrOACT model, which splits a tough decision into its separate parts.

The PrOACT model is composed of eight key elements, the first five are identified in the acronym: (Pr) Problem: Clarify the problem for which a decision is being made. (O) Objectives: Clarify what you are trying to achieve with your decision. (A) Alternatives: Create alternatives based on your problem and objectives to choose from. (C) Consequences: Identify how well the alternatives meet your objectives. (T) Tradeoffs: Identify which alternatives meet your specific objectives and equate the value of different levels of achievement on different objectives. The other three elements in the PrOACT model are: 1) Uncertainty: What are the major uncertainties affecting your decision? 2) Risk Tolerance: How much risk are you willing to accept? 3) Linked Decisions: Does this decision impact current and future decisions?

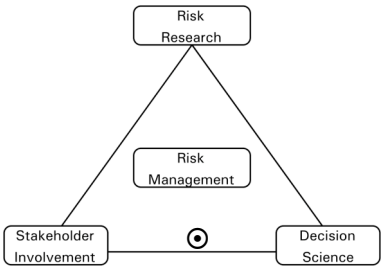
This is a particularly useful article, since it provides a very succinct and practical overview of the PrOACT model that is not tied to a specific case study. It is a good starting point for those who are interested in using this decision making model.

REFERENCE NO. 58

CITATION:

Gregory, R. S. and T.A. Satterfield. 2002. Beyond perception: the experience of risk and stigma in community contexts. Risk Analysis **22**:347-358.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

The use of the psychometric paradigm has expanded the risk-perception lexicon. Expressions of dread, voluntariness, and control have all become key in the developing dialogue between risk experts and public stakeholders. The concept of stigma has also emerged from the psychometric research. Stigma is a term associated with products, places, or technologies that individuals see as being undesirable and are subsequently intentionally shunned or avoided, often to significant economic, social, and personal costs. The majority of the research on the subject has focused on technological stigma, such as nuclear waste storage or genetic engineering, and employed primarily quantitative research methods such as technical risk analyses. The authors of this article suggest that there is a need to explore stigma in relation to resource communities, and that the methods used to study stigma should include more qualitative techniques, such as narrative elicitation or tradeoff analysis. The use of tradeoff analysis is particularly useful due to its ability to balance competing objectives held by stakeholders. Likewise, personal narratives allow stakeholders to examine and make sense of their situation. Both techniques allow for the greater inclusion of the community into the study of stigma, and provide researchers with valuable affective data concerning individuals that have experienced stigma.

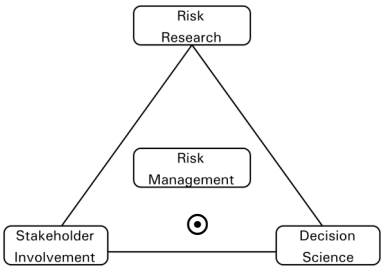
There are five commonly accepted and underlying characteristics of stigma. The authors spend a significant portion of the article discussing how they can be applied in the context of resource communities. These include the ideas that 1) the source of the stigma is often a hazard with risky characteristics, such as the use of herbicides in the forest industry; 2) stigma is often associated with the overturning of a norm, such as the changing of the traditional perception of loggers as hardworking individuals with valuable skills to that of individuals that contribute directly to the destruction of the environment; 3) stigma tens to lead to an inequitable distribution of the benefits and costs associated with the stigmatized item (e.g., when the logging industry was prosperous the entire community benefited; however, when the industry was hit with hard times, the downturn had a much larger impact on those directly employed by it); 4) there seems to be significant uncertainty about how long stigma will last or have an impact; and 5) concerns often exist about the management of stigmatized events or activities in terms of conflicts of interest or the use of proper values and precautions.

REFERENCE NO. 59

CITATION:

Gregory, R., and K. Wellman. 2001. Bringing stakeholder values into environmental policy choices: A community-based estuary case study. Ecological Economics **39**:37-52.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

Recent environmental policy initiatives have focused on three main goals: 1) incorporating stakeholder values, 2) utilizing sound science, and 3) using scarce funds wisely. It is difficult to achieve these three goals simultaneously without directly incorporating them into the design of the program or project alternatives. This paper discusses the need to join deliberation (stakeholder input) and analysis (sound physical and social science) to design a program or project that meets the goals stated previously. The authors describe an evaluation tool that was used to link restoration actions proposed by technical-science experts for estuary management in Tillamook Bay, OR, with the values and concerns expressed by community stakeholders. Tillamook Bay is important both ecologically and economically to the people of northwestern Oregon. The Tillamook Bay National Estuary Project (TBNEP) developed a Comprehensive Conservation and Management Plan (CCMP) for the watershed which the authors were then hired to evaluate in terms of the costs, benefits, and risks of the proposed actions. The main objective of the evaluation was to provide insight about the key trade-offs to both citizens and decision makers. The authors first contacted TBNEP staff, community leaders, and stakeholders to work through the entire set of proposed actions to produce a list of fundamental objectives for the project. They also held detailed value-elicitation sessions with key stakeholder groups, introduced tradeoff techniques (i.e., even swaps) to aid participants in comparing actions that differed across many dimensions, and developed a workbook where participants chose among actions and then completed detailed choice tasks involving the costs and benefits of each action plan.

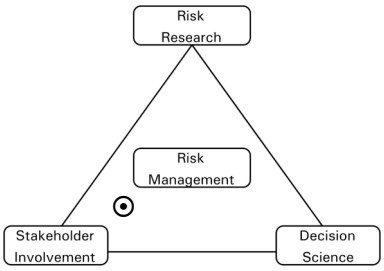
Seventy-nine participants completed the workbooks over a two-day period. Approximately half of the participants preferred the action plan to protect and restore tidal wetlands (over upgrading forest roads and limiting livestock access). Overall, when asked to make tradeoffs within the three action plans, two-thirds of all participants selected the higher-intensity version of each plan even though it was more costly. The authors believe the approach was successful at linking analysis and deliberation, and encouraging community involvement. They also felt that this approach resulted in more defensible project recommendations than past efforts because it focused first on clarifying trade-offs among different stakeholder objectives.

REFERENCE NO. 60

CITATION:

Gregory, R., R. Mendelsohn, and T. Moore. 1989. Measuring the benefits of endangered species preservation: From research to policy. Journal of Environmental Management **29**:399-407.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

This paper reviews five studies that have estimated economic values for endangered species through contingent-valuation (CV) methods in an attempt to increase understanding of public attitudes toward endangered species. CV methods allow a dollar value to be placed on the benefit of preserving endangered species and their habitats. The authors review these previous studies in an attempt to link endangered-species valuation with the policies that will eventually be the means to preserving the species. The five studies reviewed by the author asked participants to estimate the value they would place (use value, option price, existence value, non-consumptive value, or total value) on either an endangered species or their habitat. The values identified by participants ranged from an average use value of $1.40 per annual visitor for a Texas refuge with a whooping crane population to a total average value of $31.00 per household for the Illinois Beach State Nature Preserve which provides habitat for several plant and wildlife species. Although each of these studies were designed to elicit values for well-known endangered species through a hypothetical market, there were also many differences within the approaches. These differences include the object that was being valued, the extent to which it was being preserved, the type of value that was being elicited, and the extent to which preservation was guaranteed or just increased. In order for these studies to be useful for forming policy, the measure of the benefit must equal the policy application. Therefore, the author discusses five questions that must be addressed to identify the appropriate type of contingent valuation for each specific policy context.

1) What is the object to be valued (i.e., species, habitat, individual, or probability of extinction)?
2) What is the value of an increase in species populations?
3) What is the appropriate time frame for the analysis?
4) What should be the geographic scope of analysis?
5) Should all species be treated equally, or should preference be extended to those more valued by humans?

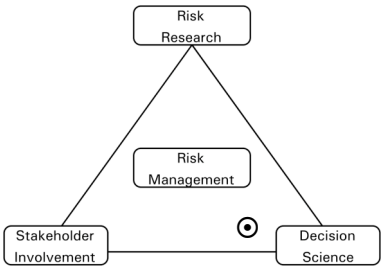
In summary, the author believes that contingent-valuation methods may hold promise as a means to identifying not just the costs but also the benefits of endangered-species preservation in a manner that will be useful for informing policy and management decisions. Previous efforts – although somewhat lacking – have demonstrated that people are willing to sacrifice in order to ensure the preservation of endangered species, but the amount of sacrifice varies from person to person and across each specific context.

REFERENCE NO. 61

CITATION:

Gregory, R., S. Lichtenstein, and D. MacGregor. 1993. The role of past states in determining reference points for policy decisions. Organizational Behavior and Human Decision Processes **55**:195-206.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

The reference point that an individual adopts when evaluating a decision can have a large impact on their final judgment or preference. Prospect theory predicts that individuals identify a reference point, usually the status quo, and evaluate decisions as some change (i.e., a loss or a gain) from that point. This study investigates how adopting different reference points may affect support for a proposed environmental improvement program. Specifically, the authors hypothesize that an improvement program that is framed as a restoration to an earlier, better condition will be evaluated more favorably than an identical program that is framed as an improvement from the current status quo, due to the selection and use of different reference points. The authors chose two improvement program contexts: changes in health through a school vaccination program or hospital operation (fictional problems) and changes in the availability of environmental goods like clean air and clean water (real environmental problems). The subjects were 983 University students who volunteered to complete a questionnaire where they rated the desirability of an improvement program for six problem pairs. Each pair consisted of a present form (improvement from the status quo) and a past form (improvement from an earlier state).

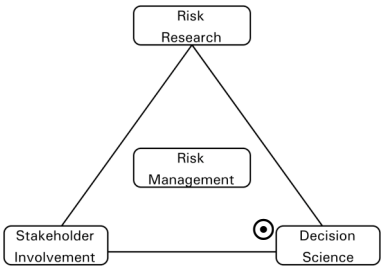
The results from this experiment support prospect theory. Subjects adopted a different reference point (not the status quo) when evaluating the past form of the problems, which were framed as a restoration of a loss. They indicated a significantly greater desirability for the improvement programs that would restore the past status as opposed to those that would result in an improvement relative to the current condition. These results support the notion that changes in reference positions can alter the way that individuals evaluate policy and management options. They also support the notion of preference construction, that individual preferences for complex policy and management decisions are dynamic and largely influenced by the way that a problem is presented or framed. These results are important for risk communicators and decision makers to consider when seeking the public input for complex decisions processes as subtle shifts in framing can produce differing results.

REFERENCE NO. 62

CITATION:

Gregory, R., S. Lichtenstein, and P. Slovic. 1993. Valuing environmental resources: A constructive approach. Journal of Risk and Uncertainty **7**:177-197.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

This paper reviews the use of contingent valuation (CV) methods for estimating the economic value of environmental goods, and proposes a new CV approach based on a combination of current techniques along with multi-attribute theory and decision analysis. CV asks individuals to provide a dollar value for a good or a proposed change in its quantity, quality, or access. The authors believe that there is a need for this type of valuation, but that the current CV methods are flawed because they do not account for the constructive nature of preferences and the multidimensional nature of environmental values. They suggest using the practices of multiattribute utility theory (MAUT) as the basis for an improved CV method based on five criteria, that the method accommodates 1) the multidimensionality of value, 2) minimizes response refusals, 3) excludes irrelevancies, 4) separates facts from values, and 5) asks the right valuation question. They believe that this multiattribute CV (MAUT/CV) method will allow value elicitation to be approached in a deliberate manner designed to rationalize the process and eliminate any bias in the resulting evaluation.

The authors outline the general approach of a multiattribute CV analysis in four steps:

1) *Structure the problem* by consulting both technical experts and non-experts to organize a description of the problem and identify all of the attributes that matter to the stakeholders.
2) *Assess utilities* (values) from the stakeholder groups (depth of value analysis is substituted for breadth of population sampling in a traditional CV approach).
3) *Calculate the total utility* (value) for any particular plan of program expressed as a single arbitrary unity (i.e., utile).
4) *Perform sensitivity analysis* by recalculating the final utility using variations and tradeoffs to identify which aspects may need to be reassessed or subjected to additional elicitations.

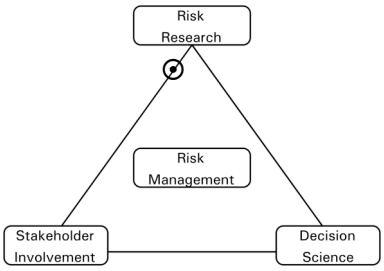
The authors conclude the paper with a discussion of the various advantages and disadvantages of MAUT/CV, stating that this new approach may address some of the lingering concerns with current CV techniques. However, it is clear that the approach will need further study and application before its success at providing defensible monetary measures of environmental values can be assessed.

REFERENCE NO. 63

CITATION:

Gregory, R., J. Flynn, and P. Slovic. 1995. Technological stigma. American Scientist **83**:220-223.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Stigma as it applies to people has been a central topic in the social science literature. Recently this concept has been discussed in the context of places, technologies, and products that have been seen as being unusually dangerous. This article explores two aspects of the concept of technological stigma, its characteristics, and its possible implications for public policy. The authors suggest that stigma reminds us that most technological advances have two faces: One shows the potential for benefit, the other shows the potential for risk.

Five features often characterize stigmatized places, products, and technologies. First, the source of stigma is a hazard with characteristics, such as dread consequences and involuntary exposure. Second, the impacts of the hazard are perceived to be unevenly distributed across demographic groups or geographic regions. Third. the impacts of the hazard are also often perceived to be inexplicable, in the sense that its magnitude or persistence over time is not well known. Fourth, stigma is also often applied to hazards that appear to violate or overturn what is considered right or natural, a disturbance of norms. Finally, the management of stigmatized hazards is often contentious since it involves concerns over not only risk but also values and norms. The examination of stigmatized places (i.e., Yucca Mountain in Nevada), technologies (i.e., nuclear power) and products (i.e., apples treated with the preservative Alar) all demonstrated that each of the above-mentioned characteristics were evident. The authors suggest that the unique nature of technological stigma and its characteristic features leads to distinctive public policy implications.

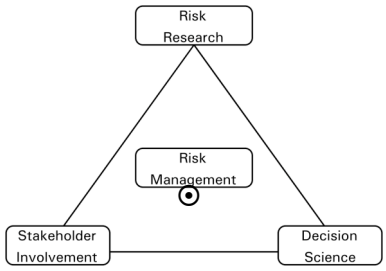
Currently there are several typical policy responses to technological stigma: One option is to litigate stigma claims under the aegis of tort law. Often those associated with hazards marked by technological stigma have attempted to pay off impacted parties and move on to different geographic areas or less stigmatized practices. Another option is to try to restrict communications that often contribute to the development of stigma, such as negative news reports about new technologies. A final option, often used, is the simple abandonment of stigmatized technologies, products, or places. The authors suggest that all of these practices are insufficient since they fail to either address the fundamental characteristics of stigma (as noted above) or lead to the rejection of hazards whose benefits may outweigh their risks. A better method of handling technological stigma would be for risk managers to reduce the current heavy reliance on technical expertise and to include concerns over the questions of values, fairness, and equity in decision processes. In addition, the authors advise that the public should have an expanded role in the decision-making and oversight of the risk-management process.

REFERENCE NO. 64

CITATION:

Gregory, R., J. L. Arvai, and T. McDaniels. 2001. Value-focused thinking for environmental risk consultations. Research in Social Problems and Public Policy **9**: 249-275.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

This paper discusses value-structuring techniques for linking analysis and deliberation, and reviews an experimental test of a structured, value-focused decision approach by the same authors as a means for involving both public and expert stakeholders in environmental risk management decisions. The article takes as its starting point the renewed interest in public and non-expert input when making complex risk-management decisions. Improving the quality of this input has been highlighted in the literature as critical for making better policy and management decisions. The authors believe that a structured process provides the foundation for incorporating a wide range of stakeholders and achieving a high-quality level of participation. The structured approach that they utilize places values at the core of the process and is typically based on the five steps referred to in Hammond, Keeney, and Raiffa's decision-aiding model (see Reference No. 67).

The authors point out that it is often difficult to identify and define individual values and incorporate them in the decision process. In order to achieve this goal, a key element of a structured approach is to use specific analytical tools to encourage and deepen deliberation among the participants. A few of the tasks that are key to achieving this aim are identifying stakeholder concerns through means and ends objectives, developing attribute measures that make sense to stakeholders, incorporating affective responses into the process, clarifying the range of values and the factors influencing them, addressing uncertainties and emphasizing learning over time, and perhaps most important, encouraging tradeoffs across the conflicting objectives.

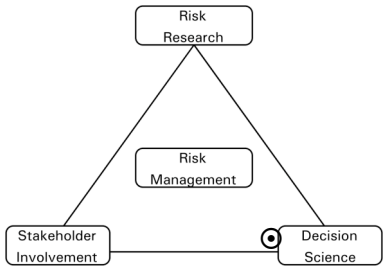
The experimental approach they reviewed is more fully addressed in a separate article by Arvai, Gregory, and McDaniels (see Reference No. 6). The goal of the experiment was to determine if a deliberative risk-communication approach that helps to structure decision making by focusing the participants' attention on values, objectives, and tradeoffs would result in higher quality and more informed risk management judgments. Overall, the results of the experiment demonstrated that participants in the structured, value-focused risk-communication approach were able to make higher-quality decisions than those who took part in an unstructured, alternative-focused approach. These results support the authors claim that structured approaches yield higher-quality decisions by both conveying information in ways that can be understood by a broader range of participants and encouraging the consideration of a wide range of objectives and alternatives. The authors conclude with the assertion that structured approaches are a more defensible way to involve the public in complex risk-management settings because they focus on providing insight rather than achieving consensus, which is the goal of many risk-management processes.

REFERENCE NO. 65

CITATION:

Gregory, R., T. McDaniels, and D. Fields. 2001. Decision aiding, not dispute resolution: Creating insights through structured environmental decisions. Journal of Policy Analysis and Management **20**:415-432.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Public participation has become commonplace in environmental decision-making processes. Several assumptions underlie this focus on stakeholder involvement: inclusion of impacted parties will lead to better solutions; it will result in solutions that will be more widely accepted by local communities, and it should help lead to the development of consensus between the various parties on the issues of concern. The third assumption of consensus building has been manifested in the use of dispute-resolution techniques in many collaborative stakeholder negotiations. The authors of this article contend that this focus on consensus building through dispute resolution can impede the decision-making process and lead to the adoption of inferior policy. To support this assertion the authors cite three major flaws with this consensus-building process, particularly in the context of government agencies: 1) government agencies are charged with developing solutions that are in the broad public interest; however, the use of consensus-building through dispute resolution often leads to decisions that reflect the interest of a small-group of concerned parties neglecting the perspective of the general taxpayer; 2) when people are left to their own devices to make decisions, particularly in groups, they often violate the principles of rational decision making; and finally, 3) dispute resolution often emphasizes procedural issues over the definition of the problem at hand.

In order to avoid the pitfalls associated with the development of consensus through the use of dispute resolution the authors suggest an alternative view of stakeholder participation in the decision-making processes: decision aiding. Below are the six key steps in the decision-aiding process:

1. Determine what matters to stakeholders in the form of objectives.
2. Develop a set of attractive alternatives.
3. Use the best technical information to describe the various alternatives, including uncertainties.
4. Identify the tradeoffs the alternatives entail.
5. Summarize the areas of agreement and disagreement among the stakeholders and the reasons for their occurrence.
6. Develop policy alternatives that may foster consensus.

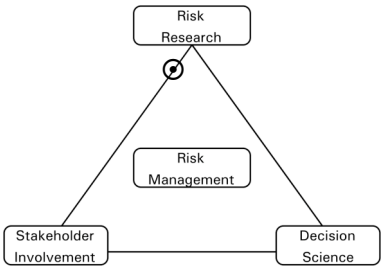
The authors explore the successful implementation of this process with a short case study of the Alouette River (in British Columbia, Canada) stakeholder committee.

REFERENCE NO. 66

CITATION:

Gustafon, P.E. 1998. Gender differences in risk perception: Theoretical and methodological perspectives. Risk Analysis, **18**: 805-811.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Over the past years the study of gender differences in the perception of risk has developed into a substantial area of research. However, the majority of the studies that examine the relationship between risk and gender tend to be quantitative in nature and fail to offer substantive explanations for observed differences between men and women in the perception of risk. There is a need to link these differences to gender theory. This article explores these problems by examining three facets of the subject area: 1) the respective contributions of quantitative and qualitative research methods to the study of gender differences in risk perception; 2) a brief look at some of the possible explanations that have been offered in past research for these differences; and 3) suggestions about the role that gender theory should play in looking at gender differences in risk perception.

The author found that most quantitative studies of risk perception find that men and women express different levels of concern about the same risks; however, most qualitative studies show that men and women actually perceive different risks. For example, qualitative studies have shown that men and women often attribute different meanings to the same risk. To help us better understand this discrepancy the author suggests that future research on gender differences in risk perception should employ multiple methods and perspectives, mixing quantitative and qualitative techniques.

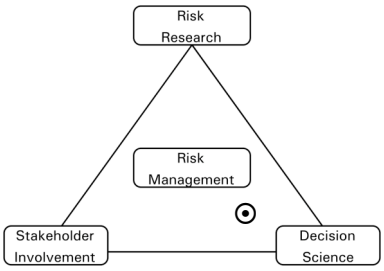
The article also suggests that the explanations often provided in the literature for the difference between male and female risk perception can be divided into two camps. The differences are either attributable to the different activities and social roles that the respective sexes play in our society, or to the status of male-female power relations and questions of trust and social control in society. The author observes that while both of these explanations have convincing elements they have failed to contribute to a cohesive theoretical base to examine the phenomenon. The author suggests that gender theory could fill this role and offers four perspectives from gender theory that should be considered in future research. First, gender makes a difference and should always be considered; failing to do so often leads to the perception of male experiences (of risk for example) as universal and gender-neutral. Second, gender differences should be recognized as primarily socially construed and not biologically based. Third, gender relations should be considered as analogous to power relations; the social relationships between men and women tend to be unequal and can often be described as oppressive and exploitative in various contexts, such as the workplace. Fourth and finally, the unequal natures of gender relations are not accidental but systematic. For example, the author would argue that the unequal pay earned by women for doing the same work as men is not accidental but a reflection of the gender inequality that is systematic in our society.

REFERENCE NO. 67

CITATION:

Hammond, J. S., R. L. Keeney, and H. Raiffa. 1999. Smart Choices: A Practical Guide to Making Better Decisions. Harvard Business School Press, Boston, MA.

REFERENCE TYPE: Book



SYNOPSIS:

Drawing its theoretical base from behavioral decision research (e.g., studies of simplifying heuristics, problems with tradeoff avoidance associated with complex choices) and decision analysis (e.g., multiattribute utility theory, the theory of rational choice), this book presents an easy-to-read overview of a non-technical approach for improving the quality of decisions. The book presents a series of five steps: problem definition (establishing a robust definition of the decision problem—or as the authors put it, decision *opportunity*), objectives elicitation or clarification (identifying and understanding "what matters" in the context of an impending decision), creating alternatives (establishing strategies for achieving objectives), assessing consequences (determining or predicting how well each alternative addresses stated objectives), and making tradeoffs (which involves balancing objectives when they cannot be achieved at once). The authors present a useful acronym—PrOACT—to both help the reader remember the steps in the process and, as they put it, serve as a reminder to be proactive during decision making. The book also leads the reader through a discussion of risk tolerance and linked decisions so as to provide greater insight about the stability of one's preferences and how the five steps may be used across a series of related choices.

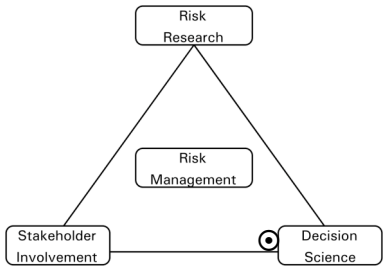
Aimed at a general audience, theses five steps align well with the basic steps of decision analysis. Unlike other texts, the authors discuss these steps in the context of easy-to-understand examples (e.g., buying vs. renovating a home, looking for a job) without referring to the complex steps normally associated with decision analysis (as in Keeney's *Value Focused Thinking* or Clemen's *Making Hard Decisions*). Beyond providing practical applications, the book has much to offer researchers and practitioners in the arena of risk communication in that the approach discussed is readily transferable to individual cases and group deliberations about risk management. To this end, the five basic steps outlined in the book have been applied in many cases studies (e.g., see Reference No. 99) and experiments (e.g., see Reference No. 6) carried out in the context of environmental risk management.

REFERENCE NO. 68

CITATION:

Hsee, C. K. 1996. The evaluability hypothesis: An explanation for preference reversals between joint and separate evaluations of alternatives. Organizational Behavior and Human Decision Processes **67**:247-257.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Normative decision theory assumes that people have stable and consistent preferences regardless of how these preferences are elicited. However, more recent findings from descriptive behavioral theory indicate that preferences are actually constructed during the elicitation process. One consequence of these inconsistent preferences is the tendency of people to exhibit preference reversals when considering the same option in two normatively equivalent evaluation conditions. Hsee develops the Evaluability Hypothesis based on his experiments regarding these preference reversals. The Evaluability Hypothesis states that preference reversals between joint (i.e., options evaluated in a side-by-side comparison) and separate (i.e., options evaluated on their own) evaluations occur because one of the attributes involved in the stimulus options is hard to evaluate independently and the other is relatively easy to evaluate independently. Hsee tested this hypothesis through a series of experiments involving a choice between two dictionaries, job candidates, televisions, and CD changers.

The dictionary choice study has become the seminal work on this subject. In that experiment, subjects were asked to spend between $10 and $50 on one of two dictionaries: Dictionary A, which had 10,000 entries and was in “like-new” condition and Dictionary B, which had 20,000 entries and was in excellent condition but had a torn cover. Subjects were first assigned to one of three treatment conditions: two separate evaluations where subjects indicated a purchase price for either Dictionary A or Dictionary B and a joint evaluation where subjects were asked how much they would be willing to pay for each dictionary in a side-by-side comparison. On average, subjects in the separate-evaluation conditions were willing to pay more for Dictionary A than for Dictionary B. However, subjects were willing to pay more for Dictionary B in the joint-evaluation condition, demonstrating a preference reversal. In separate evaluations, higher values are assigned—on average—to the dictionary that is “like-new” than to the one that has a torn cover. In contrast, when evaluating the two dictionaries jointly, it becomes clearer to respondents that the dictionary with 20,000 entries is superior to the one with 10,000 entries—regardless of the condition of its cover.

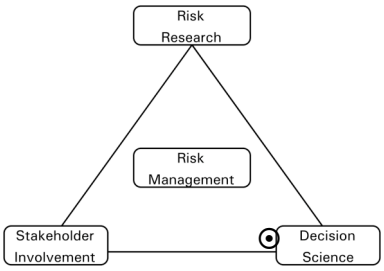
The remaining experiments further tested the evaluability hypothesis by changing the nature of the attributes, but each experiment supported the hypothesis that preference reversals can occur not just due to different evaluation scales – as was previously thought – but also due to the evaluation mode. These results provide insight about how to best present risk management options during decision making. Specifically, they suggest that options should be presented jointly in order to provide decision makers with an appropriate frame of reference for comparing and evaluating the attributes of the various options.

REFERENCE NO. 69

CITATION:

Hsee, C. K. 1998. Less is better: When low-value options are valued more highly than high-value options. Journal of Behavioral Decision Making **11**:107-121.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

According to normative decision theories, people have consistent and well-defined preferences; however, behavioral decision research suggests that preferences are often constructed in an ad hoc manner and are easily influenced by the framing of a decision task, such as using a gain or loss frame, or an acceptance or rejection frame to examine a problem. This article presents a series of experiments that explore the malleability of preferences in two contexts: the "less-is-better" effect and preference reversals. The "less-is-better" effect occurs when a normatively less valuable option is judged more favorably than the alternative of greater value. For example, in one of the reported experiments participants in one condition (A) were presented with 7 oz. of ice cream in an overfilled cup, participants in condition (B) were presented with 8 oz. of ice cream in an under filled cup; participants in condition (A) were willing to pay more for their serving of ice cream than participants in condition (B).

The author hypothesizes that the "less-is-better" effect operates under this and similar conditions due to the concept of evaluability. This concept asserts that when an individual judges an option in isolation, the judgment is influenced more by attributes that are easy to evaluate than by attributes that are hard to evaluate, even if these latter attributes are more important. For instance in the ice cream experiment, participants judged the value of the serving of ice cream they were presented with not by how much ice cream was actually in the respective cups (the more important but harder-to-evaluate attribute), but by how much ice cream was present in relation to the size of the cup it was served in (the less important easy-to-evaluate attribute).

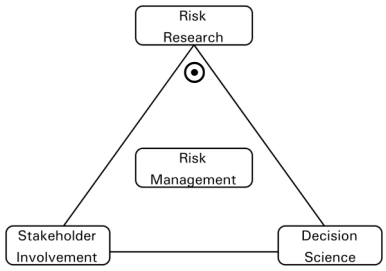
The paper also examines the occurrence of preference reversals. A preference reversal occurs when an individual changes a stated preference based on an alternate framing of a decision task. As noted above the author suggests that the "less-is-better" effect will only operate in separate evaluations, and will lead to preference reversals in joint evaluations. This was demonstrated in an experiment that was a slight alteration of the ice-cream study. In this experiment there were three conditions, conditions (A) and (B) which were the same as in the previous experiment and condition (C) in which participants were presented with both servings of ice cream. Similar to the first study, the 7 oz. of ice cream in the small cup was more highly valued than the 8oz. of ice cream in the bigger cup; however, a preference reversal occurred in the joint evaluation condition with the 8 oz. serving of ice cream being preferred over the 7 oz. serving. The author suggests that this preference reversal occurs due to the fact that the harder-to-evaluate but more important attribute (the actual amount of ice cream) becomes easier to evaluate when individuals are given a reference point for comparison, rendering the "less-is-better" effect null.

REFERENCE NO. 70

CITATION:

Hsee, C. K., and E. U. Weber. 1997. A fundamental prediction error: Self-other discrepancies in risk preference. Journal of Experimental Psychology: General **126**:45-53.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Risk preference is a predictor of an individual's behavior under risk (i.e., whether they will be risk seeking or risk averse when faced with two options). Although the formation of individual risk preferences is fairly well understood, very few studies have been conducted to look more closely at the way in which individuals judge the risk preferences of others. This experimental study tests the following four hypotheses regarding the way that individuals predict others' risk preferences:

1) The *Default Hypothesis*. People use their own risk preferences to predict those of others and are likely to assign to others the same risk preference as they assign to themselves.
2) The *Risk-as-Value Hypothesis*. People tend to perceive others as being less risk-seeking than themselves.
3) The *Risk-as-Feelings Hypothesis*. People predict others to have similar risk preferences to themselves but predict that they will be more risk-neutral.
4) The *Stereotype Hypothesis*. People base their predictions of another person's risk preference on a stereotype about the group to which that person belongs.

In each of three studies, risk preference was assessed by asking participants to choose between a risk option and a sure option which varied from question to question. The first study found that participants systematically predicted others to be more risk-seeking than themselves, contradicting the default and risk-as-value hypotheses but consistent with the risk-as-feelings and stereotype hypotheses. The second study replicated the first study but also explored the reasons for the self-others discrepancy. Participants again predicted unknown others as more risk-seeking than themselves; however, they did not predict the person sitting next to them as more risk-seeking. These results support the risk-as-feelings hypothesis but not the stereotype hypothesis. The third study added a cash incentive for enhance the accuracy of prediction, but found that it had no effect. Participants still predicted others to be more risk-seeking than themselves.

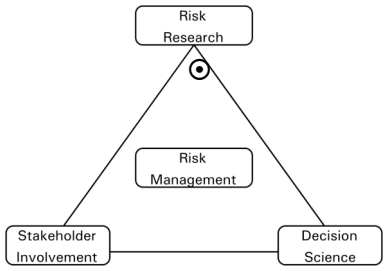
In practical terms, the observed self-others discrepancy or bias is important for decision-makers to understand in order to more accurately predict peoples' risk preferences and develop policies that better reflect people's willingness to make risk tradeoffs.

REFERENCE NO. 71

CITATION:

Hsee, C. K. and E. U. Weber. 1999. Cross-national differences in risk preferences and lay predictions for the differences. Journal of Behavioral Decision Making **12**:165-179.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

This article explores the appearance of systematic cross-national differences in risk preference. The authors suggest that this issue is of both theoretical and practical significance. Theoretically, most of the research about risk preferences is generated in the US, limiting their explanatory scope when examining other countries and cultures. Practically, it can potentially help people involved in foreign affairs accurately predict the risk preferences of their counterparts in other countries, and as the population of the US becomes more diverse due to immigration there is a need to understand these diverse populations' perception of risk. In order to investigate the possibility of systematic cross-national differences in risk preference, the authors report the results of two studies that focus on two countries: the US and China. These countries were chosen due to the significant differences in their political systems and cultural value systems, and the fact that they both have a significant impact on the world's economy and international affairs. Both studies explored risk preferences in financial contexts (i.e., lottery participation and investment in stocks), and the perception of participants in one country of the risk preferences of participants in the other country.

Both studies supported the conclusion that Chinese participants were more risk seeking than American participants in the context of financial decisions. The authors suggest that this difference may be due to the "cushion hypothesis," which suggests that the collectivist nature of Chinese society, and the large support network that is associated with this system allows individuals to make riskier decisions knowing that they have a place to turn to if their decisions result in negative outcomes. Individuals in an individualist society, such as the US, have much weaker support systems and fewer places to turn if their decisions lead to negative circumstances.

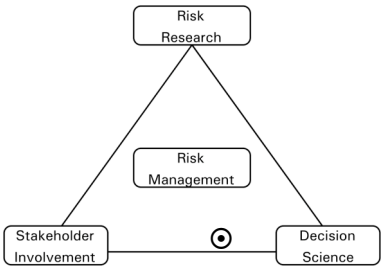
The studies also found that the lay prediction of risk preferences were the inverse of the actual data, Chinese participants believed that American participants would be more risk-seeking in their preferences and American participants made the same false prediction. The authors suggest that these incorrect lay perceptions may be due to stereotypical views of the respective nations' cultures, due largely to media influence. Americans are often portrayed as being adventurous and risk seeking, while the Chinese are often shown as being risk averse and conservative by the media.

REFERENCE NO. 72

CITATION:

Irwin, J.R., P. Slovic, S. Lichtenstein, and G. McClelland. 1993. Preference reversals and the measurement of environmental values. Journal of Risk and Uncertainty. **6**: 5-18.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

The most common method for measuring the value of environmental resources (e.g., air quality, forest wildlife resources) is the contingent valuation (CV) method. The CV method commonly uses a technique called willingness to pay (WTP), which asks individuals to state the dollar value they are willing to pay for a proposed change in quantity or quality of a resource in a hypothetical market. Although this method has been widely used, there are several problems with the CV approach: it captures attitudinal intentions rather than behaviors; it is difficult to make CV scenarios comprehensive and meaningful; and the results are often susceptible to cognitive and contextual biases. The studies presented in this paper demonstrate a specific contextual bias, the construction of preference, which indicates a shortcoming on the part of the CV method in the valuation of environmental resources.

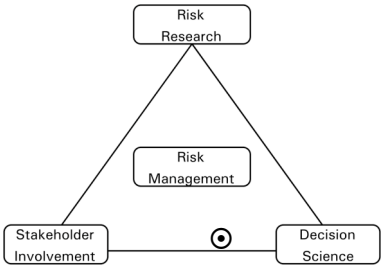
The authors present three studies that demonstrate preference reversals in settings where improvements in air quality are compared with improvements in consumer commodities. The air-quality improvement was shown with two color photographs of visible air pollution over Denver, CO. Improvements in consumer commodities were presented with pictures of the commodities (e.g., a worse camera and a better camera) and lists of features. The first two studies presented people with three trades, one for the improvement in air quality, the other two trades for the consumer commodities. Half the subjects were asked to provide WTP for the trades, the other half were asked to make choices between the pairs of trades. The third study asked subjects to provide a WTP and a choice for air-quality improvement and the consumer commodity improvement. All three studies demonstrated a preference reversal between WTP and choice modes; willingness to pay leads to a greater preference for improved commodities whereas choice leads to greater preference for improvements in air quality. These preference reversals indicate that subjects' preferences are dependent on the context of the choice mode (WTP vs. choosing), and point to a need for a different approach to eliciting values for environmental resources.

REFERENCE NO. 73

CITATION:

Johnson-Cartee, K.S., B.A. Graham, & D. Foster. 1992. Siting a hazardous waste incinerator: Newspaper risk communication and public opinion analysis. Newspaper Research Journal **13**:60-72.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Local opposition to hazardous waste disposal sites is often based on NIMBY (Not in my backyard) or LULU (Locally unwanted land uses) attitudes. However, there it is not clear if these attitudes are appropriate reactions to potential sources of risk or the result of poor risk-communication processes. This article looks at the role a local newspaper plays as a primary provider of risk information and corresponding public information/attitudinal levels associated with the attempt to site a hazardous-research facility. The context for the study was the failed attempt by the University of Alabama to site a local hazardous-research facility in Tuscaloosa County. The major newspaper in the area is the *Tuscaloosa News*. Data was collected for the study through content analysis of relevant newspaper articles, and a survey of community members concerning their knowledge of hazardous materials in general and the siting of hazardous materials. The study focused on the local newspaper due to the fact that prior research had shown that most individuals rely on print media as their major source of information for complex topics such as hazardous-waste disposal issues.

The study found that the newspaper coverage of the issue was poor and made three significant errors that hamper successful risk communication. 1) The newspaper provided little information about hazardous waste, hazardous waste disposal, risk assessment, and cost-benefit analysis. 2) The coverage consisted mainly of stories that addressed the questions of "who said what, when, and where," but ignored the more substantive questions of "so what?" or "how come?" 3) The stories focused on the theme of controversy and not hazardous waste and hazardous-waste disposal methods. The primary source for most articles was either the university (who supported the facility) or opposition groups. The survey of the community members found that they knew little about the hazardous-waste disposal methods and were generally uninformed concerning the issue.

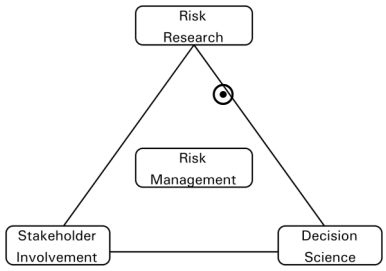
The authors close the paper by providing science reporters and editors with a series of recommendations on how to report risk-cost-benefit redistribution situations: 1) Reporters should use multiple sources, such as academic reports and government documents, for their stories. 2) The public needs to be presented with both the costs and benefits associated with an alternative. 3) The public needs to be educated about the basic science underlying many of these contentious environmental issues.

REFERENCE NO. 74

CITATION:

Johnson, B.B. 1999. Risk comparisons in a democratic society: What people say they do and do not want. Risk: Health Safety and Environment **[Summer 1999]**: 221-230.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

A major rational for research and practice of risk communication is to enhance the public's knowledge so that they can make better-informed decisions. One way that risk communicators have attempted to put risks into perspective for the public is by making risk comparisons. There is some debate over which types of comparisons are most appropriate and worthwhile in assisting the public in decision-making in risk scenarios. Proposed federal legislation would in part require risk comparisons as part of decision-making to regulate a risk. In an attempt to fill a gap in the understanding of how the public views risk comparisons in risk-related decision-making, the author conducts two focus groups to ask directly what types of risk comparisons are acceptable and helpful when quantifying risks. The focus groups were asked whether risk comparisons, and what type of risk comparisons would be useful in decision-making about hypothetical cases involving asbestos, radon, drinking water, industrial emissions, and an economic-development commission.

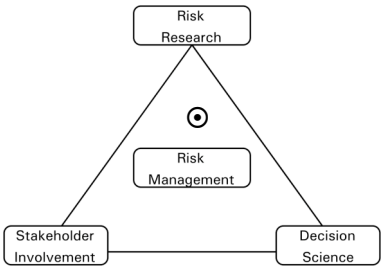
Focus group participants rejected dissimilar comparisons (such as those comparing exposure to a hazard through food ingestions versus death in a car accident) as well as comparing voluntary to involuntary risks (such as exposure to asbestos in a school versus cigarette smoking). Preferred alternatives offered by focus-group participants included "apples to apples" comparisons (utility water quality to bottled-water quality). Several focus group participants did find that although dissimilar comparisons were not useful in the context of legal decision-making (i.e., as a juror), the same comparisons provided information that might be useful in making decisions on a personal level. Most focus-group participants rejected comparisons involving involuntary issues (issues over which they have no personal control, such as environmental issues), yet indicated that risk information for involuntary risks (i.e. water pollution, air pollution) may be useful in setting risk-management priorities. In general, the focus groups in this study feel that risk comparison information is generally unnecessary, or that risk comparisons are suspect as propaganda. Although unable to clarify specific risk comparisons that are acceptable and useful to the public in decision-making about risk, the research reported here does identify some of the obstacles that must be addressed in designing risk-communication efforts involving risk comparisons. The author calls for additional research into the public concept of risk comparisons.

REFERENCE NO. 75

CITATION:

Johnson, B. B. 2002. Gender and race in beliefs about outdoor air pollution. Risk Analysis **22**:725-738.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Over the past ten years the importance of race and gender in the perception of risk has become a central aspect of the risk-communication and management literature. Variation in the assessment of risk among varied demographic groups has led many researchers to suggest that these differences should be considered in formal risk policies and communication. A oft-cited example of inter-ethnic variation in the risk-perception literature is the "white male" effect (a term used to describe a select group of white males that perceive an inordinately low amount of risk from everyday hazards, first coined by Flynn et al.; see Reference No. 35). The literature has also consistently documented the observation that males typically perceive less risk from everyday hazards than females. This article examines further these two facets of the risk perception literature by looking at the differences and similarities in the views of white and nonwhite males and females of outdoor air pollution. In addition to collecting information concerning individuals and multiple aspects of air pollution (including concerns, judged risks, trust and personal vulnerability) using a self-reported questionnaire, the study included a quasi-experimental survey that examined participants' ability to both understand government reports (specifically, the Pollutant Standard Index, PSI) dealing with the health effects of different air pollution conditions and the impact of these reports on their subsequent behavior. In the experimental portion of the study, individuals were given one of four hypothetical air pollution levels and one of the various PSI tables that explained its health implications. Respondents were then asked to indicate their level of concern, judged personal health risk, and their intended response and attention to the air-pollution information they were given.

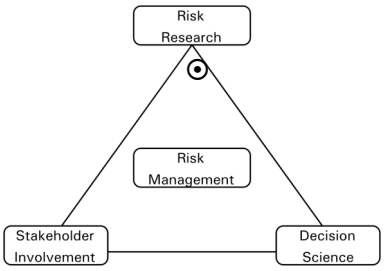
The results of the questionnaire portion of the study partially confirm previous findings concerning the perception of risk among different demographic groups. White males were found to perceive significantly less risk from air pollution and to be less concerned about its health effects than nonwhite women. But the difference between white men and nonwhite men/ white women, while significant, was not as pronounced as similar measures reported in other studies that examined risk-perception differences between demographic groups. The researchers suggest that this decrease in risk-perception variation among demographic groups may be due to the fact that the members of the study population were all exposed to similar conditions as opposed to individuals in a national study. The experimental section of the study found that nonwhites were much more likely than white to change their behavior in response to information concerning air-pollution conditions; however, they were also more likely than white males to report not completely understanding the PSI tables. These findings confirm the need for risk communication to be sensitive to different demographic groups in order to be successful.

REFERENCE NO. 76

CITATION:

Johnson, B. B., and P. Slovic. 1998. Lay views on uncertainty in environmental health risk assessment. Journal of Risk Research **1**:261-279.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Uncertainty is inherent in environmental health risk assessments, but there has been some debate about communicating uncertainty to the public. Some argue that communication about uncertainties in risk estimates is necessary in order to avoid conveying incomplete or misleading information, and that presenting uncertainty may increase lay people's risk knowledge and trust in the honesty and competence of the agency providing risk estimates. Criticisms of communicating uncertainty include the concern that a range of risk estimates might be misinterpreted, and that non-technical audiences may imply an equal likelihood of all estimates in a range. The authors discuss several studies that address public responses to the communication of uncertainty in risk estimates.

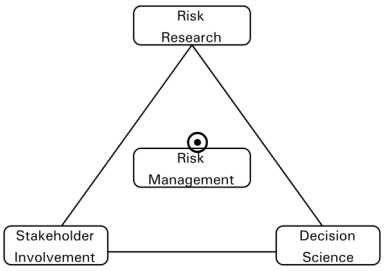
The authors also conducted a pilot study to see how people would respond to a range of risk estimates. The findings of these studies suggested that lay people were not familiar with the concept of uncertainty in risk assessments and science in general, and pointed to the need for additional research into lay people's response to uncertainty in risk estimates. Several focus groups were used to design a questionnaire focused on a government announcement about a hypothesized chemical in drinking water; this paper reports the results of this study. The results of the questionnaire are discussed in terms of general responses to environmental health risk uncertainty, responses to range bounds, reasons for uncertainty, uncertainty and agency performance, and familiarity with uncertainty in risk assessment and science. Several important implications of the findings of this study are that 1) the presentation of uncertainty in the form of a range of risk estimates is seen as honest and competent in general; 2) a zero lower bound in a range of risk estimates is suspicious to lay respondents; 3) the use of zero as a lower bound led people to believe the risk was probably higher; 4) people tend to treat the higher risk estimate in a range as more probable; and 5) changes in risk estimates do not seem to affect public beliefs about risks strongly, although lowering risk estimates seems suspicious. The authors conclude with directions for future research related to communicating about uncertainty in risk assessments.

REFERENCE NO. 77

CITATION:

Johnson, F.R., and A. Fisher. 1988. Conventional wisdom on risk communication and evidence from a field experiment. Risk Analysis **9**:209-213.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

This article reports the results of a study that examined the fundamental objectives and means of risk communication. The study focused on the risk associated with radon exposure in the home. The study had two primary objectives: to determine if individuals respond better to quantitative or qualitative risk information, and if people respond better to a risk communications format that gives explicit directions about what they should do to reduce risk ("command" tone) or a format that focused on personal judgment and evaluation of the risk situation ("cajole" tone). These objectives led to the creation of four radon risk-information booklets. These booklets were given to homeowners taking part in a radon-monitoring program, who were subsequently interviewed by the researchers to determine the effectiveness of the different booklet formats in communicating risk information. The data collected by the study provided empirical support for several theoretical considerations for sound risk-communication practices that had been suggested in the literature:

1) Subtle differences in the presentation of risk information can significantly impact individuals' perceptions and decisions concerning the risk.
2) People have problems with probabilistic risk information, they prefer that risk information indicate how a particular risk will directly affect them.
3) Personal biases and limitations can lead to inaccurate perceptions of risk problems.
4) People tend to place too much emphasis on the risk associated with dramatic causes of death, such as cancer.
5) People will take risk information about a specific hazard and over-generalize it to other related hazards.

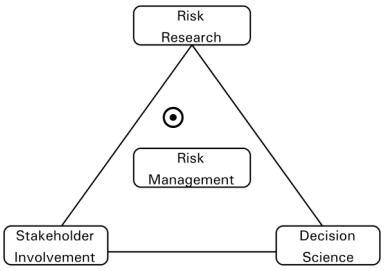
The authors close the article by suggesting that the most significant finding of the study was that risk communicators must determine in advance what specific objective(s) they intend for their risk-communication program in order for it to be effective. This is due to the fact that traditional objectives of risk-communication programs may not coincide with each other. For example, the desire to reduce the anxiety associated with a particular risk may not be consistent with educating the public about the facts.

REFERENCE NO. 78

CITATION:

Johnson, F. R., A. Fisher, V. K. Smith, and W. H. Desvousges. 1988. Informed choice or regulated risk? Lessons from a study in radon risk communication. Environment **30**:12-15; 30-35.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

The goal of most risk-communication programs is to motivate people to voluntarily and rationally reduce risks. However, this goal is often not achieved due to other factors that affect the effectiveness of risk information (i.e., trustworthiness, credibility, context). This study reports preliminary results of an experiment designed to test people's responses to alternative presentations of the same facts about risks from radon exposure. Results from an earlier study conducted by the US EPA in Maine indicated that homeowners who received radon test results, as well as a pamphlet describing the risks associated with various radon levels, still underestimated their individual risk. In the current study, radon monitors were placed in 2300 New York homes. The homeowners' baseline knowledge about radon was tested prior to receiving their individual test results. The homeowners were then provided with their test results as well as one of six different risk information treatments (i.e. five booklets that were a combination of quantitative vs. qualitative and command vs. cajole, as well as a one-page fact sheet). Homeowners were then interviewed a final time after receiving the risk information to see what they had learned and how they reacted to the information.

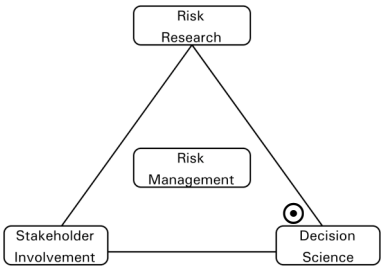
The results indicated that the booklets helped people learn more about radon than the fact sheet, with some booklets performing better than others in specific categories. However, no one booklet performed best for all the categories of test questions. In regards to risk perceptions, the booklets did help homeowners to form judgments about radon risks with those receiving high test results perceiving a higher level of risk than those receiving low test results. However, the command-version booklets performed better in regards to helping homeowners place their test results on the overall radon risk chart. Overall, the results indicate that different treatments of risk information do affect the way that individuals learn, form risk perceptions, and behave. Future risk communication efforts should carefully consider the findings from this study to ensure that the message is effective at informing individuals and helping them to reduce risk in their lives.

REFERENCE NO. 79

CITATION:

Kahneman, D., and A. Tversky. 1979. Prospect theory: An analysis of decision under risk. Econometrica **47**:263-291.

REFERENCE TYPE: Journal Article [Research]



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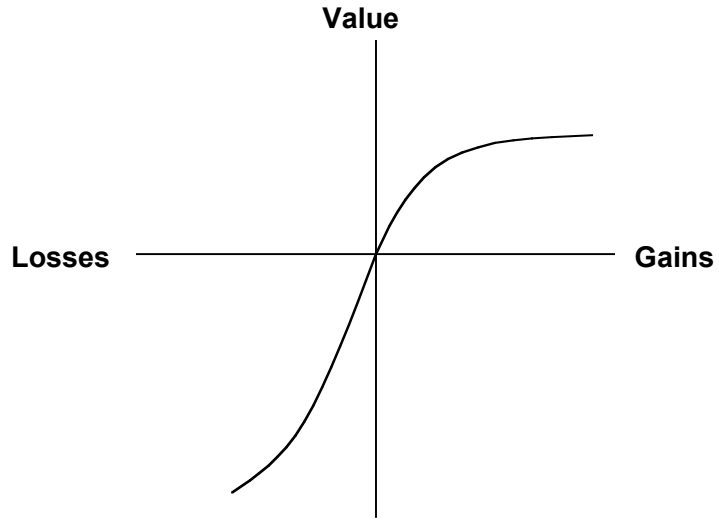


Traditionally, Expected Utility Theory (EUT) has been accepted as a normative and descriptive model of decision-making. It was assumed that most reasonable people followed the basic tenets of the theory when making decisions. However, the authors of this article challenge this notion and present several choice problems in which people systematically violate the axioms of EUT. The authors demonstrate through experimental evidence that individuals repeatedly ignore four key aspects of EUT under certain conditions: 1) People overweigh outcomes that are certain, compared to those that are probable (certainty effect). 2) The certainty of the outcome causes people to be more adverse to losses and conversely more seeking of gains. 3) Two separate options that are identical in terms of probabilities and outcomes could have different values depending on their presentation (framing). 4) People often disregard the shared aspects of separate options and focus on the characteristics that distinguish them. This can lead to the development of inconsistent preferences. Considering these critiques of EUT the authors present an alternative descriptive model of decision making under risk called Prospect Theory (PT).

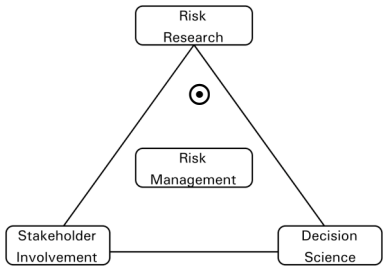
According to PT individuals have a reference point for each decision that they make. Instead of evaluating their decision based on its own criteria (such as probability and outcome, as EUT suggests), people weigh their options in relation to their respective reference point. In addition, in PT people view the outcomes of their decisions not as final states but as changes in welfare or wealth. Probably the most significant aspect of PT is how it explains people's perception of losses and gains. A central principle of PT is that individuals place greater value on losses than comparable gains. For example, an individual would place greater value on losing $20.00 of his or her own money than finding $20.00 on the street. This phenomenon can be seen in a hypothetical prospect-value function (See figure). The value curve is much steeper for losses than for comparable gains.

REFERENCE NO. 80

CITATION:

Kasperson, R.E., O. Renn, P. Slovic, H.S. Brown, J. Emel, R. Goble, J.X. Kasperson, and S. Ratick. 1988. The social amplification of risk: A conceptual framework. Risk Analysis **8**: 177-187.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

One of the most challenging aspects of risk communication and management is responding to risk events that technical analysts determine to be relatively minor in nature, but elicit strong public concern. A hypothesized reason for this discrepancy between expert and lay public perception of risk is the difference in the ways that the two groups judge and evaluate potential risk. Technical analysts often rely on factors such as mortality, property loss, or injury to calculate the risk associated with an event. On the other hand, the lay public often evaluates risks using more affective cues such as the dread associated with the risk or the voluntary/involuntary nature of exposure to the risk. The accident at Three Mile Island (TMI) in 1979 is an example of a risk event that led to no fatalities and was associated with no significant injuries or property loss, but still resulted in serious social impacts, such as stricter regulations on nuclear technology and greater public opposition to nuclear power. The authors of this paper present a theoretical framework that explores the social amplification and attenuation of risk events that is similar to signal-transmission theory. Social amplification is the process by which particular aspects of risk events, such as the voluntary or involuntary nature of the risk event, is amplified or attenuated in the public discussion of the risk event.

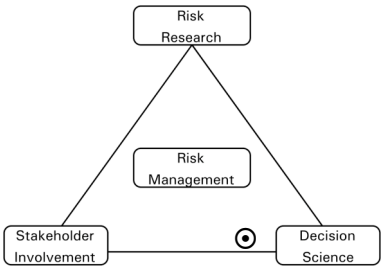
According to this theoretical framework, risk events such as the accidents at TMI produce a "signal." This signal is transmitted to the public via different "stations." The news media, experts that evaluate risks, public agencies, or social organizations can all act as stations that communicate various characteristics of the risk event to the public. The "recipient" (lay public) subsequently "filters" the signal focusing on the characteristics of the risk event and the respective station that conveys the information that most interests them. The recipient then processes the risk information using cognitive heuristics in order to place social values on the information that aid in decision-making processes. The recipient then interacts with others to help further interpret the signal and to formulate group and individual behaviors to react to the risk event. This process, particularly the filtering of relevant information regarding the risk event, leads to the amplification or attenuation of risk. This model also offers insight into how risk events with relatively few victims can have a major impact on the larger society. These events can have significant social impacts if the stations that transmit their signal to the larger public focus on the involuntary nature of the situation or other negative aspects of the risk event. This is especially true if these stations are primary media outlets that reach many individuals.

REFERENCE NO. 81

CITATION:

Keeney, R., D. von Winterfeldt, and T. Eppel. 1990. Eliciting public values for complex policy decisions. Management Science **36**:1011-1030.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

In a democratic society, voting for political representatives is the primary mode of incorporating public values in policy decision-making. However, there is still the need to integrate public values and expert recommendations and valuations in specific policy contexts. This becomes a daunting task as the policy framework moves from local to national, and increasingly difficult issues, such as national security, are confronted. There are several common methods used for addressing the need to incorporate multiple stakeholders in democratic policy construction: surveys, indirect elicitation of public values, direct value elicitation, focus groups, and public involvement. All of these methods have their respective strengths and weaknesses. In an attempt to avoid the various weaknesses of the above methods, this article presents a unique format for eliciting public values that combines several aspects of focus groups and direct value elicitation: a public value forum. This article presents the basics of this elicitation technique and reports the results of a study that implemented this method with a group of German stakeholders concerning national energy policy.

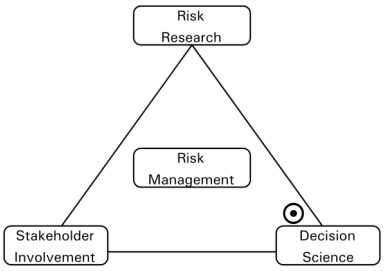
Before the actual public value forum can occur, the policy problem must be constructed by identifying policy alternatives, and a value tree of objectives and attributes to evaluate these alternatives must be created. Additionally, members of the public must be selected to take part. Depending on if the policy focus is specific (use stakeholders) or general and impacts the community as a whole (use random members of the public) the forum may focus on stakeholders or random members of the public. After these initial steps of preparation there are 6 stages in the actual public value forum: 1) introduction of policy problem and explanation of the forum process; 2) refinement of the objectives and attributes; 3) elicitation of single-attribute utility functions; 4) elicitation of tradeoffs among the attributes from the participants; 5) combining of steps 3 and 4 with expert judgments to evaluate the policy alternatives; and 6) reconciliation of participants' intuitive and modeled evaluations of the alternative policies. The authors' found this process successful in producing national energy policy alternatives that were considered feasible by the researchers and experts in the experiment with German stakeholders. It should be noted that this specific method of eliciting public values for policy decisions has not been widely utilized in the decision-making field since this publication. However, this process provided part of the initial framework for the much more widely accepted and utilized PrOACT decision-making model: (**Pr**) Problem: Clarify the problem. (**O**) Objectives: Clarify what you are trying to achieve with your decision. (**A**) Alternatives: Create alternatives based on your problem and objectives to choose from. (**C**) Consequences: Identify how well the alternatives meet your objectives. (**T**) Tradeoffs: Identify which alternatives meet your specific objectives and equate the value of different levels of achievement on different objectives.

REFERENCE NO. 82

CITATION:

Keeney R.L. and T. L. McDaniels. 1992. Value focused thinking about strategic decisions at BC Hydro. Interfaces **22**:94-109.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Over the past two decades there has been increased emphasis on the role of values in stakeholder-based decision. While values have traditionally been studied in relation to personal decision-making processes, this article examines the importance of organizational values in the strategic planning of a major public hydroelectric utility, the British Columbia Hydro and Power Authority. The investigators conducted extensive interviews with three senior individuals in the organization whose values were considered to be representative of the organization as a whole and were seen as key decision-makers. Three concepts play an important part in this process: objectives, end objectives, and mean objectives. Objectives are defined, as a statement of something that one wants to achieve with their decision. End objectives are fundamental objectives of value that stakeholders care about in a decision context, and means objectives are methods to achieve specific ends. With these concepts in mind, the researchers then used the data from these interviews and subsequent follow-up interviews to develop and quantify strategic objectives for BC Hydro using the following steps, referred to as value-focused thinking:

1) Key decision-makers, with the help of analyst, identify what factors are fundamentally important for the organization's future decisions.
2) Strategic objectives are structured into a hierarchy that clarifies the difference between means and ends objectives and eliminates duplicates.
3) Attributes are defined for the objectives to clarify what the objectives mean and how to measure possible consequences.
4) The development of a utility function over the strategic objectives that indicates the value trade-offs among the objectives.

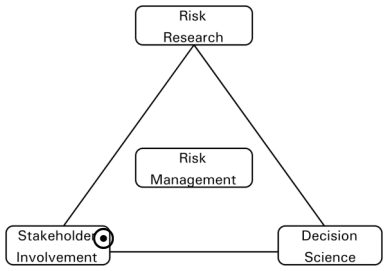
The researchers found that the end product of the above process, the utility function, could be used to provide useful insight, based on structured and quantified values, into a number of strategic decision processes at BC Hydro. These include how to clarify complex decisions, improve communication within the organization, facilitate stakeholder input and regulatory review, and identify decision opportunities. The researchers assert that this process of structuring values, value-focused thinking, can provide valuable insight into many significant organizational decisions.

REFERENCE NO. 83

CITATION:

Lal, P., H. Lim-Applegate, and M. Scoccimarro. 2001. The adaptive decision-making process as a tool for integrated natural resource management: Focus, attitudes, and approach. Conservation Ecology **5**:1-21.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

Integrated natural resource management (INRM) integrates multiple disciplines across spatial and temporal scales, and involves stakeholders in planning and implementation of key decisions. INRM and closely related approaches are considered to be more effective than single-disciplinary approaches for managing complex natural resource issues. In order for INRM to be successful, it must focus on how people make decisions, and how they interact with their natural environment. Stakeholders, researchers, managers, technical experts, and other end users often approach decision problems with predispositions, and may have to make significant changes in attitude and behavior in order to participate effectively. All stakeholders must be involved in developing strategies for change, and strategies should be employed that give individuals incentives to change. The authors propose an iterative, adaptive decision-making process (ADMP), a problem-focused, action-oriented participatory process aimed at producing use and management strategies that stakeholders agree with and take ownership of. ADMP has three inherent themes: 1) participatory action research, 2) a user-friendly decision support system (DSS), and 3) dialectic, stakeholder-based decision-making supported by rigorous analysis. Participatory action research requires the active involvement of all stakeholders in the entire research-extension-development process. The DSS comprises data sets, key analytical models, and a user interface. DSS uses a multidisciplinary approach, and describes key processes and special and temporal connections between human and natural systems. The dialectic decision-making process recognizes that no one interpretation of a decision problem may be complete, and therefore assumes there are many different interpretations based on different scientific paradigms, experiences, and value systems. Decisions are achieved through interactions between stakeholders, and the decision process is aided by the use of a DSS.

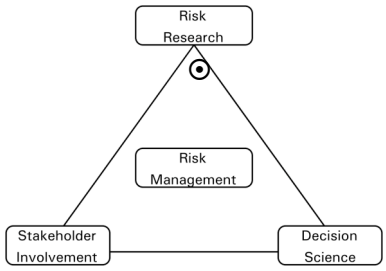
There are four phases of the ADMP: 1) subsystem identification, 2) reflection, 3) action, and 4) adaptive learning. Phase one includes a stakeholder, institutional, and resource assessment,. In phase two, the priority problems are identified, and a common vision is established. Phase three includes the DSS, and stakeholders and managers agree on the management strategies to be implemented. In phase four, the management strategies are now implemented, and monitored in an iterative manner. The authors present two case studies in which the ADMP was applied in natural resource management settings. The first relates to the response of the Fiji sugar industry to reforms in the international sugar market. The second concerns water resources assessment and management in Thailand. Although at press neither of the ADMP processes was complete, the case studies illustrate how the process was implemented in the first three stages.

REFERENCE NO. 84

CITATION:

Leiss, W. 1996. Three phases in the evolution of risk-communication practice. Annals of the American Academy of Political and Social Science **545**:85-94.

REFERENCE TYPE: Report



SYNOPSIS:

In this article, risk communication is defined as the iterative flow of risk information between academic experts, regulatory practitioners, interest groups, and the general public. Risk-communication research and risk perception studies have raised questions as to how we can improve the quality of the dialogue between experts and the public, and how to apply this improved dialogue to achieve greater social acceptance of controversial aspects of managing environmental and health risks. The author describes three “phases” in the evolution of the practice of risk communication over the past 15 years. As a new phase emerges, lessons learned from the earlier stage are incorporated into the new phase.

In Phase I (1975-84), experts and institutions provided comparative risk information to the public as a means of engaging in risk communication. These risk messages were not well received; the public did not feel their concerns were being addressed, and many technical experts scoffed at the public distrust in the “numbers.” This conflict perpetuated by data gaps in ever-changing scientific research led to ineffective communication of risk messages.

Phase II (1985-94) began with the realization that statements about risk needed to be regarded as acts of persuasive communication. Risk communicators borrowed two key elements from the field of marketing: 1) the knowledge and characteristics of the audience (understanding how the risk situation is related to the audiences’ situation) and 2) the legitimacy of the audience’s perception of the situation. The main difficulty with adapting this marketing approach to risk communication was the lack of trust and credibility in risk messages. Rather than pushing the technical risk assessments (Phase I), risk communicators began an honest effort to understand the bases for public risk perceptions.

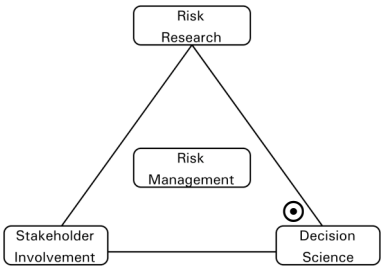
Phase III (the “current” phase) attends to this lack of trust by shifting the focus away from communication techniques and towards an emphasis on social context. Risk-communication efforts in this phase are characterized by a demonstrated effort by institutional risk actors to increase trust by a commitment to responsible risk communication. Meaningful stakeholder interaction and government regulatory frameworks may bolster responsible risk communication efforts. The author then presents two examples of successful risk communications: Dow Chemical Canada Inc. and CXY Chemicals. Dow Chemical voluntarily took on a risk assessment and communication effort to measure and communicate to the public about dioxin emission levels at a plant in Ft. Saskatchewan, Alberta. CXY Chemicals North Vancouver plant implemented a series of recommendations for immediate risk reduction after a quantitative risk assessment (QRA) at the facility.

REFERENCE NO. 85

CITATION:

Lerner, J., and D. Keltner. 2001. Fear, anger, and risk. Journal of Personality and Social Psychology **81**:146-159.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

The majority of judgment and decision research on affect has focused on the effects of valence on judgments, specifically contrasting positive-affect traits with negative-affect traits. The authors of this study extended these findings regarding the effects of emotions on unrelated judgment tasks by examining specific emotions (namely fear and anger) instead of general positive or negative affect. They proposed an appraisal-tendency framework to link emotion-specific appraisals to a wide array of judgment tasks. The framework is based on two assumptions: 1) Emotions trigger changes in cognition, action, and physiology which often extend past the specific event that elicited the original emotion. 2) Emotions are associated with specific appraisals. The authors hypothesize that each emotion activates a predisposition to appraise future events according to the dimension that triggered the initial emotion, calling this the appraisal-tendency hypothesis. An initial study supported the appraisal-tendency hypothesis, demonstrating that fearful people make pessimistic risk assessments, and angry people make optimistic risk assessments (fear and anger differ across the appraisal themes of certainty and control, which in turn determine judgments of risk). A series of four experiments were presented in this study, each building on the findings of the initial study. In Study 1, 75 undergraduates were measured for dispositional fear and anger, and then asked to indicate the extent to which they favored an option (using the Asian disease problem) framed as either a gain or a loss. In Study 2, 600 undergraduates were measured for dispositional fear, anger, happiness, and then measured for optimistic perception by asking them to estimate their own changes of experiencing 26 major life events. In Study 3, undergraduates were prescreened and three groups (purely anger-prone, purely fear-prone, and purely happiness-prone) were selected to participate in a one-on-one interview where they were asked to indicate their responses to an optimism questionnaire. In Study 4, 63 undergraduates were assessed for baseline affect, emotion induction, optimistic perception, and the extent to which certain events were under individual or situational control.

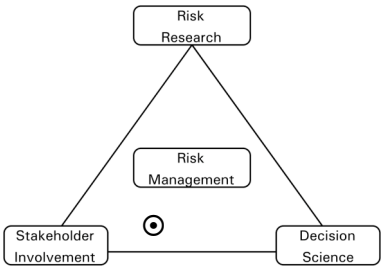
The results of each experiment supported the appraisal-tendency hypothesis. Specifically, fearful individuals consistently made pessimistic risk judgments while angry and happy individuals made optimistic risk judgments, regardless of whether the judgments were self-relevant, probabilities were known, and estimates were expressed publicly or privately. In addition, appraisal tendencies (i.e., certainty and control, ambiguity and unambiguity) do appear to mediate emotion and judgment outcomes. These results have implications for studies of judgment and decision making because they demonstrate that a small number of trait emotions (fear and anger) predict sharply contrasting risk perceptions and judgments across a range of tasks. The authors believe that these findings validate the need for further research exploring other appraisal tendencies.

REFERENCE NO. 86

CITATION:

Lichtenstein, S., R. Gregory, P. Slovic, and W. Wagenaar. 1990. When lives are in your hands: Dilemmas of the societal decision maker. Pages 91-106 in R. M. Hogarth, editor. Insights in decision making: A tribute to Hillel J. Einhorn. University of Chicago Press, Chicago, IL.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

It is common practice to incorporate public input into major risk-management decisions. However, there may be times where the societal decision maker must consider ignoring public desires and instead make a decision that is in the best interest of the affected parties. This article addresses the dilemmas of the societal decision maker and identifies situations where it may be best to ignore the desires of the public. In general, the authors believe that it is important to seek public input because they may possess unique and relevant information that experts have not considered. Disregarding public opinion may result in a decision that can never successfully be implemented. However, the majority of the article covers the situations where it may be best for the societal decision maker to consider ignoring public values. These include situations where:

- people object to the use of decision analysis
- people reject the axioms of rational choice
- when individual and societal perspectives differ
- when people do not want what they claim to want

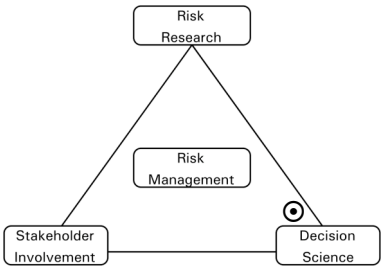
The authors believe that the societal decision maker is better off going against public opinion when the non-expert participants object to making the tradeoffs necessary within decision analysis, reject the axioms of rational decision making, focus solely on one issue of concern instead of the greater interests of the community, and express desires that they are not willing to back-up with actions. The authors also believe that the SDM should adopt a risk-neutral utility function for lives and money, but it is less clear how the SDM should handle differing individual and societal perspectives, as well as public opinions that are misinformed.

REFERENCE NO. 87

CITATION:

Loewenstein, G., C. Hsee, E. Weber, and N. Welch. 2001. Risk as feelings. Psychological Bulletin **127**:267-286.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

A popular research topic in fields dealing with judgment and decision making is the way that people make decisions under risk and uncertainty. The major theoretical contribution of this research has been expected utility (EU) theory, which assumes that people make decisions by assessing the probability or likelihood of possible outcomes through a complex cognitive calculation, largely ignoring the impact of emotional processes on decision making. The authors believe that a better theory of choice would be one that incorporates emotions, specifically anticipatory emotions or those felt immediately in reaction to a risk (i.e., fear, anger, dread). Previous work regarding the affect heuristic, affect-as-information, and somatic markers provide evidence that emotions not only inform the decision process but that they often diverge from cognitive evaluations of risk. In response to this work, the authors propose a new theoretical framework called the risk-as-feelings hypothesis which is meant to explain when and why emotional reactions diverge from cognitive evaluations of risk and how these emotional responses affect decision behavior. The two most controversial aspects of this framework are that feelings can arise without cognitive mediation and that feelings or affective responses can be determinants of behavior.

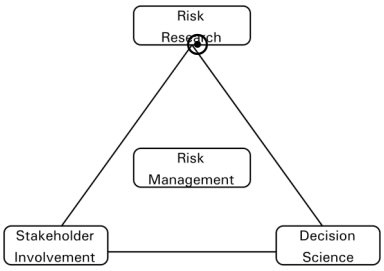
The authors provide evidence for the role of feelings or emotions as a predictor variable (separate from cognitive reactions) in decision making. They believe that emotional and cognitive reactions diverge for two main reasons: 1) Emotional responses to probabilities and outcomes (largely experienced as fear) are different than those produced through cognitive evaluations. 2) Fear is heavily influenced by variables that play only a minor role in cognitive evaluations. These variables include the time interval between the decision and the outcome, the vividness of the outcome, insensitivity to variations in probability, and evolutionary preparedness. In summary, the authors state that future risk-related research should assess the emotional reactions, specifically intense emotions, experienced during risk-based decision making as well as incorporate more traditional measures like probability and outcome. They state that individuals react to risk in two ways, through cognitive evaluations and emotional reactions, which can at times be contradictory. This is especially problematic for policy makers because it often results in public evaluations of risk that differ from experts evaluations. Policy and decision makers need to be sensitive to this divergence between cognitive and emotional evaluations and attempt to mitigate any fear displayed by the public.

REFERENCE NO. 88

CITATION:

Lundgren, R., and A. McMakin. 2004. Risk Communication: A Handbook for Communicating Environmental, Safety, and Health Risks. Batelle Press, Columbus, OH.

REFERENCE TYPE: Book



SYNOPSIS:

A common refrain amongst on-the-ground practitioners is that risk communication efforts must be targeted, understandable, and effective without provoking hostility or mistrust; these are the dominant themes in *Risk Communication: A Handbook for Communicating Environmental, Safety, and Health Risks*. This book's objective is to provide a readable overview of ideas for how to best convey risk information. The book is written primarily for agency practitioners charged with communicating with the "general public" and contains sections dealing with current laws relating to right-to-know and informed consent, methods for stakeholder participation, and media relations. The most recent edition of this book is divided into five self-contained parts: Part I provides a general overview of theories and practices of risk communication. Part II discusses risk-communication planning. Part III describes implementation. Part IV discusses the evaluation of risk-communication efforts. Part V—extensively revised—deals with risk communication after a health or environmental emergency.

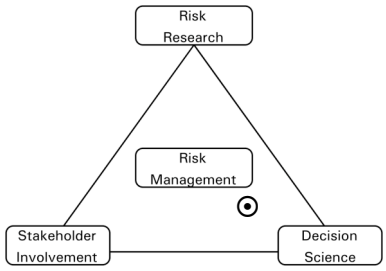
As an initial introduction to the field risk communication, this book works very well—mainly because it raises many more questions than it answers (e.g., regarding the more subtle nuances of stakeholder engagement and what it means to meaningfully inform risk-management decisions). Such a book will serve those who read it as one among a series of several publications very well. However, to those looking for a "quick fix," *Risk Communication: A Handbook for Communicating Environmental, Safety, and Health Risks* falls dangerously short. Though intended to serve practitioners as a useful handbook, its "cookbook" approach leaves much to be desired (e.g., in terms of distinguishing between multi-channel risk *communication* and essentially one-way risk messages) and is likely to provide novices with a false sense of security when marching forward with poorly or incompletely conceived risk-communication efforts.

REFERENCE NO. 89

CITATION:

Maguire, L. A., and C. Servheen. 1992. Integrating biological and sociological concerns in endangered species management: Augmentation of grizzly bear populations. Conservation Biology **6**:426-434.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Endangered species management largely deals with balancing the needs of an endangered-species population with the needs and concerns of the human population living in the same area. Grizzly populations are especially hard to protect due to the threat that they pose to the health and security of humans and their property. The authors in this article used a combination of decision-analysis techniques, expert opinion consensus, and tradeoff analysis to develop and evaluate a management plan that would involve translocating bears from more robust grizzly populations into a struggling population within the Cabinet-Yaak Ecosystem of northern Montana and Idaho. The participants in this process first met to 1) characterize the decision, 2) identify objectives and criteria that would later be used to evaluate the management alternatives (i.e., maximize population growth and minimize human-wildlife conflict), 3) identify the management alternatives (i.e., combinations of various age classes and genders), 4) identify uncertainties (i.e., mortality rates, conflict with humans, etc.), 5) estimate probabilities for the uncertainties, and 6) assign values to each possible outcome according to the criteria defined earlier. Quantitative analysis was used to calculate the expected value of each decision criteria across the various management alternatives. Participants then met again to review the results of the analysis, develop a framework for making tradeoffs across conflicting criteria, and finally develop a set of management recommendations and methods for implementation.

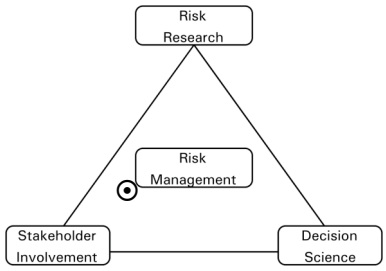
The results indicated that for each combination of age and gender, the rates of retention would be relatively low and the rate of conflict would be relatively high for translocated bears. However, the tradeoff analysis did identify that 4- and 8-year-old females exhibited the best combination of high retention and low conflict when translocated in late summer. This management recommendation was eventually followed, but only after an extensive public-education campaign to ensure that those living in the Cabinet-Yaak region would support the management plan. Public comments actually resulted in fewer bears being moved than had originally been recommended. This study is an excellent example of decision analysis and structured decision-making techniques being utilized to address a complex management problem. The authors state that this approach helped experts to dissect the problem into smaller components, provided a framework for incorporating both technical facts and social values, provided a means of incorporating and measuring uncertainties, and allowed the experts to quantify the potential problems with translocation and rank the various alternatives.

REFERENCE NO. 90

CITATION:

Mascarenhas, M., and R. Scarce. 2004. "The intention was good": Legitimacy, consensus-based decision making, and the case of forest planning in British Columbia, Canada. Society and Natural Resources **17**: 17-38.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

As is the case with most articles that have as their focus collaborative environmental management, this paper begins with a statement hailing the importance of broad-based participation in the decision-making process. Rather than moving on to a discussion of prescriptive approaches aimed at enhancing such a process, the article instead poses an important question: What constitutes an effective measure of success in participatory environmental planning? This article addresses this difficult question through a qualitative study of collaborative forest management in the Canadian province of British Columbia. Specifically, the study was based on a review—conducted via 199 first-person, open-ended interviews with participants—of land-use planning processes in several provincial Land and Resource Management Planning (LRMP) areas (though it's unclear how the reliability of the authors' conclusions was established). Rather than designing the study based on already-established metrics of "successful" process (which often collect information on closed-ended Likert-type scales), this study takes as its focus the observations of participants' own experiences and feelings.

According to the authors (who are making some difficult-to-validate inferences from the responses of their subject pool—see above), the most powerful explanatory concept for tying together the information provided by the research subjects was legitimacy. As it is defined in this article, legitimacy is comprised of several factors. A short list includes the level of representation in the process (e.g., the involvement of local *and* outside participants), the role of government (e.g., to ensure accountability and implementation), and the dynamics of the discourse (e.g., consensus-based approaches as a means of reducing tension vs. an exercise in power).

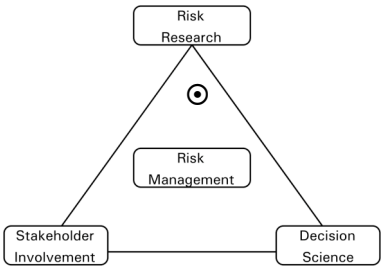
Overall, the authors' conclusions vis-à-vis legitimacy conform with findings from other studies. For example, a cited study from New England also emphasized legitimacy as the cornerstone of a successful environmental planning effort. Mascarenhas and Scarce conclude with a discussion of the practical implications of this research. From a practical perspective, a better understanding of the importance of legitimacy in participants' assessments of planning processes provides much-needed guidance to facilitators and management agencies regarding the aspects of stakeholder-based decision-making processes that ought to be incorporated (e.g., constructive vs. adversarial consensus building exercises). From the perspective of research, the authors make the argument that their open-ended, participant-focused methodology adds a much-needed element to the toolkit of evaluators interested in the quality of collaborative environmental management efforts.

REFERENCE NO. 91

CITATION:

McCaffrey, S. 2004. Thinking of wildland fire as a natural hazard. Society and Natural Resources **17**:509-516.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Very few studies of natural hazards have considered wildland fire. The objective of this article is to address this gap in the literature by applying select conclusions from hazards research (with roots in geography and risk analysis) to wildland fire. The central question of the article is: *why are certain management options favored over others, and what are the mechanisms that influence this choice?* To address this question, the author presents two explanatory categories. These are 1) factors affecting individual awareness (e.g., residence time, personal experience, etc.) and 2) the ability to turn knowledge into action (e.g., availability or access to resources, expected residence times, etc.). With this overall question and the two explanatory categories as a starting point, the article next explores four (sub)questions of interest:

1. *How can people move into a high hazard area and not recognize the danger?* In answering this question, the author draws on theories from risk analysis, specifically the nature of risks as defined by the psychometric paradigm. She concludes that, in addition to a high level of perceived control, fire hazards do not receive adequate recognition because wildfire does not score highly on the *dread*, *familiarity*, and *exposure* scales.

2. *How can one experience a wildfire and still do nothing (post-exposure)?* The author suggests that relatively infrequent exposure (less than one-fire-per-home ownership cycle) leads to downgrading of future probability. Another suggestion is the creation of "disaster subculture" (i.e., accepting disaster as a part of life regardless of the action taken) in areas that receive frequent fires.

3. *Why don't public education efforts seem to work?* Here the author—very briefly—discuses recent findings from studies of risk communication that really just restate the question in answer-form: improved knowledge does not always lead to behavior change (e.g., because of a lack of comprehension or trust in the communicator).

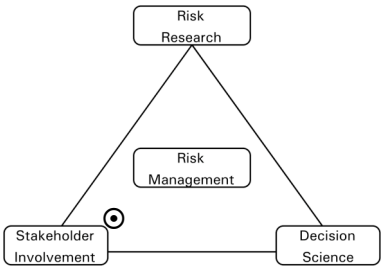
4. *Why don't people who understand the hazard take action to reduce the risk of future exposure?* Here the author discusses ideas of "pseudocertainty," or the idea that people are likely to take action only when they believe a management action will lead with certainty to protection (rather than a reduced level of risk in terms of probability, for example).

REFERENCE NO. 92

CITATION:

McComas, K. A. 2003. Citizen satisfaction with public meetings used for risk communication. Journal of Applied Communication Research **31**:164-184.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

This article explores citizen satisfaction with public meetings as a form of participatory environmental decision-making. Public meetings are a common form of public participation in the United States that can be used for decision-making purposes or simply for information exchange among interested parties. Ideally, public meetings should offer an opportunity for experts and non-experts to exchange ideas, allowing each to equally influence policy and management decisions. This study focuses on government-sponsored public meetings, which often fall short of the ideal two-way communication desired by citizens who attend the meetings. Citizen satisfaction with a series of public meetings regarding a landfill in upstate New York was measured based on six variables taken from the literature: 1) satisfaction with public meetings, 2) previous meeting attendance, 3) public meeting expectations, 4) relational/informational communication (i.e., communication climate, personal feedback), 5) risk perceptions, and 6) agency credibility. The author hypothesized that irrespective of meeting attendance, citizen satisfaction with the public meetings would relate positively to expectations of public meetings, perceived elements of relational/informational communication, and perceived agency credibility. In addition, citizen satisfaction would relate negatively to the perceived risks associated with the meeting topic. Surveys were mailed to a sample of residents living near the landfill following four public meetings sponsored by the New York Department of Health. The survey consisted of a series of questions (on 7-point Likert-type scales) meant to measure the above-mentioned variables.

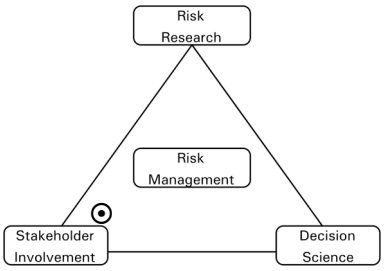
The results supported each of the four hypotheses. Dissatisfaction with the meetings was largely based on a perceived lack of relational/informational communication elements, low agency credibility, low expectations of public meetings, and heightened risk perceptions. Specifically, most respondents had low expectations for the meetings and tended to not be overly satisfied with public meetings as a format for involving the public in environmental management decisions (regardless of whether or not they had attended a meeting). Despite low expectations and satisfaction, the participants indicated that public meetings can be an effective way of disseminating information, involving citizens, and learning how others feel about a problem. The author believes that future research should explore these findings in additional settings, as well as investigate how satisfaction encourages or discourages participation. The results of this study suggest that emphasizing relational/informational elements when communicating with the public and attempting to increase credibility (i.e., openness, accuracy, trustworthiness) may increase participant satisfaction with the process. Finally, when the risks associated with the problem are perceived to be high, alternative methods of risk communication (outside of public meetings) may be beneficial.

REFERENCE NO. 93

CITATION:

McComas, K. A. 2003. Trivial pursuits: Participant views of public meetings. Journal of Public Relations Research **15**:91-115.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

There is much debate as to whether public meetings are a useful, credible, and engaging method for involving the public in environmental decision-making. Some argue that public meetings are relatively quick, simple, and inexpensive compared to other methods of public participation, and that public meetings provide forums for meaningful open discussion about related interests. Others argue that public meetings alienate the public and encourage skepticism among audience members. It has also been suggested that public meetings offer government agencies a useful means for minimizing public impact on decisions (e.g., to inform the public about a decision already made, or to satisfy legal requirements for public involvement). This conflict can lead to confusion as to whether or not to hold public meetings. This article takes a critical look at public meetings, and reports the results of a study examining participants' views about government-sponsored public meetings.

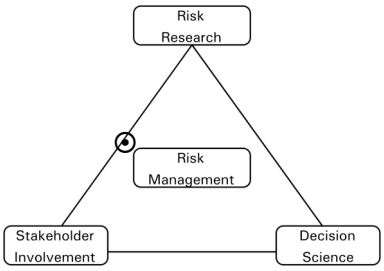
The study was conducted over a 2-year period to examine participants' experiences with public meetings held about local waste sites in two neighboring upstate New York communities. Public meetings were conducted regarding noxious odors emanating from the site, as well as to decide whether to grant an expansion permit to the company owning the site. The study focuses particularly on two public meeting after which meeting participants received mail surveys. The results of the surveys indicate that 1) attendees believed that their participation at the meetings had no impact on the decisions, 2) their opinions did not matter, and 3) participants arrived with low expectations, and tended to leave feeling worse about the situation. The author offers several suggestions as to why people participate given low expectations. The first is that people attend to acquire information (i.e. technical) about the issue. Second, people can gather information about how other people in the community feel about an issue. Third, people may attend to offer support to friends and neighbors. Fourth, people may attend to feel like they are contributing. Fifth, attending public meetings may offer participants a sense of having control over a risky situation. Finally, attending a public meeting may serve some type of ritualistic purpose for participants. Implications of this study include: 1) after participating in a public meeting, participants may feel less satisfied with their relationships with government agencies responsible for the process, and 2) participants may feel a sense of futility with the process, which may lead to diminished willingness to engage in active communication. This may lead to inability to reach targeted audiences with important information, incomplete input from the public on decisions, and additional costs in time and resources due to unsuccessful efforts to involve the public.

REFERENCE NO. 94

CITATION:

McDaniels, T. 1998. Systemic blind spots: Implications for communicating ecological risk. Human and Ecological Risk Assessment **4**:633-638.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Communicating with lay people about ecological risk issues is a difficult task. First, the lack of a commonly accepted, precise definition of “ecological health” and “ecological risk” combined with the differences in personal and cultural experiences that guide individual perceptions of “healthy” make a common understanding difficult to settle on. Second, ecological risks involve complex issues, such as the health and productivity of natural systems on temporal and spatial scales, not just for individuals or single species. This paper describes three “blind spots” or obstacles to lay peoples’ understanding of ecological risk issues identified through two surveys of lay peoples’ perceptions of ecological risk. The author suggests that ecological risk communication is likely to work best as one component of a public decision-making process, and communicators must be aware of the obstacles the following “blind spots” present in successful communication efforts.

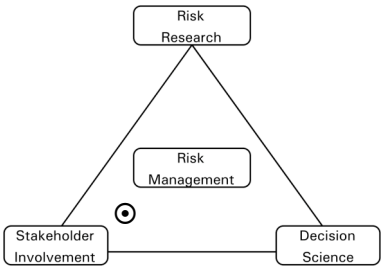
The first “blind spot” in lay perception of ecological risk is the simplification of ecological systems. On average, lay people have little or no understanding of what ecological systems entail. Lay people generally view ecological risks in terms of effects on specific animals or single species, not as dynamic effects on complex systems. The second “blind spot” is identified as a lack of connection between causes and consequences. When comparing items that could be viewed as an indirect cause (air conditioning), a direct causes (CFC emissions) and a consequence (ozone depletion) related to global change processes, lay people viewed direct and indirect causes as substantially less risky than the consequences of these actions. The subjects were unable to recognize that normal everyday activities are the forces leading to the consequences. The final “blind spot” in lay perception of ecological risk is the reduction in risk perception for an activity or technology when the benefit derived from the activity or technology is high. Lay people are considering the “net benefit”, or are considering the “acceptability” or the risk rather than assessing the risk irrespective of benefit. Additionally, activities and technologies that are familiar and provide benefit as a part of normal life (e.g., automobiles) are not seen as particularly ecologically risky. The author offers several implications for communicating about ecological risk. First, a clear understanding of the purpose of the risk communication must be established. A clear framework with well-articulated objectives and alternatives will help participants to focus on understanding the complexities of the issue. Second, a focus on local issues will be more salient than global concerns, although an understanding of global implications of local actions is an important part of ecological risk communications.

REFERENCE NO. 95

CITATION:

McDaniels, T., and R. Gregory. 2004. Learning as an objective within a structured risk management decision process. Environmental Science & Technology **38**:1921-1926.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

As the role of stakeholders in regulatory and decision processes has increased, greater demands are placed on technical specialists and regulatory bodies. At the same time, there is increasing concern about the effectiveness and success of these processes for involving stakeholders in complex decisions. Social learning (defined as knowledge building within groups, organizations, and societies) could help improve these processes, but fostering social learning within diverse stakeholder groups will not be an easy task. Learning through adaptive management (AM) has been suggested as one approach to providing the basis for better decision-making over time. AM is a science-based approach in which different policy actions are tried out in informative contexts, creating experimental designs and evaluating outcomes as a basis for judging what has been learned. Adaptive management has become more commonplace in guiding large-scale environmental research and management projects, involving many organizations and multiple stakeholders. However, the issue of how to foster learning within AM decision processes has been largely overlooked. This paper attempts to link AM to concepts of structured decision-aiding involving stakeholder groups. Specifically, the paper outlines the advantages of viewing learning as an objective within stakeholder decision processes. Drawing on the value-focused thinking concept from applied decision analysis, emphasis is placed on directly involving stakeholders in creating and implementing alternatives to foster learning in the decision process. The authors propose three steps needed to treat learning as an objective within a decision process. First, learning must be specifically stated as one of the objectives in the decision context. Second, a specific performance measure must be developed for the learning objective. Finally, the willingness to accept reduced performance on other objectives in order to achieve more learning must be considered.

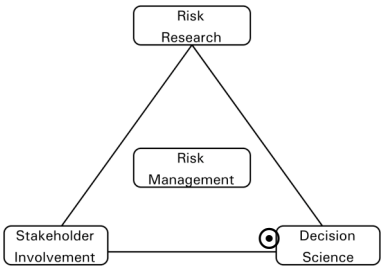
The authors present a case-study example concerning water use for fisheries and hydroelectric power in British Columbia, Canada. The Alouette River Management Committee (ARMC) began a multi-stakeholder, structured decision process in 1995 to develop a new operating plan for water flows at hydroelectric power facilities near Vancouver, B.C. Previous attempts at water-use planning for this site involved major conflicts among stakeholders, regulators, and the utility (BC Hydro). By treating learning as an explicit objective in the planning process, the ARMC was successful in reaching a consensus decision. This success has encouraged BC Hydro and provincial regulatory agencies to implement similar consultative planning processes at all other major hydroelectric sites in the province. As of spring 2002, nine plans had been successfully completed and another 12 were underway.

REFERENCE NO. 96

CITATION:

McDaniels, T., and W. Trousdale. 1999. Value-focused thinking in a difficult context: Planning tourism for Guimaras, Philippines. Interfaces **29**:58-70.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

This article discusses a field test of the structured decision aiding approach that is the focus of Hammond et al.'s *Smart Choices* (Reference No. 67). The context for this case study is tourism planning for Guimaras, Philippines. This is a unique application of the decision aiding model for several reasons. Traditionally, this decision tool has been used only in western nations; this case study exposed the techniques to a new culture. In addition, there were many barriers presented by socio-political conditions of Guimaras: a developing nation, poor communication and transportation infrastructures and the lack of financial support. Finally, the stakeholders taking part in the process varied widely in their knowledge and professional expertise concerning tourism. The researchers used a simplified 3-stage version of the PrOACT method to structure the process.

1) Structure the fundamental objectives important to achieving a decision or set of decisions.
2) Use fundamental and means objectives to create new alternatives that are likely to garner broad support.
3) Use objectives to define information requirements and to evaluate alternatives.

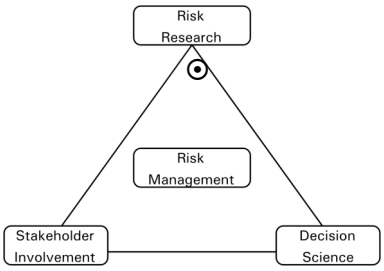
The researchers found that this derivative of value-focused thinking worked well in creating several viable tourism options for Guimaras. The researchers conclude that value-focused thinking is a useful tool for addressing any decision-making or organizational difficulty and can be viewed as decision or organizational "therapy."

REFERENCE NO. 97

CITATION:

McDaniels, T., L. J. Axelrod, and P. Slovic. 1996. Perceived ecological risk of global change: A psychometric comparison of causes and consequences. Global Environmental Change **6**:159-171.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Learning about lay views is an important step in beginning to characterize the general 'social construct' of global change, and to help build communication efforts to increase public understanding of these complex hazards. A psychometric risk-perception study was completed to obtain judgments about ecological risk factors associated with these processes. Factors such as natural disasters, technologies, human practices, human beliefs and social systems, and important ecological consequences of other items were rated on 31 scales to account for risk perceptions. A factor analysis was completed to characterize risk perceptions, and five factors were found to explain nearly all the variance in responses to the scales. These five factors can be characterized as 1) impact on species, 2) human benefits, 3) impact on humans, 4) avoidability, and 5) knowledge. This factor structure provides a framework for comparing risk perceptions across different risk items.

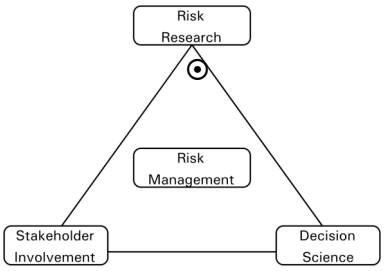
This article focuses on lay perceptions of ecological risks of three global environmental change processes: a) climate change, b) ozone depletion, and c) species loss. All three of these risks were included in the items rated most highly on the ecological risk scale in the psychometric study. Interestingly, the relative ratings of the three global change processes by the lay sample correspond with expert ratings of ecological risk. Although both lay people and experts agree that these processes pose high ecological risk, there are significant misconceptions about global change. The study was purposely designed to allow the authors to compare lay perceptions regarding the various events in cause-effect linkages in global change processes. The overall study included items termed as indirect causes, direct causes, and consequences. For instance, the list of items included air conditioning (indirect cause), which contributes to CFC emissions (direct cause), which leads to stratospheric ozone depletion (a consequence). The findings of this study indicate that lay people perceive technologies or actions that contribute to global change processes very differently than the consequences of these processes. For instance, species loss can be directly linked to the conversion of habitat to human-dominated land use (such as housing and urbanization), yet development of housing and urbanization were both perceived as substantially less risky than the loss of habitats. The authors provide several possible explanations for this disconnect between cause and effect in global change processes, and suggestions for improving communication efforts related to global change issues.

REFERENCE NO. 98

CITATION:

McDaniels, T., L.J, Axelrod, and P. Slovic. 1995. Characterizing perception of ecological risk. Risk Analysis **15**: 574-588.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

A major focus of the risk literature is the characterization of people's perception of perceived health risk associated with an array of technologies (i.e., nuclear power), places (i.e., Superfund sites) and activities (i.e., smoking cigarettes). This research has provided insight into several aspects of health risk management: communication of health-risk information; social amplification of risk; stigmatization of products, places, and activities and determination of the values underlying health-risk tradeoffs. There has also been growing interest in ecological risks, threats to the functioning of natural systems. While most of this research has focused on the biological and physical aspects of ecological risk, there has been little research examining human perception of ecological risk. This article reports the results of a study that looked at the social aspects of ecological risk. The objective of the study was to clarify what people mean when they say something is risky to the environment. In order to reach this objective the researchers used the psychometric paradigm. The development of a psychometric paradigm is composed of four basic steps: 1) The development of a list of hazards items to be evaluated. 2) The development of multiple psychometric scales that reflect characteristics of the risks that influence individuals perception of risk, and are used to evaluate the list of hazards established in step 1). 3) Have individuals evaluate the list of items on each of the scales. 4) Use factor analysis to identify the underlying factors that capture the variation in the individual and group responses.

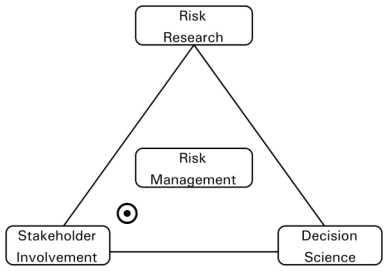
The researchers relied on a group of technical experts and lay people to develop a list of hazards that pose a possible ecological risk (Step 1). These hazards fall into four groupings: natural disasters, technologies and their appliances, human practices that negatively impact the environment, and human beliefs and political/social systems. The scales used to evaluate these hazards were developed using information from focus groups of experts and laymen concerning general issues of ecological risk (Step 2). 31 scales in total were developed, ranging from reversibility of impacts to general riskiness. The hazards were evaluated using these scales by a group of university students (Step 3). Their ratings of the different hazards on the various scales led to five significant factors being identified after factor analysis: impact on species, human benefits, impact on humans, avoidability, and knowledge of impacts (Step 4). The authors believed that the results of this descriptive study had four practical implications: help in the understanding of current ecological controversies, improve the quality of ecological risk-communication efforts, determine the factors that influence individual response to ecological risk, and provide a starting point for further research of the subject.

REFERENCE NO. 99

CITATION:

McDaniels, T., R. Gregory, and D. Fields. 1999. Democratizing risk management: Successful public involvement in local water-management decisions. Risk Analysis **19**:497-510.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

Several recent reports (including the Congressional Commission on Risk Assessment and the National Research Council's Committee on Risk Assessment) have called for increased public participation in setting policy for risk management. Although risk-management policy involves public resources and public values, risk decisions are extremely complex and making and implementing policy choices is difficult even for risk-management specialists. Because there are a wide variety of motivations and processes for public involvement, it is difficult to know which public involvement alternatives are best for helping the lay public to play a meaningful role in decision-making about risk. This paper discusses concepts for designing public involvement, reasons for involving the public in decision-making, and the range of current practices. Finally, the authors present a successful public involvement effort that addressed and resolved a highly controversial water-management issue in British Columbia, Canada.

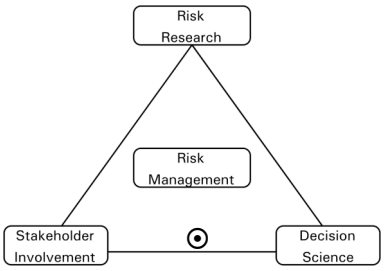
Behavioral decision research has consistently found that people are "quite bad" at making complex, *unaided* decisions. Yet, involving the public in decision processes should help to provide insight that will foster widely supported policy choices that reflect public values, and build lasting support for those choices. Current public involvement practice can be divided into two extremes, the first being a decision process designed entirely by the group itself, the second only allowing public participation in the form of specific, formally structured value judgments. The authors suggest a group process that falls in the middle of these two extremes. In order to better design group decision processes to guide public involvement through complex risk-management choices, the authors suggest the inclusion of four specific concepts: 1) value-focused thinking, 2) adaptive management, 3) a structured decision process, and 4) an "informative" decision rule. The paper presents a case study of the decision aiding approach implemented for Alouette River Stakeholder Committee (ASC) to help develop a water management plan for the South Alouette River system in British Columbia, Canada. A wide variety of objectives, including fisheries and ecological health, flood control, recreation activities, and power production were considered. The ASC was able to make tradeoffs between objectives, and reach consensus on all major issues addressed in the process. This agreement, reached by a diverse group of stakeholders, had held for over a year (at press) with all parties satisfied by the results.

REFERENCE NO. 100

CITATION:

McDaniels, T., R. Gregory, J. L. Arvai, and R. Chuenpagdee. 2003. Decision structuring as a means of alleviating embedding in environmental valuation. Ecological Economics **46**:33-46.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Embedding is the widely-observed phenomenon where a good is assigned a higher value if evaluated on its own rather than as a part of a more inclusive set. In the standard contingent valuation (CV) approach to willingness-to-pay (WTP) elicitations, the same good is typically assigned a higher WTP if it is evaluated on its own than if its value is inferred from the WTP expressed from an inclusive good or set of goods. In order to improve the quality of information about public values for non-market goods, a careful examination of judgment tasks and values elicitation processes is needed. The authors suggest that embedding is to be expected when insufficient attention is given to the articulation of the value component of an assessment, and when not enough context is provided to serve as a basis for the difficult trade-offs that must be made as part of the evaluation exercise. In order to overcome embedding, the authors propose that 1) evaluations be structured in terms of multiple value dimensions rather than single-attribute choices, 2) alternatives be compared in terms of underlying attributes, based on the information needed for a complete decision framework, and 3) opportunities be provided for discussion and feedback. The combination of these three efforts will lead to better decision processes for complex environmental choices.

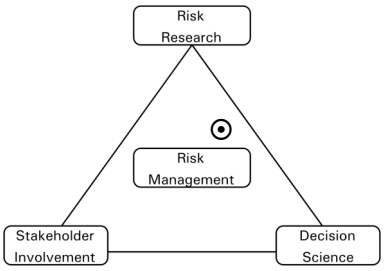
This paper presents the results of an experiment involving a structured, small-group approach to conducting environmental policy evaluations. The objective of this study was to explore whether a structured decision process led to higher-quality decisions about environmental values; specifically, to examine whether a structured decision approach can overcome embedding in environmental evaluation. The experiment examined the economic and ecological benefits of increased fisheries production that could result from changes to the operation of hydroelectric power generation facilities in British Columbia, Canada. Subjects participated in two small facilitated groups, and completed workbooks designed to help structure choices. The first group was asked to provide WTP evaluations for one river, and then asked for WTP for ten rivers. The sequence of one and ten rivers was reversed for the second group. The order in which the structured WTP questions were presented did not have a statistically significant effect on subjects' WTP responses. The results of this experiment showed a significant reduction in embedding using a structured approach when compared to a standard contingent-valuation approach.

REFERENCE NO. 101

CITATION:

Mendelsohn, R., and R. Gregory. 1992. Managing environmental accidents. Pages 296-308 in G. L. Peterson, C. S. Swanson, D. W. McCollum, and M. H. Thomas, editors. Valuing wildlife resources in Alaska. Westview, Boulder, CO.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

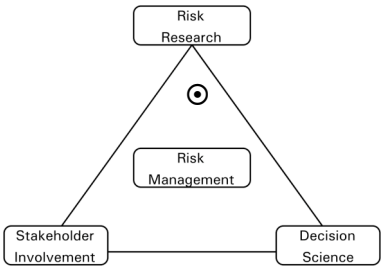
This simple article addresses the need to balance costs and benefits when developing regulations to manage environmental risks. The authors state that efficient and effective risk management requires accurate measurements of the potential damage resulting from an accident, as well as the costs of abatement. The authors begin by discussing risk analysis techniques that are meant to estimate two important damage factors: the likelihood of an accident (probability) and the associated physical consequences (magnitude). They state that a weakness of risk analysis is its inability to incorporate tradeoffs and failure to recognize value judgments which identify an acceptable level of risk. Incorporating value judgments into a risk assessment requires that social values be integrated with the technical data traditionally utilized during risk analysis and assessment. The authors provide an overview of the techniques often used to place a value on nonmarket goods with the most common method being contingent valuation. The authors conclude the paper with a discussion of risk management, stating that once an expanded risk assessment (incorporating both technical and social concerns) has been completed there are four tools that should be used to manage environmental accidents. These include: 1) regulating precautions to reduce the chance that an accident will occur, 2) prescribing actions that should automatically be taken once an accident occurs, 3) calculating the damages which may occur and charging fines for unmitigated damage, and 4) providing compensation either before an accident occurs for those placed under additional risk or after for those incurring damages.

REFERENCE NO. 102

CITATION:

Morgan, M. G., B. Fischhoff, A. Bostrom, L. Lave, and C. J. Atman. 1992. Communicating risk to the public. Environmental Science and Technology **11**:2048-2056.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Risk communication should supply lay people with the information they need to make informed decisions about risks that may affect their health, safety, or the environment around them. These decisions are often made on a personal level (such as risks associated with diet); lay people also participate in public processes in which decisions are made on a much larger scale (such as the siting of a hazardous waste facility). In making these decisions, people process new information in the context of their existing beliefs. Therefore, risk communicators must understand the nature and extent of these beliefs in order to design successful risk messages. This article presents a framework for designing risk messages that supply lay people with the information they need in a way that fits with their intuitive way of thinking. A study using radon as an example to the mental models approach is used to demonstrate the approach.

The first step in the "mental models" approach is to construct an influence diagram. Working with a group of experts, a network showing the relationships between factors of a hazard was created, reviewed, and revised. This diagram then provides a template for characterizing a lay person's mental model. The characterization is made as to 1) the appropriateness (whether beliefs are accurate, erroneous, peripheral, or indiscriminate), 2) the specificity (level of detail), and 3) the category of knowledge. When eliciting the lay person's responses regarding a particular topic (in the case reported here, radon), the analyst begins with open-ended questions and progressed through the interview with increasingly directed prompts in order to address all aspects of the influence diagram. Once complete, the mental model is coded against the expert diagram. Although respondents are likely to express many accurate beliefs, many of the ideas that emerge during these elicitations tend to be incorrect or misguided.

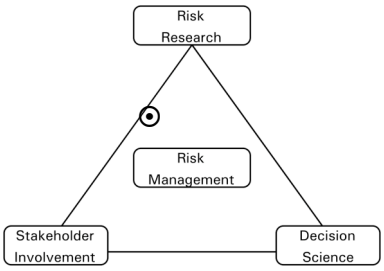
Using the concepts from the mental models approach, risk messages can be designed to attend to gaps and incorrect beliefs in lay people's understanding of a risk. Informative materials (e.g., brochures) can attempt to add, delete, replace, generalize, and refine parts of people's beliefs. To test the effectiveness of the mental-models approach, the authors designed two risk messages (brochures) about radon—the product of a mental models analysis—and tested them against the EPA's "Citizens Guide to Radon." In a series of tests, (including open-ended interviews, true-false tests, a multiple-choice test, a short problem-solving task, and verbal protocols), subjects reading the two brochures designed using the mental-models approach performed significantly better than those reading the EPA brochure.

REFERENCE NO. 103

CITATION:

Morgan, M. G., B. Fischhoff, A. Bostrom, and C. J. Atman 2002. Risk Communication: A Mental Models Approach. Cambridge University Press, Cambridge, UK.

REFERENCE TYPE: Book



SYNOPSIS:

This user-friendly text provides an overview of the mental-models approach to risk communication. The mental-models approach is a systematic and empirical method for informing the design of such risk-communication processes. Mental models are psychological representations of real or hypothetical situations. Their theoretical underpinnings date back to early research in cognitive science; more recent work on mental models emphasizes their use as a tool for diagrammatically representing people's perceptions and understanding of a wide variety of stimuli, including objects, states of affairs, sequences of events, as well as other the social and psychological actions of daily life.

In the context of risk-communication design, the mental-models approach is also based on the notion that people tend to assemble their knowledge of risks into a conceptual map of ideas (i.e., a mental model). Model development in the context of research and practice in risk communication involves eliciting these conceptual maps from stakeholders via a carefully designed, open-ended interview protocol. Once elicited, it is possible to analyze these mental models with an eye toward looking for important gaps in stakeholders' knowledge. Identifying these gaps can help to pinpoint people's specific information and decision-making needs, and contribute to the development of a framework for more efficient and effective risk-communication processes.

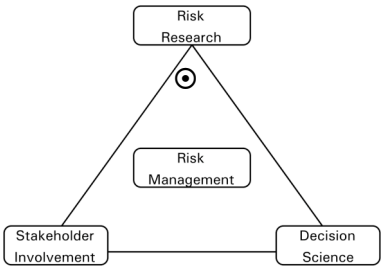
Mental-models research as applied to risk communication has been undertaken in the context of a variety of risks, including those from radon and global climate change. These examples are outlined in detail in the text. One of the key conclusions of this body of work is that, while non-expert stakeholders did indeed lack fundamental knowledge about many risks, experts' intuition and perceptions of stakeholders' knowledge were an incomplete—and often inaccurate—descriptor of stakeholders' actual information and decision-making needs.

REFERENCE NO. 104

CITATION:

Mullet, E., C. Duquesnoy, P. Raiff, R. Fahrasmane, and E. Namur. 1993. The evaluative factor of risk perception. Journal of Applied Social Psychology **23**:1594-1605.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

The majority of risk perception research points to the two-axis psychometric paradigm as the best explanation for societal risk perceptions. The paradigm is based on two factors, *dread* and *unknown risk*, and occasionally a third factor concerning the number of people affected by a hazard. The authors of this study propose that a fourth evaluative factor may exist that is separate from these three factors. They define the evaluative factor as the "moral" nature of the hazard or a subject's personal position (either favorable or unfavorable) toward a hazard, activity, or event. The objective of the study was to determine if an evaluative factor could account for the variance not explained by the two (sometimes three) classic factors and if this new factor could enhance predictions of public reactions to safety issues. Sixty students were recruited to rate 15 risk characteristics (i.e., personal attitude, beneficial to society, common-dread, newness, number of exposed, etc.) across 29 hazardous activities, substances, and technologies.

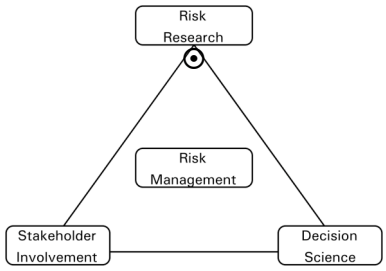
A principal component factor analysis of the 15 risk characteristics identified the four factors noted above (i.e., these four factors accounted for 87% of the variance). These included an *evaluative* factor (26.8% of variance), a *dread* factor (23.2% of variance), a *unknown risk* factor (21.4% of variance), and a *number-of-people-exposed* factor (15.6% of variance). A second principal-component factor analysis of the 29 hazards identified five factors which accounted for 91% of the variance. These included opposition to risks that were uncontrollable, unavoidable, unknown, gratuitous, and affected a large number of people. In summary, the three factors often cited in the literature were identified as being critical in this study. However, the hypothesized fourth factor was found to be important for explaining people's risk perceptions.

REFERENCE NO. 105

CITATION:

National Research Council. 1989. Improving Risk Communication. National Academy Press, Washington, DC.

REFERENCE TYPE: Book



SYNOPSIS:

This book is the product of a study initiated by the National Research Council and conducted by the Committee on Risk Perception and Communication. The committee's goal was to address risk communication practices within government and industry to identify the problems often associated with conducting effective risk-communication activities. The committee defines effective and non-controversial risk communication as a two-way, interactive exchange of information between experts and non-experts that is meant to inform risk-management decisions. They state that there are two major types of risk-communication problems, 1) those deriving from institutional and political systems and 2) those of risk communicators and recipients. Problems within the system are more difficult to address and include dealing with legal considerations, divided authority, and systematic biases in the provision of information. Problems of those sending and receiving the information are much easier to address and include establishing and recognizing credibility, making the messages understandable, preparing emergency messages, capturing and maintaining attention, and getting information.

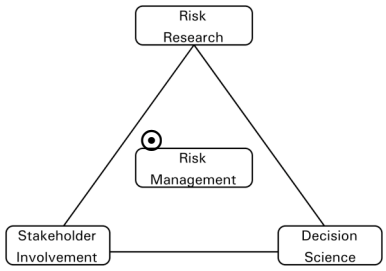
The recommendations of the committee focus on improving risk-communication efforts conducted by government agencies and large private corporations. They identified four objectives that are essential for improving the risk-communication process. These include goal setting (establishing realistic goals), openness (maintaining two-way communication), balance (ensuring accountability and accuracy in risk messages), and competence (incorporating expertise on both the risk being addressed and risk communication). The committee also identified four generic issues that have been a source of trouble for risk communication efforts in the past. These include audience orientation (relating the message to the perspective of the audience), uncertainty (openly disclosing gaps and areas of disagreement), risk comparisons (cautiously utilizing comparisons), and completeness (including information on the nature of the risk, benefits, alternatives, uncertainty, and management issues). In conclusion, the committee recommends that a consumer's guide to risk and risk communication be developed and that additional work be conducted to increase our understanding of effective risk communication.

REFERENCE NO. 106

CITATION:

National Research Council 1996. Understanding Risk: Informing Decisions in a Democratic Society. National Academy Press, Washington, DC.

REFERENCE TYPE: Book



SYNOPSIS:

This influential book takes as its starting point the fact that the process of risk assessment is not free of value judgments. Judgments about the nature and severity of environmental risks inevitably incorporate implicit understandings about such factors as the theoretical basis of a hazard, causality, and uncertainty. These factors are by no means universally shared even within in similarly situated expert groups but are nevertheless important in how they influence the way in which research is conducted (and conclusions from research are drawn). It is these judgments that lead to the selection and implementation of alternative research approaches by researchers in the same field to learn about the same problem, the collection of data that both supports and refutes identical hypotheses, and the inevitable management controversies that follow.

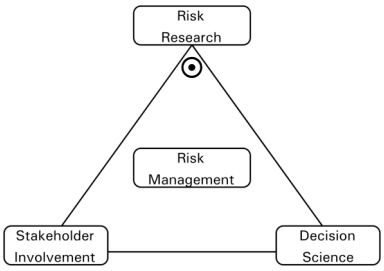
A recognition or these (and other) factors inherent in the identification, assessment, and management of risk leads to the need for more deliberative approaches, which can enable risk analysis—and on a broader scale—environmental decision-making to become a more inclusive process, with multiple access points for dissenting or minority views, and local or non-expert perspectives. This need is best addressed not through the creation of new (or a straightforward switch to alternative) methods for assessing risk but rather through a redefined role for *risk characterization*. Under this more deliberative model, risk characterization is conducted with a diverse group of participants that reflect not only traditional technical expertise (e.g., scientists such as economists and ecologists) but also—dictated by the needs of a specific situation—a broader set of "stakeholders" (e.g., members of interested or potentially affected parties, elected officials, etc.). Throughout this process of risk characterization, the assessment of risk is driven by an "analytic-deliberative" process. Inclusive deliberations help to define the overall risk (i.e., to what or to whom, when, and how) to be assessed and provide insight to analysts about ways in which the assessment and its subsequent interpretation ought to take place. Sound analysis, in turn, provides much needed information on which to base these deliberations. In this sense, risk characterization is not simply a synthesis of the information obtained through risk assessment; it is an important shaper of the risk-assessment process.

REFERENCE NO. 107

CITATION:

Otani, H., D. Leonard, V. Ashford, M. Bushroe, and G. Reeder. 1992. Age differences in perception of risk. Perceptual and Motor Skills **74**:587-594.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Previous studies have found evidence that cautionary signage or warning labels are ineffective because they are often ignored by the general public. This study investigates the effectiveness of warning labels by testing how different age groups respond to them. The authors expected older adults to be more cautious than younger adults, based on the literature, but they were not sure how the hazards would be perceived when the warning label was ignored and how likely the participants would be to disregard the warnings. 358 adults were divided into three age groups (18-29 years, 30-59 years, and 60-85 years) and were given a questionnaire which presented three pages of warning signs with varying degrees of consequences (i.e., no, mild, and severe). The subjects were asked to provide ratings as to how risky they thought it would be to disregard the warning and how likely they would be to disregard the warning.

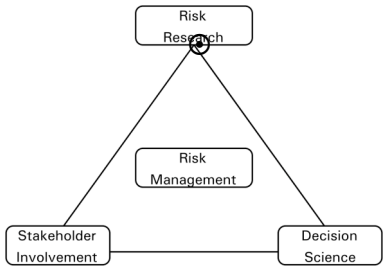
The results indicated that older adults and women thought it was riskier to ignore the warnings than younger adults and men. The results also indicated that the 18-to-29 year-old group was more likely to disregard the warning than the two older groups. To summarize, the original hypothesis was supported; older individuals were more cautious than younger individuals. The older subjects perceived higher risk from disregarding a warning and were less likely to disregard the warning. The age differences were not observed among all the warning labels, and the varying degrees of consequences did not seem to effect the subjects' perceptions of the risk.

REFERENCE NO. 108

CITATION:

Paustenbach, D. J. 2002. Human and Ecological Risk Assessment: Theory and Practice. John Wiley and Sons, New York, NY.

REFERENCE TYPE: Book



SYNOPSIS:

The field of "risk analysis" is comprised of three related sub-disciplines—risk assessment, risk management, and risk communication. Briefly, risk assessment involves the identification of hazards, establishing dose-response estimates (e.g., the relationship between different levels of risk and their environmental consequences), and ascertaining exposure intensity (e.g., the levels of exposure to a risk that are currently experienced or anticipated under different conditions). Risk management is devoted to the development of regulatory options for coping with impending and existing risks, as well as the evaluation of public health, environmental, social, economic, and political consequences of management actions. Risk communication fits somewhere in the middle, filling the vacuum that exists between the technically oriented risk assessors and the policy analysts concerned with managing risk.

Several books have been written in an effort to deal with the theoretical and practical relationships that exist among these three sub-disciplines. One of the most recent, and perhaps best, is *Human and Ecological Risk Assessment: Theory and Practice*, edited by Dennis J. Paustenbach. The book incorporates roughly two-dozen case studies (ranging from power-plant emissions to the effects of pesticides on birds) to present both the theoretical underpinnings of risk analysis and a step-by-step guidebook for use by practitioners currently working in one of the three sub-disciplines. The 32 chapters illustrate current methods and ideas for conducting hazard identification, dose-response and exposure assessment, cost-benefit analysis, and stakeholder-based risk communication and management.

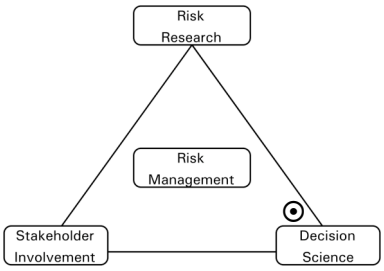
Though the thorough coverage of a wide variety of risk-related issues and concepts is very impressive, the book's real strength lies in its collection of contributors. Most books devoted to the field of risk analysis are written primarily by academic researchers. The chapters in *Human and Ecological Risk Assessment: Theory and Practice*, on the other hand, are written primarily by on-the-ground practitioners currently active in the field and, therefore, resonate with an air of tangibility and authenticity. Contributors include Gail Charnely (a former president of the Society for Risk Analysis), Anne Sergeant (of the USEPA), and Warner North (or NorthWorks, Inc.). Those chapters authored by the relatively small fraction of academic professionals (e.g., Paul Slovic and Lester Lave) are equally well written.

REFERENCE NO. 109

CITATION:

Payne, J. W., J. R. Bettman, and E. J. Johnson. 1992. Behavioral decision research: A constructive processing perspective. Annual Review of Psychology **43**:87-132.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

This article reviews behavioral decision research (BDR) for the period from 1983-1991. The authors note two major trends in the literature: that concepts and methods from this field are being widely adopted, and that although the amount of research is small, there is a growing focus on problem structuring and learning elements of decision behavior. The authors go on to identify four major themes of BDR including 1) preference construction, 2) beliefs about uncertain events, 3) decision-making under risk and uncertainty, and 4) frameworks for contingent-decision behavior. Preference construction is the idea that preferences do not exist prior to a decision being made; instead they are constructed during the elicitation process. Inconsistent preferences most likely result from decisions with conflicting values (resulting in procedural and descriptive variance), a level of complexity, or uncertainty in individual values. Beliefs about uncertain events, or the way that people judge the probability or likelihood of a specific event, are another major focus of BDR. Specifically, researchers have studied strategies for probabilistic reasoning (i.e., heuristics like availability, anchoring and adjustment, and representativeness) and the contingent usage of strategies for assessing uncertainty (i.e., use or misuse of base-rate information, conjunction fallacy, and expert judgments of uncertainty.) Decision-making under risk and uncertainty is the study of how people make decisions involving tradeoffs between the desirability of a consequence and its likelihood. Specifically, the majority of work in this area focuses on generalizations of expected-utility models (i.e., relationships between values and options, interactions between probabilities and payoffs), responses to repeated-play gambles, and ambiguity and risky choice. Frameworks for contingent-decision behavior are explanations for why people use different strategies when making decisions. The cost-benefit framework stems from the concept of bounded rationality, stating that cognitive processes have costs and benefits and decision-makers will utilize the strategy that is most appropriate for the specific situation or context. The perceptual frameworks contend that decision making strategies are chosen or utilized in response to the formulation or representation of decision problems.

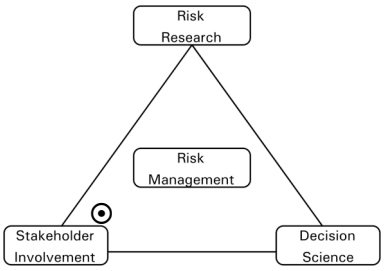
The authors conclude with a discussion of the applications of BDR. They state that the goal of BDR is to improve decision-making processes by changing the information environment in which a decision is made, informing decision analysis, and improving the measurement of human values or preferences. The constructive and contingent nature of decision behavior can both pose problems and create opportunities for decision-makers, making it an important field for further study and research.

REFERENCE NO. 110

CITATION:

Pellow, D. N., A. Weinberg, and A. Schaiberg. 2001. The environmental justice movement: Equitable allocation of the costs and benefits of environmental management outcomes. Social Justice Research **14**:423-439.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Over the last three decades there has been an increasing focus on the distributive impact of environmental pollution across class and race in the United States. This focus has led to the conclusion that people of color and the poor are most negatively influenced by the nation's pollution problems and the subsequent formation of the environmental-justice movement. This article explores the basic indicators of environmental inequality as racism, expands the focus of the environmental justice movement from a national to global scale, and presents an alternative framework for the examination of environmental inequality. A theme that runs throughout the entire article is the importance of including all impacted stakeholders in environmental decision-making processes, not just those that are the most vocal or powerful (economically and/or politically).

The authors point to seven aspects of environmental inequality in the U.S. as signs that it maybe a manifestation of systematic racism: 1) Unequal and unfair processes (protection and enforcement) in the siting of hazardous facilities in poor, multi-racial communities; 2) disproportionate impact of occupational hazards on the poor and workers of color; 3) the breaking of treaties with native peoples in terms of mining, weapons testing, and waste dumping; 4) unsafe and segregated housing; 5) discriminatory transportation and zoning laws; 6) the exclusion of the poor and people of color from government and corporate environmental decision-making processes; and 7) the neglect of social justice and human health by the traditional environmental movement.

The authors also suggest that environmental racism is a global problem with many industrialized nations shifting their waste onto third-world nations, which are often nations of people of color. There are two significant reasons for this occurrence. First, stringent environmental laws in many industrialized nations have forced many corporations and to some extent the government to locate new places to dump hazardous waste outside of national boundaries. Second, many third-world nations are in debt to many industrialized nations and are unable to fairly negotiate the "trade" of hazardous waste.

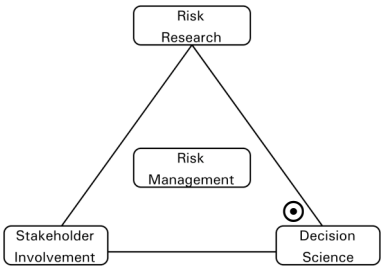
In closing, the author suggests that environmental racism should not be viewed as a simple "perpetrator-victim" situation, but be analyzed through a more complex framework based on the four following principles: 1) In order to address these problems there is a need to understand the historical origins of environmental inequality. 2) Environmental inequality involves stakeholders with varying degrees of economic and political power. 3) Institutional racism and other forms of inequality play an important role in the environmental-justice movement. 4) Patterns of environmental inequality continuously evolve and vary over time and context.

REFERENCE NO. 111

CITATION:

Peters, E., and P. Slovic. 2000. The springs of action: Affective and analytical information processing in choice. Personality and Social Psychology Bulletin **26**:1465-1475.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

A growing body of literature exists regarding the importance of affect in information processing and decision making. This article reports the results of an experiment meant to improve on the existing literature in three ways. One, this study attempts to shed light on the means by which affect is acquired and how it affects choices, as opposed to using stimuli that already contain affective meaning (i.e., an electric shock results in pain). Two, this study allows for individual variation in choice behavior. Three, previous research has focused on the relationship between affect and relatively simple choices (i.e., either a gain or a loss). This study asks participants to make choices regarding objects that are a complex mix of gains, losses, and expected values. The study methods are based on previous research regarding gambling choices of brain-damaged individuals (resulting in an inability to feel or use emotions) and those without brain damage. In this earlier study, the brain-damaged patients almost always showed poor judgment, consistently choosing cards from a high-loss deck, while the non-patients usually chose cards from a high-gain deck. The authors of this study wanted to replicate this work but with non-brain-damaged college students in order to test their claim that the intensity of an individual's affective reaction to information will determine its weight in a choice task. Specifically, they predicted that self-reported reactivity to negative events would be negatively related to the number of choices from high-loss decks, and self-reported reactivity to positive events would be positively related to the number of choices from high-gain decks. Participants were asked to accept or reject the top card (representing either a dollar gain or loss) from one of four decks presented randomly on a computer screen. The computer tracked the overall gains and losses compiled by each participant and ended after the 100^{th} card was chosen.

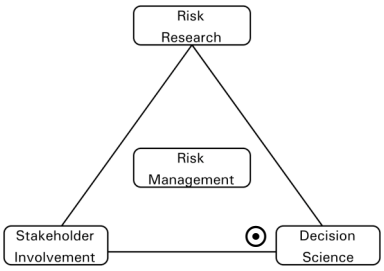
The results supported both hypotheses, especially the first hypothesis regarding the relationship between negative reactivity and choices from the high-loss decks. Overall, the results demonstrated that self-reported individual differences in affective reactivity were related to the choices as predicted. This research makes three important contributions to our understanding of affect. 1) Affect does play a role in decision making (the extent of our affective reaction may determine which attributes carry the most weight in our decisions). 2) Individual differences in affective reactions among college students were associated with learning (observing which decks repeatedly won or loss) and choices among complex stimuli. 3) This study was able to replicate Damasio's major findings (that affective feelings are important for guiding an individual through complex choice tasks) among a non-brain-damaged population.

REFERENCE NO. 112

CITATION:

Peters, E., P. Slovic, and R. Gregory. 2003. The role of affect in the WTA/WTP disparity. Journal of Behavioral Decision Making **16**:309-330.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

A reoccurring theme in judgment and decision-making is the constructive nature of preferences, and the difficulty that individuals have with placing value on objects. This study examines the construction of pricing preferences for lottery tickets between buyers (i.e., willingness-to-pay) and sellers (i.e., willingness-to-accept). The authors propose that buyers and sellers will find different information useful or salient when searching for cues to identify their pricing preferences. They also argue that affective considerations will influence pricing and may provide an explanation for the known disparity between willingness-to-pay (WTP) and willingness-to-accept (WTA) measures. Four experiments were conducted to examine the relationship between affect and WTA/WTP prices, and to identify which information was most salient to buyers and to sellers. In the first study, participants were asked to provide both their WTA (as a seller) and WTP (as a buyer) for one of two hypothetical lotteries, a 5% chance of winning $10 or a 50% chance of winning $100. Participants were also asked how they would feel about no longer owning the ticket (as a seller) and how they would feel about owning the ticket (as a buyer). In the second study, participants were presented with real lottery tickets and real monetary outcomes in order to make the task more engaging. It was expected that affect would play an even stronger role in the second study and that the WTA/WTP disparity would be even larger. In the third study, participants were asked to provide written accounts of their thoughts, feelings, and any numbers that crossed their mind while making their WTA and WTP judgments. In the fourth study, participants were again asked to respond as both a buyer and a seller, but this time to a series of 18 hypothetical lotteries, rating their positive and negative affect for each ticket and then providing a WTA or WTP judgment.

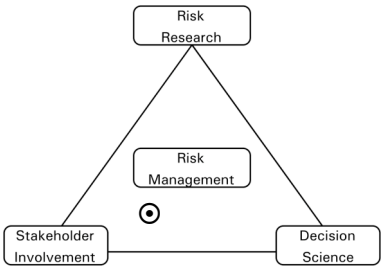
The results of this study were consistent with past research; buyers and sellers searched for cues when constructing their price preferences. The disparity between WTA/WTP (WTA was much higher on average) that was identified in this study appears to be a partial result of the affective feelings that the participants felt about either gaining (positive WTP affect) or foregoing (negative WTA affect) a lottery ticket. First-time buyers and sellers found numerical cues (zero for WTP and the winning amount of the lottery for WTA) to be the most salient and appeared to anchor on those values and make adjustments from those points when constructing their price preferences. The authors conclude the paper by identifying three roles that affect may play in the construction of monetary values. First, affect can act as information (i.e., for anchoring and adjustment. Second, affect may direct an individual's attention to specific decision-relevant information (i.e., numerical cues). Finally, affect may motivate individuals to do extra work (i.e., hypothetical vs. real tasks).

REFERENCE NO. 113

CITATION:

Petts, J. 2000. Municipal waste management: Inequities and the role of deliberation. Risk Analysis **20**:821-830.

REFERENCE TYPE: Reference Article [Review Article]



SYNOPSIS:

This article explores the decision processes involved in the management of municipal solid waste in the United Kingdom. While the article does focus on management and government processes that are different from the United States, and on a management issue that is outside the scope of traditional natural resource issues, it still offers practical insight into several issues that resource managers and decision makers in general may face. The author clarifies the difference between "decision tools" (an analytic procedure mainly used by decision scientists to drive decision processes, such as cost-benefit analysis), "decision process" (a process that addresses the concerns of various stakeholders and considers the contextual aspects of a decision), and the concept of an "analytical-deliberative process" using the definition provided by the National Research Council:

> "Analysis uses rigorous and replicable methods developed by experts to answer factual questions. Deliberation uses processes such as discussion, reflection and persuasion to communicate, raise and collectively consider issues, increase understanding and arrive at substantive decisions. Deliberation frames analysis and analysis informs deliberation."

The author also explores the difference between "inter- and intragenerational equity." Intergenerational equity is the concept that a certain stock of man-made, natural, or social capital assets must be passed on to the next generation in a state that is equivalent to our own. However, this concept confounds decision processes due to the fact that it is difficult for present day society to imagine how these assets will be used, in what quantity and in what state by future societies. Intragenerational equity stresses the fair distribution of the above-mentioned stock among present day society (at local, regional, national, and global levels). The author suggests that analytic-deliberative processes should allow individuals to place equal emphasis on intra- and intergenerational equity issues, instead of the traditional focus on primarily intragenerational equity issues.

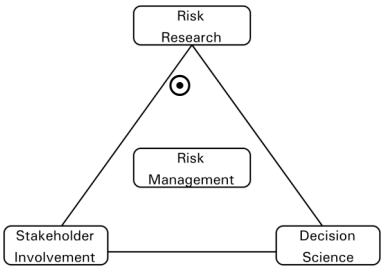
The author also explores some of the weak points of community advisory committees as a part of the analytic deliberative process: 1) People prefer to focus on intragenerational interests and objectives. 2) People are more likely to represent the interest of their constituents and not future generations. 3) The people selected to take part may not be representative of public opinion, and minority viewpoints may be ignored.

REFERENCE NO. 114

CITATION:

Plough, A., and S. Krimsky. 1987. The emergence of risk communication studies: Social and political context. Science, Technology, & Human Values **12**:4-10.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

The authors state that the study of risk communication has recently emerged as a means to manage public risk perceptions and individual behavioral responses to risk. However, the practice of risk communication has been around for thousands of years, dating back to Babylonian efforts to assess and adapt to risk. Three key events over the past few centuries led to the rise of modern risk communication; these include the rise of the modern state, the development of public health institutions, and the creation of decision analysis techniques that were eventually used to address risk factors in health, medicine, and the environment. As risk-analysis techniques continued to develop in the 1960's and 1970's, there became a need to bridge the gap between technical risk assessment and public risk perceptions. Risk communication evolved as a means for informing individuals about risk and gaining acceptance for policies grounded in risk assessment. There are many different forms of risk communication, each varying in their 1) intentionality, 2) content, 3) audience directed, 4) source of information, and 5) flow. For example, a narrowly defined risk-communication approach would have a specific expected outcome, cover only health and environmental risks, target a specific audience, have scientists as the only source of information, and channel information from experts to non-experts through designated channels.

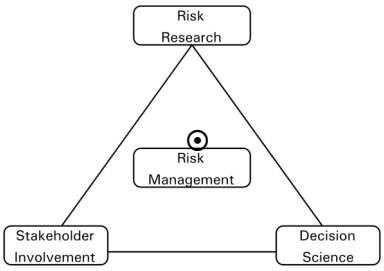
The discrepancy between what experts deem important (i.e., based on quantitative risk analysis) and what the public deems important (i.e., based on personal preferences) makes it difficult to incorporate both scientific rationality and the democratic rights of the community into risk-based decision making. One way to reduce this opposition is to communicate with the public about risks and enable them to think about the problem in a similar way to experts. This public-education model was found to be faulty because it did not fully address public risk perceptions. Risk communication is now being modified to incorporate both technical and cultural rationality, with both being necessary to analyze a risk event. Technical rationality emphasizes objective inputs and is considered independent of the specific problem context. Cultural rationality emphasizes subjective or experiential information, is largely dependent on context, and seeks to incorporate technical information into a larger decision framework. Early risk communication models did not attempt to merge the two rationalities, but the authors argue that a better model would be one that creates respect for cultural risk perceptions and makes technical definitions of risk more accessible to the public or local culture.

REFERENCE NO. 115

CITATION:

Powell, D., and W. Leiss 1997. Mad Cows and Mother's Milk: The Perils of Poor Risk Communication. McGill-Queen's University Press, Montreal, PQ.

REFERENCE TYPE: Book



SYNOPSIS:

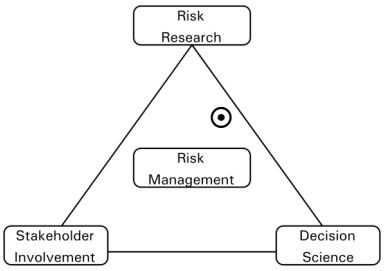
Effectively communicating the nature and consequences of environmental and health risks presents a significant public policy challenge. "Mad Cows and Mother's Milk" outlines—using several case studies—the role of risk management in dealing with public controversies, focusing on risk communication to highlight a series of lessons applicable across a wide variety of risk contexts. Included among the case studies presented are the risk-management and communication efforts surrounding the Bovine Spongiform Encephalopathy (BSE) scare in the United Kingdom and Canada, global warming, and genomic science. In each of these cases, the authors discuss how the hesitancy or unwillingness on the part of industry and government agencies to communicate meaningfully about potential risks can create, in their words, a “risk information vacuum.” This vacuum can—and often is—filled with information provided by other groups, namely agenda-driven organizations such as Greenpeace. Similarly, the authors are quite critical of the news media for their superficial treatment of many risk-related issues. However, while Powell and Leiss discuss in detail the essential role that risk communication plays in the broader risk management process, they offer very little in terms of how risk-communication efforts might be improved.

REFERENCE NO. 116

CITATION:

Read, D., A. Bostrom, M.G. Morgan, B. Fischoff and T. Smuts. 1994. What do people know about global climate change? Survey studies of educated laypeople. Risk Analysis **14**:971-982.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Currently, one of the most contentious and heavily debated environmental issues is the question of global climate change. Past research, using open-ended elicitation procedures with small subject samples, have shown that most laypeople have a poor understanding of the concept of global climate change with the majority of their knowledge of the subject being based on a mixture of correct and incorrect beliefs. This study attempts to expand these results by utilizing closed-ended elicitation procedures, which allow for larger sample sizes than previously used research methods, to examine lay perception of global climate change. In addition this study focuses on the perceptions of well-educated laypeople due to the following reasons: they may be the opinion leaders in their community, they are likely to take on activist and leadership roles, and their erroneous beliefs concerning global climate change are probably shared by their less-educated peers. The primary objectives of the study were to assess public understanding of the issue and to determine how to better design risk communications about global climate change. The survey used to collect data for the study was designed to assess participants' beliefs about the major concepts of climate-change processes. The survey examined several major content areas: 1) Has warming occurred and how much? 2) Basic processes associated with climate change. 3) What causes global climate change? 4) What are the effects of global climate change? 4) How can humans respond to global warming?

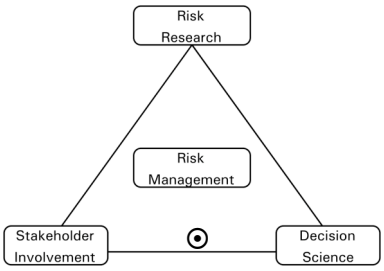
The study found that most educated laypeople failed to understand two central facts concerning global climate change: 1) The increase in the concentration of carbon dioxide in the atmosphere is the primary cause of global warming. 2) The burning of fossil fuels is the most significant source of carbon dioxide in the earth's atmosphere. The authors suggest that future risk-communication programs about the effects of global climate change must first address these two basic deficiencies in lay knowledge before addressing other more complex questions and concerns linked to the issue. The authors assert that the first steps in this process are addressing lay misunderstanding of stratospheric and tropospheric ozone problems, and their general blurring of global climate change with other environmental problems.

REFERENCE NO. 117

CITATION:

Redpath, S. M., B. E. Arroyo, F. M. Leckie, P. Bacon, N. Bayfield, R. J. Gutierrez, and S. J. Thirgood. 2003. Using decision modeling with stakeholders to reduce human-wildlife conflict: A raptor-grouse case study. Conservation Biology **18**:350-359.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

In order to successfully resolve human-wildlife conflicts, managers are increasingly aware that communities and other stakeholder groups must participate in the decision-making process. This participation is particularly important in decision-making about conservation policies that may affect the economic or social well-being of local people. These processes are often made more difficult when contentious issues polarize stakeholder groups, and communication between groups is limited. One way to evaluate the perspectives of different stakeholder groups and to assess the acceptability of management options to the groups is to use a multicriteria analysis.

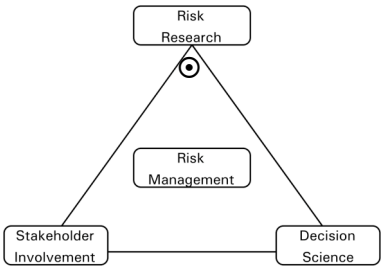
Using multicriteria decision analysis (MCDA) to evaluate the perspectives of two conflicting stakeholder groups, the authors conducted a workshop to evaluate management solutions for the conservation of a protected raptor (the Hen Harrier) and the management of a game bird (the Red Grouse) in the uplands of the United Kingdom. Red Grouse are managed for commercial hunting, and the Hen Harrier and other raptors are perceived to reduce grouse harvests, and are often killed as a result. During a 2-day workshop facilitated by two of the authors, conflicting stakeholder groups (raptor conservationists and grouse managers) met to quantify the criteria necessary to evaluate alternatives for management of moorlands (grouse habitat) and the legally protected raptors. The first step in quantifying the criteria was to create a hierarchical decision tree, which was then used as a framework for a MCDA. The combination of these approaches provides a transparent process by which decisions can be traced. This is accomplished by identifying the criteria used, the relative weights of the criteria, the individuals making the assessments, and the range of opinions within the stakeholder groups. Criteria were ranked and weighted by the stakeholders, and these weights were used as a basis for comparing other management alternatives. Although there was clear divergence between the groups on preferred management alternatives, participants found that the process highlighted areas for compromise and identified a common ground between the conflicting stakeholder groups.

REFERENCE NO. 118

CITATION:

Renn, O. 1992. Concepts of risk: A classification. Pages 53-79 in S. Krimsky and D. Golding, editors. Social Theories of Risk. Praeger, New York.

REFERENCE TYPE: Book [Chapter]



SYNOPSIS:

This chapter provides an overview of the various risk perspectives, describing the strengths and weaknesses of each approach as well as the realm of application for each. The authors state that all risk concepts or perspectives have one element in common, the distinction between reality and possibility. Apart from this commonality, each perspective differs in the way that it conceptualizes uncertainty, identifies negative effects, and reflects reality. The seven major risk classifications, as defined by the author, can be split into technical risk analyses (actuarial, toxicological/epidemiological, and engineering approaches), economic perspectives, psychological perspectives, sociological perspectives, and cultural perspectives. Technical risk analyses anticipate potential harm by averaging events over time and space and using frequencies to specify probabilities. Economic perspectives are similar to technical analyses, but potential harm is transformed into subjective utility measures that are based on a social definition of undesirable effects. Psychological perspectives further expand the realm of subjective or socially-defined risk measures by incorporating personal preferences for probabilities and recognizing the importance of contextual variables on risk perceptions (i.e., catastrophic potential, qualitative risk characteristics, expected number of fatalities, beliefs associated with a risk). Sociological perspectives vary widely with the base unit for analysis ranging from individualistic to structural and the nature of risk ranging from constructivist to objective. The common denominator among sociological perspectives is their interest in explaining or predicting social injustice in relation to the distribution of inequity. Cultural perspectives are based on the belief that social responses to risk are determined by cultural beliefs or practices. These perspectives include five cultural prototypes: atomized individuals, bureaucrats, hermits, entrepreneurs, and egalitarians.

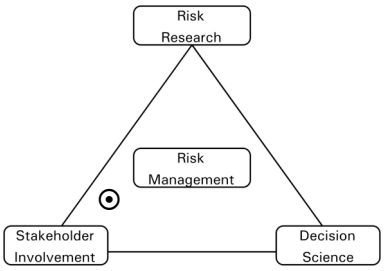
In summary, the author states that the various perspectives each have their specific role in analyzing and defining risk. However, an approach that integrates the strengths of each of the above-mentioned perspectives would be best for analyzing risk and making policy and management decisions. At the very least, an adequate approach to risk analysis needs to incorporate both technical and social perspectives of risk. The author mentions that one such integrated framework may exist in the concept of social amplification (see Reference No. 80).

REFERENCE NO. 119

CITATION:

Renn, O. 1999. A model for an analytic-deliberative process in risk management. Environmental Science & Technology **33**:3059-3055.

REFERENCE TYPE: Journal Article [Case Study]



SYNOPSIS:

A recent National Research Council report emphasized the need for assessment and dialogue when incorporating the public in risk-based decision making processes. They referred to this approach as the analytic-deliberative process. This paper addresses the need, potential, and requirements for a successful analytic-deliberative process when making risk-management decisions. The primary requirement of such a process is to combine both technical expertise and public values into the process through continuous two-way communication between experts and non-experts. The author proposes a hybrid model of citizen participation termed "cooperative discourse" as a means of successfully integrating analysis and deliberation. This model consists of three steps: 1) identification and selection of concerns and evaluative criteria, 2) identification and measurement of impacts and consequences related to different policy options, and 3) conducting a court-modeled discourse with randomly selected citizens as "jurors" and representation by interest groups as "witnesses". The author discusses several case studies where the cooperative discourse model has been applied in Germany, Switzerland, and the United States. The case studies demonstrate that the expectations of the model can be met on several levels (local, regional, and national) and that the approach is a valid method for eliciting preferences and value judgments from non-experts in a relatively short period of time.

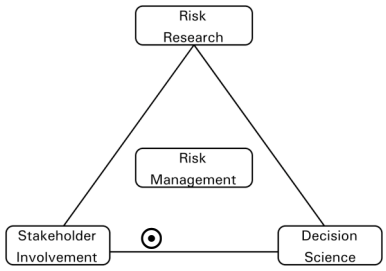
The paper concludes with a brief discussion of the model and its ability to assign specific roles to participants while also ensuring that citizens, experts, and stakeholders are engaged in continuous dialogue throughout the decision process. Based on the results of the case studies, the author believes that five conditions must be met in order for the model to be successful. First, the decision problem must have a variety of options. Next, exposure to the disadvantages of each option should be felt equally among the local population. There should also be enough personal experience among the participants to make them feel comfortable discussing the issues. Fourth, the final decision maker must be willing to consider the recommendations of the participants. Finally, a supervisory board must be available to help identify stakeholders and provide assistance throughout the process.

REFERENCE NO. 120

CITATION:

Riley, S. J., W. F. Siemer, D. J. Decker, L. H. Carpenter, J. F. Organ, and L. T. Berchielli. 2003. Adaptive impact management: An integrative approach to wildlife management. Human Dimensions of Wildlife **8**:81-95.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Because of increased stakeholder involvement in wildlife management, wildlife managers must develop management plans for a wide variety of stakeholders with diverse and often conflicting stakes in wildlife management. With increasing stakeholder involvement in wildlife management planning, a shift toward focusing on the impacts of human-wildlife interactions has been suggested. Impacts are significant positive or negative effects defined in terms of human values, and result from events or interactions involving: 1) wildlife individuals, populations, habitats, and communities; 2) wildlife-management interventions; and 3) stakeholder interactions with respect to wildlife. These impacts often result from events or interactions of several possible types: wildlife-wildlife interactions, wildlife-environment interactions, wildlife-human interactions, human-wildlife habitat interactions, and human-human interactions where wildlife is a reason for the interaction. The authors propose adaptive impact management (AIM) as an approach to managing these impacts, integrating knowledge from multiple disciplines and engaging stakeholders in participator management to identify important impacts.

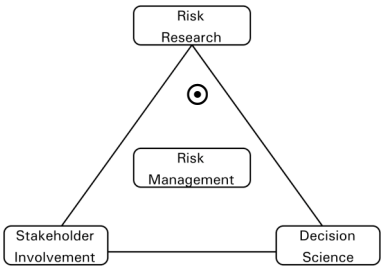
Adaptive management approaches frequently fail to identify and incorporate human values in the objectives, focusing on means objectives rather than stakeholder-defined fundamental objectives. AIM seeks to integrate the technical (biological) considerations with the human-dimensions considerations. AIM also seeks to define objective functions in terms of desired impacts as identified by stakeholders. By shifting the focus to impacts and stakeholder involvement, AIM will lead to management that more closely addresses the concerns of society, which will lead to stronger political support for experimental management. Additionally, AIM will lead to improvements in shared learning among scientists, managers, and stakeholders. The adaptive impact management (AIM) approach has seven components: situational analysis, objective setting, development of system model(s), identification and selection of management alternatives, actual management interventions, monitoring, and refinement of models and, eventually, interventions. The authors present an AIM example of the development of a statewide management plan for black bears in New York State. The New York Department of Environmental Conservation (DEC) created a team of biologists and managers to deal with growing concerns about impacts of increasing black bear populations in New York State. This team has worked with stakeholders to design a scale to measure bear impacts by state region, stakeholder group, and value orientation. Further qualitative assessments of stakeholder-defined impacts will be used in statewide black bear management planning.

REFERENCE NO. 121

CITATION:

Ropeik, D. and G. Gray 2002. Risk: A Practical Guide for Deciding What's Really Safe and What's Really Dangerous in the World Around You. Houghton-Mifflin Company, Boston, MA.

REFERENCE TYPE: Book



SYNOPSIS:

Presented in a series of narrative vignettes about individual risks encountered in the home, at work, during travel, in the environment, and in medicine, *Risk: A Practical Guide for Deciding What's Really Safe and What's Really Dangerous in the World Around You* by David Roepeik and George Gray is, at its core, a book written with two objectives in mind. The first of these objectives (*Risk*) involves outlining for the reader the risk associated with a number of commonly encountered events, motor vehicle accidents for instance. The second objective (*Deciding What's Really Safe and What's Really Dangerous*) involves helping the reader use the risk-information that is provided to make more thoughtful risk-management choices.

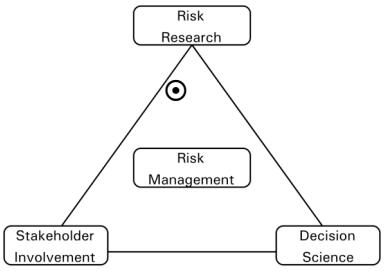
As Roepeik and Gray note in their introduction, risk (R), when formally calculated, is a function of the probability (P) of an event occurring and its consequences (C); i.e., R=P•C where P and C are further characterized by the level of exposure to a given hazard. Thoughtfully discussing risk in these terms is not an easy task, yet it is of little surprise that the authors, well respected in the field of risk analysis, excel at doing so. All of the risks presented in the book receive a virtually identical treatment in that essential facts are conveyed without overwhelming the reader with unnecessary detail. Each "chapter" (e.g., Tobacco, Motor Vehicles, Asbestos, Vaccines, etc.) located in one of three sections (I. Home, Transportation, Work; II. The Environment; III. Medicine) begins with the presentation of a schematic "risk meter," a two-factor, horizontal bar graph to display the likelihood of exposure to hazardous levels (a function of probability and exposure) and the consequences of the exposure to the hazard in terms of severity and the number of people potentially affected. Both factors are rated on a scale of low through medium and high. The remainder of each chapter is devoted to a carefully researched and appropriately detailed description of the hazard (e.g., what is a vaccine?; how does the hazard come to be?; what is the mechanism of potential harm?), the range of exposures (e.g., how are people exposed to the risk?; where does the risk occur?), and the range of consequences (e.g., what is the level of harm associated with the hazard and how does it manifest itself?). In the case of motor vehicle accidents, for example, attention is devoted to the number and type of vehicles involved, whether alcohol is a factor, speed, and the driver's age and gender (males are more likely to be involved in fatal crashes than females). Regarding the range of exposures, proper restraints, vehicle type and size, and whether pedestrians, bicyclists, and motorcyclists are involved are also discussed and factored into the final risk calculation. Finally, several pages are devoted to a discussion of how the risk can be reduced (e.g., avoiding impairment, utilizing restraining devices, and taking part in graduated licensing programs for young drivers).

REFERENCE NO. 122

CITATION:

Roth, E., M. G. Morgan, B. Fischhoff, L. B. Lave, and A. Bostrom. 1990. What do we know about making risk comparisons? Risk Analysis **10**:375-392.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Covello and colleagues developed a manual in 1988 for the chemical industry which advised plant managers on how to best communicate with the public using risk comparisons)see Reference No. 25). This manual was a significant addition to the risk-communication literature because it provided a framework for evaluating risk comparisons. The manual identified 14 categories of risk comparison, divided into five ranks. For example, the first-rank (highly acceptable) risk comparisons included comparisons of the same risk at two different times, comparisons with a standard, and comparisons with different estimates of the same risk. This paper tested Covello's categorization and ranking system by asking several groups of lay people to evaluate the acceptability of 14 statements (regarding the risks of a chemical produced by a small town plant) based on the 14 risk-comparison categories. The level of acceptability for each statement was measured by seven ratings scales based on Covello's definition of "acceptable." These scales included clarity, perceived relevance, perceived helpfulness, whether the risk appeared over- or underemphasized, reassurance quality, level of trust in plant managers, and whether the statement should be utilized by the plant manager when communicating with the public.

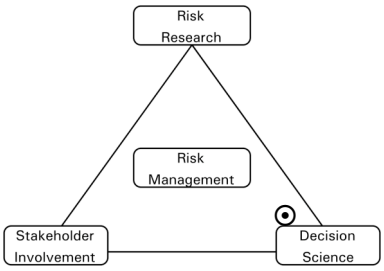
The results did not support the ranking system identified by Covello and colleagues. The subjects' actually placed three of the statements that Covello ranked high near the bottom of this study ranking, and three of the four statements that Covello ranked low near the top of this study's ranking. The authors identified four main reasons why the Covello ranking system may have done poorly. First, the comparison of risks across domains fared better than expected. Second, the comparison of occupational with environmental risks fared better than expected. Third the comparison with a standard and comparisons with different estimates of the same risk fared worse than expected. Fourth, the comparison of the risk of doing or not doing something fared worse than expected. The authors also suggest three reasons why the classification may have failed; these include flaws in measurement, flaws in the examples, and flaws in the underlying classification theory. The results of this study point to a need for further research into the effectiveness of risk comparisons because of the important role that they serve in risk communication and decision-making. They are key to helping individuals identify decision-relevant attributes, measure the magnitude of the consequences, and articulate individual preferences.

REFERENCE NO. 123

CITATION:

Rottenstreich, Y., and C. Hsee. 2001. Money, kisses, and electric shocks: On the affective psychology of risk. Psychological Science **12**:185-190.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Expected-utility theory and prospect theory both provide explanations for how decisions are made under risk. Each theory makes different assumptions concerning the impact of probabilities. Expected utility theory assumes that the actual probabilities are incorporated into the decision while prospect theory proposes a psychophysical deconstruction of probability (i.e., the impact of a given change in probability on a decision diminishes with its distance from certainty and uncertainty). The authors of this paper propose another weighting function, similar to the prospect-theory curve, but based on an affective rather than psychophysical deconstruction. The affective approach is based on the notion that the weighting function will be more S-shaped for choices (i.e., lotteries) involving affect-rich as opposed to affect-poor outcomes. In other words, contrary to expected-utility and prospect theory, probability and outcome will not be independent across outcomes with different affective values. The authors tested their affective-weighting function through three experiments, each involving choices between an affect-poor and an affect-rich outcome under either certainty (99 or 100% probability) or uncertainty (1% probability). They hypothesized that if the shape of the weighting function is influenced by affective reactions, then affect-rich prizes or options will elicit greater degrees of hope (under uncertainty) and fear (under certainty), resulting in greater jumps in the weighting function at each end of the curve (resulting in a function that is more S-shaped for affect-rich outcomes than for affect-poor outcomes).

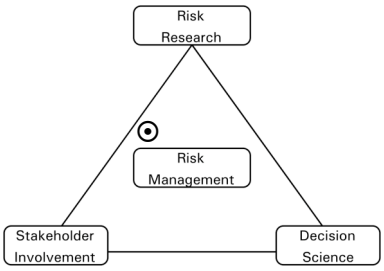
The results of the experiments supported the hypothesis. The affect-poor prize or outcome was preferred to the affect-rich prize under certainty, but the opposite occurred under low probability or uncertainty due to a larger weight being placed on small probabilities for the affect-rich prize. In other words, the results provide evidence for large weights being placed on small probabilities and small weights beings placed on large probabilities for affect-rich prizes. The results also indicated that the affective-weighting function holds for choices involving both gains and losses. In summary, the authors feel that these findings demonstrate a need to question the traditional view of choice under risk, specifically the use of separate functions for evaluating outcomes and probabilities, as well as the tendency of traditional views to ignore the affective components of decision making.

REFERENCE NO. 124

CITATION:

Ruckelshaus, W. D. 1985. Risk, science, and democracy. Issues in Science and Technology **1**:19-38.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

The environmental movement first began in the 1960's due to the writings of people like Rachel Carson and Barry Commoner. In the 1970's, dozens of environmental laws were passed and regulatory agencies were established to manage and control pollutants. More recently, the focus of environmentalism has shifted from regulating visible pollution problems like smog and raw sewage to focusing on the effects of invisible toxic pollutants on human health. This shift has changed the way in which science is applied to public health protection and environmental regulation, as well as raised questions regarding how to best manage risks within the context of democratic institutions. This essay discusses the success of our society at dealing with environmental risk, and points to early problems in environmental regulations as a barrier to effective environmental risk management in the present. The environmental laws of the 1970's mandated tough enforcement based on the assumptions that pollution problems were the result of weak enforcement by the states and that the federal government knew how to accurately measure pollutants and reduce them to acceptable levels at a reasonable cost. These assumptions turned out to be inaccurate, forcing regulatory agencies like the EPA to act under conditions of substantial scientific uncertainty (i.e., risk). The concept of risk did not play a part in developing the early environmental regulations; however it has now become clear that environmental management is largely about managing risk. Risk assessment was developed as a means to dealing with the scientific uncertainty inherent in the environment and our inability to establish zero-risk levels of pollutant exposure. However, there is concern that risk assessments may rely on assumptions that are scientifically untestable and that they may underestimate the risks from toxic substances. The author believes that risk assessments are useful for managing risk but they must be used with full recognition of their shortcomings.

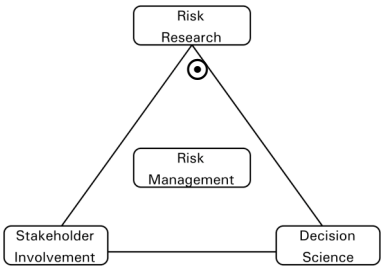
The author states that regulators must not be afraid to ask if controlling the risk is really worth it. Early regulations did not incorporate this concept into environmental management, which resulted in promises that could not be kept and expectations that could not be met. The author believes that the real definition of the problem is not environmental protection, but rather the management of risk. Risk management means giving regulatory agencies flexibility to confront and deal with risks at the local level. This flexibility should be bounded by rules that assess the adequacy and competence of information. It should also be limited by broad public acceptance and congressional oversight. Risk management should deal directly with public fear and mistrust by fully disclosing the risks involved in regulatory decisions and communicating the fact that zero risk is not possible (contrary to the goals set by early environmental legislation). Risk management, as a replacement for environmental protection, should focus on identifying acceptable levels of pollutants and managing long-term risks as opposed to focusing on immediate short-term health effects.

REFERENCE NO. 125

CITATION:

Satterfield, T. A., C. K. Mertz, and P. Slovic. 2004. Discrimination, vulnerability, and justice in the face of risk. Risk Analysis **24**:115-129.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

There is a substantial body of literature that explores the impact of gender and race/ethnicity on risk perception, but there is a dearth of studies that examine the role of discrimination and systematic environmental injustice in relation to the perception of risk. This article reports the result of a study that attempts to fill this gap by examining the American public's perception of discrimination, vulnerability and environmental injustice in the context of African-Americans', Hispanics', Asians', and Anglo-Americans' perspectives on health and environmental risks. The study was guided by four central research questions, which are followed in this synopsis by the respective significant findings related to them: Are white males characterized by the "white-male effect" less concerned about health and environmental safety problems than other demographic groups? The study found that in general the subset of individuals described by the "white-male effect" were less concerned about health and environmental safety issues than other demographic groups. To what extent does the experience of discrimination and vulnerability drive a concern for environmental health risks? The study found that those individuals that felt discriminated against or vulnerable perceived greater risk in environmental hazards than those individuals that did feel vulnerable or discriminated against. To what extent do stated beliefs about environmental injustice explain the perception of risk? The collected data suggests that individuals that expressed the belief that there were systematic inequalities in the distribution of environmental hazards were more likely to perceive greater risk than individuals that did not share similar beliefs. Finally, are differences in perceived risk between whites and nonwhites reduced when expressions of vulnerability and environmental injustice are controlled for? The study found that to some degree the significance of race and gender in relation to risk perception were reduced when expressions of vulnerability and environmental injustice were accounted for, but they still remained important and significant predictors of risk perception of environmental hazards. Data for the study was collected using a national telephone survey that over-sampled minority populations. The survey was designed to explore topics such as risk perception, worldviews, trust, environmental values, discrimination, and environmental injustice.

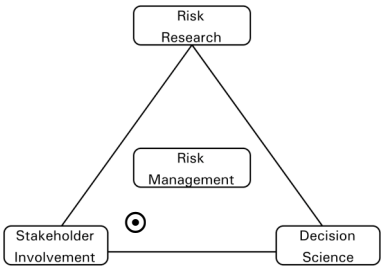
The authors suggests that their findings indicate the need for regulatory agencies that communicate and manage risk to multiple demographic groups to be sensitive to the perceived relationship between risk, vulnerability, and justice that many of these groups hold. In addition, there is a need for these agencies to recognize the impact of sociopolitical factors on risk perception in the development of policy that reflects diverse meanings of successful risk management and communication.

REFERENCE NO. 126

CITATION:

Satterfield, T., P. Slovic, and R. Gregory. 2000. Narrative valuation in a policy judgment context. Ecological Economics **34**:315-331.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

One of the biggest challenges in natural resource policy work is to involve both experts and non-experts in meaningful discussions about environmental values as a means to informing policy and management decisions. The facilitator or decision maker must choose the appropriate decision context and present background material in a way that avoids creating bias but also informs the participants. This paper tests a narrative-based decision context against a utilitarian context. Both judgment contexts contain specific quantitative and qualitative information, but the narrative relies on first-person storytelling, image-based description, and character development while the utilitarian condition utilizes passive language, justificatory evidence, and scientific thought.

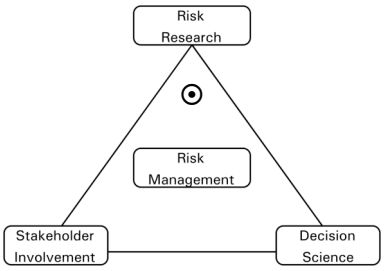
Participants in both conditions were presented with a single page of background information concerning hydroelectric production and salmon habitat. They were then asked to evaluate a policy alternative involving reductions in power production in exchange for increased water through the dam's spillways to improve salmon habitat. The experiment was meant to test two hypotheses, 1) that the language used to present the value inputs (i.e., cost, salmon population, spirituality, and significance of salmon to community) would influence which values were most influential in the final policy decision (i.e., utilitarian emphasizing economic and technical information and narrative emphasizing experiential and affect-laden information), and 2) that the narrative condition would outperform the utilitarian condition by generating stronger linkages between the value inputs and the policy evaluations. The results did not support the first hypothesis, but the second hypothesis was supported, participants in the narrative condition made better use of the value dimensions. However, participants rated the utilitarian condition higher for helping them think through both the technical and value considerations. Regardless, the authors still felt that the narrative condition performed well because the participants in that condition were more sensitive to changes in the attribute levels for each policy option and were better able to incorporate them into their decisions. Although the results are far from definitive in regards to the benefits of using a narrative condition, the authors believe that the narrative context warrants further exploration. They believe that it may improve information processing by embedding technical dimensions or relevant quantitative information into a good story allowing participants to utilize the two complementary judgment modes (analysis and deliberation) that are necessary for informed decision making.

REFERENCE NO. 127

CITATION:

Siegrist, M. 2000. The influence of trust and perceptions of risks and benefits on the acceptance of gene technology. Risk Analysis **20**:195-203.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

The development of gene technologies in the future depends heavily on the perceptions of the general public. Previous studies have found that social trust is a large factor in the perceptions and acceptance of new technologies because people have relatively little knowledge about the specific technology or risk-management decision. This paper tests a causal model for explaining the acceptance (i.e., perceptions of risks and benefits) of gene technology among the general population of Switzerland. The author's causal model of acceptance of gene technology was previously tested among university students. He found that trust had a strong influence on the acceptance of the technology, but no relationship was found among perceived risks and benefits. This goal of this study was to replicate the previous study but among the general population and across genders. It was hypothesized that the model would explain gender perceptions of gene technology, specifically that men would exhibit a higher level of trust than women and that trust would be the reason for the observed difference among other the other variables (i.e., perceived risk, perceived benefit, and acceptance of gene technology).

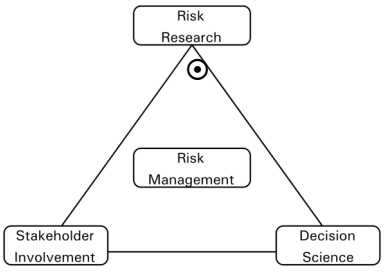
The author conducted a random survey of 1001 persons by telephone, with a final sample size of 693 respondents. The questionnaire was designed to measure the four constructs of the causal model (i.e., perceived risk, perceived benefit, trust in institutions, and acceptance of biotechnology) using 19 indicator variables (i.e., how do you assess the risks associated with altering cattle to increase the milk- or meat-production?). The results supported the model, indicating that it appropriately predicted perceptions both among the general population and across gender. Females exhibited a significantly lower level of trust, perceived lower benefits, and indicated a lower acceptance for the technology than men. When controlling for trust and perceived benefit, no significant differences were found across gender for perceived risk. The results suggest that social trust is an important factor influencing the perceptions of gene technology, impacting both perceived risk and benefit. The results indicate that companies involved in gene technology must work to increase trust with the public in order to gain acceptance for the technology. This may be achieved by both implementing strong regulations to minimize negative side-effect of the technology and framing the technology in a way that reflects important public values. The author believes that further study is needed to truly understand gender differences in risk perception and how that affects the acceptance of new technologies.

REFERENCE NO. 128

CITATION:

Siegrist, M. and G. Cvetkovich. 2000. Perception of hazards: The role of social trust and knowledge. Risk Analysis **20**:713-719.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Past research has shown that laypeople and technical experts often differ in their conclusions about the risks and benefits of different hazards. This is due in large part to the fact that technical experts posses a greater amount of knowledge, due to education and training, than the general public about the hazard[s] in question. Lacking this knowledge base, the average citizen must use other criteria to make assessments of various hazards' risks and benefits. One such criterion is the reliance of laypeople on the opinions of technical experts to guide their judgment of a hazard's associated risk and benefits. However, past research has also shown that the lay public is not indiscriminate in their selection of technical experts to help guide their assessments of risk, social trust plays a major role in this process. People trust the evaluations of experts that they believe share values that are important in a given situation. This article reports the results of a study that attempted to more closely examine the role of social trust and knowledge in the perception of risks and benefits. The researchers hypothesized that social trust in technical experts will be significantly related to judgments of risks and benefits for hazards about which an individual has little knowledge, but social trust will be less critical for risk/benefit assessments of hazards for which individuals are knowledgeable. The study employed a descriptive survey research method. On the survey participants were asked to make judgments concerning the perceived risks and benefits of various activities and technologies, trust in authorities regulating each activity or technology, and personal knowledge of the risks and benefits of each activity or technology.

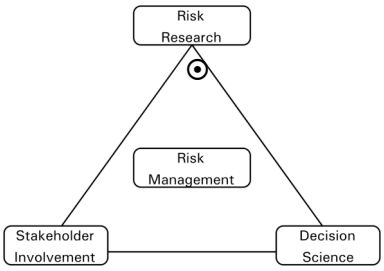
The results of the study supported the researchers' hypothesis. Individuals' risk and benefit judgments of activities that they have little knowledge of are correlated with their level of trust in the experts that regulate the respective activity. This correlation was much lower for those activities and technologies for which individuals reported having a personal knowledge. The authors suggest that the study's findings point to the need for regulators of complex technologies and activities associated with hazards that are considered dreaded and risky, such as nuclear power, to develop bonds of trust with relevant stakeholders. This should help to facilitate successful communications concerning risks and benefits.

REFERENCE NO. 129

CITATION:

Siegrist, M., G. Cvetkovich, and C. Roth. 2000. Salient value similarity, social trust, and risk/ benefit perception. Risk Analysis **20**:353-362.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Past research has shown that for many technologies there is an inverse relationship between risks and benefits. In other words, individuals have a tendency to associate low levels of risk with those technologies that they perceive as being beneficial and vice versa. In addition, researchers have shown that the perception of new and complex technologies, such as gene technology, as being safe and acceptable (beneficial) is correlated to individual's level of trust in officials and experts associated with the technology. Previous studies have shown a link between risk perception and social trust in technical experts; however, there is a lack of empirical studies that examine the link between social trust and the observed negative correlation between risks and benefits. The authors of this study address this gap in the literature by formulating a study focused on the idea that the inverse relationship between benefits and risks will be diminished when social trust is controlled. In order to examine this hypothesis the authors used the salient-value similarity model as a framework for the study. This model is composed of two core elements: salient values (values that indicate an individual's sense of what important ends and means should be followed in a particular situation) and value similarity (a comparison of the similarity of the salient values of the individual and the person being judged, the expert or agency official). Using this model as a base, the authors hypothesized that people share social trust with those who they also share salient values. Moreover, when this social trust is controlled for, the relationship between perceived risk and perceived benefit diminishes. Data was collected for the study using a descriptive-survey research methodology. The survey consisted of questions that examined participants' perception of risk and benefits for pesticides, nuclear power, and artificial sweeteners, their level of value similarity with experts and regulators of the above-mentioned technologies or products, and their level of social trust in these experts and regulators.

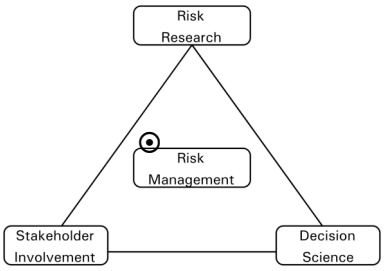
The authors found that for pesticides and artificial sweeteners, the correlation between perceived risk and perceived benefits decreased significantly when social trust was controlled. These findings also held true for nuclear power to a lesser degree. The researchers also found that social trust had a positive relationship with perceived benefits and a negative relationship with perceived risks. The results of the study suggest that the sharing of salient values is important in the development of social trust, and that this social trust has a significant impact on the assessment of the risks and benefits of a hazard.

REFERENCE NO. 130

CITATION:

Simons, M., and J. L. Arvai. 2004. Communicating the risks of wildland fire: Using mental models research to identify risk communication needs for natural resource management. Risk Analysis: In Press.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

In the context of risk-communication design, the mental-models approach is based on the notion that people tend to assemble their knowledge of risks into a conceptual map of ideas (i.e., a mental model). Model development in the context of research and practice in risk communication involves eliciting these conceptual maps from stakeholders via a carefully designed, open-ended interview protocol. Once elicited, it is possible to analyze these mental models with an eye toward looking for important gaps in stakeholders' knowledge. Identifying these gaps can help to pinpoint people's specific information and decision-making needs, and contribute to the development of a framework for more efficient and effective risk-communication processes. The research reported in this article involves the application of the mental-models approach to this unique context at the wildland-urban interface of an extremely fire-prone area: the Squamish Forest District (SFD) in southwestern British Columbia, Canada. The objectives of the study were to 1) examine and measure how local expert and non-expert stakeholders conceptualize wildland fire and its associated risks and benefits with the intent of identifying information gaps and disparities in relevant expert and non-expert knowledge, and 2) characterize expert and non-expert stakeholders' awareness of wildland fire-management activities.

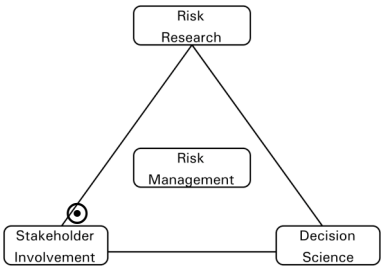
An analysis of the results revealed many gaps in non-experts' understanding of individual concepts and, by extension, a less-complete overall understanding of the mechanics, risks, and benefits of wildland fire when compared to the mental models of sampled experts. Specifically, many important concepts were notably absent from the mental models of non-experts in the SFD. For example, most non-experts did not identify the effects that forest-management activities such as fire suppression (identified by 23% of the non-expert sample) and timber harvesting (identified by 46% of the non-expert sample) can have on fuel accumulations. The mental models were also analyzed and revealed several gaps in understanding. For example, experts and non-experts did not differ significantly with respect to their understanding of possible fire ignition sources as well as potential risks to the environment and people's quality of life. Beyond these knowledge gaps, the study also revealed several areas of robust knowledge. For example, both groups possessed robust knowledge of the threats that fires pose to air and water quality, wildlife habitat, and soil quality. Overall, this study provides local wildland fire managers with guidance for the design of risk-communication efforts that would both 1) facilitate the exchange of information between experts and non-experts and 2) provide all stakeholders with relevant technical and values-oriented information on which to base judgments about wildland fire management.

REFERENCE NO. 131

CITATION:

Sjoberg, L. 2003. Attitudes and risk perception of stakeholders in a nuclear waste siting issue. Risk Analysis **23**:739-749.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Much of the recent research in the fields of risk communication and management have emphasized the importance of including stakeholders in decision-making processes. However, a common concern surrounding the issue of stakeholder involvement is if these individuals are truly representative of wider public opinion. This is of particular significance to government agencies that are charged with enacting policies that are deemed best for general society. The research reported in this article explore the idea of stakeholder inclusion, its objective was to determine if stakeholders are representative of the people they claim to represent if they differ in opinion. The context for the research was the siting of a permanent high-level nuclear-waste repository in one of four communities in Sweden. To collect data for the study, the researcher mailed 1500 extensive questionnaires to a randomly selected set of individuals in each community. The questionnaire was composed of items that examined participants' support for a waste repository, self-reported involvement and interest in the issue, self-reported activities with regard to a proposed local repository, perceived risks of nuclear waste, perceived risk and benefits of a local repository, perception of risk from 26 general hazards, and an attitude scale to identify extreme views concerning the siting of the repository in the local community. In this study a stakeholder was defined as an individual that has special concern or interest in an issue, and can be considered concerned either on the basis of self-report or on the basis of observed activities; objective criteria such as real-estate ownership near the proposed site were not considered. The researcher hypothesized that stakeholders would have more extreme views than others.

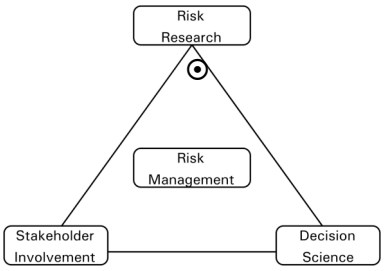
The study found that those individuals that were identified as stakeholders (by their responses to survey items concerning self-reported involvement and interest in the issue and self-reported activities with regard to a proposed local repository) had more extreme views than non-stakeholders. Those stakeholders that were opposed to the siting of the repository in their local community made the most negative ratings of the risks they associated with the issue, and were least positive concerning the possible benefits of a potential facility. Those stakeholders that supported the siting of a local repository held the exact opposite views. These findings confirm the researchers' hypothesis, and suggest that there should be guarded optimism concerning the involvement of stakeholders in decision-making processes that may be perceived as risky. Stakeholders may hold views more extreme than the general public that may bias the process of political and social problem solving. The author concludes on this accurate but rather naive note: in a democratic process the views of everybody should be heard and taken into account, not just the most vocal.

REFERENCE NO. 132

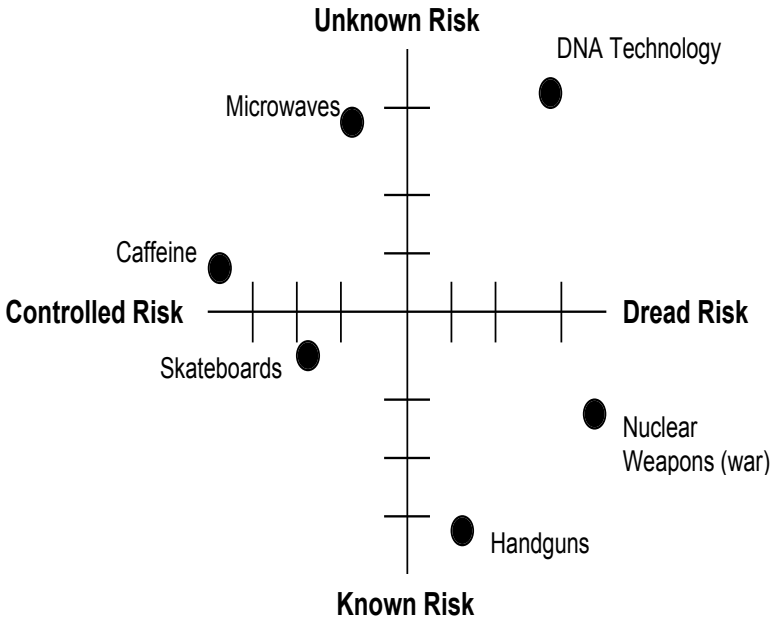
CITATION:

Slovic, P. 1987. Perception of risk. Science **236**:280-285.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:



In this seminal article the author explores the perception of risk in the context of the psychometric paradigm. The psychometric paradigm is a taxonomic scheme that uses psychophysical scaling and multivariate analysis techniques to produce cognitive maps of risk attitudes and perceptions. Individuals make quantitative judgments concerning the current and desired riskiness of a variety of hazards and the desired level of regulation of each. These judgments are then correlated to characteristics of hazards that have been hypothesized to explain risk perceptions and attitudes that anchor the two axes of the paradigm. One axis measures unknown risk and known risk on each end, the other axis measures dread risk and controlled risk. The various hazards are then placed on the scale according to their placement on the two axes. For example, there is a large amount of dread associated with nuclear weapons, but some knowledge of the risk that is associated with them. On the other hand the use of caffeine is seen as a very controlled risk, but there is a certain amount of uncertainty concerning its possible risk.

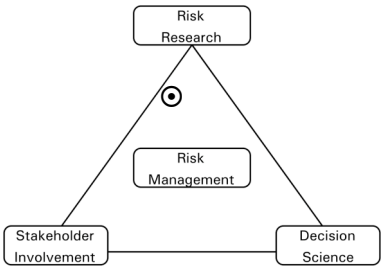
The utilization of the psychometric paradigm to examine risk perception is useful in aiding risk analysis and policy-making in two ways. First, it can help provide a basis for understanding and anticipating public response to hazards. For example, the management of the occurrence of an accident involving a hazard such as DNA technology would have to account for the relatively high level of uncertainty surrounding the technology and the high level of dread associated with it. The use of the psychometric paradigm allows decision-makers to be cognizant of these factors beforehand. In addition, the use of this paradigm can help improve risk communication between lay people, technical experts, and decision makers concerning these hazards.

REFERENCE NO. 133

CITATION:

Slovic, P. 1992. Perception of risk: Reflections on the psychometric paradigm. Pages 117-152 in S. Krimsky, and D. Golding, editors. Social Theories of Risk. Praeger, New York, NY.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

This chapter provides an overview of the psychometric paradigm including 1) early results, 2) more recent developments, and 3) new methods of analysis for understanding risk perceptions. The author begins by explaining that the psychometric paradigm was developed out of work regarding revealed preferences. The revealed preference approach assumes that society, through a process of trial and error, arrives at a balance between the risks and benefits for any activity or event. The author and his colleagues tested this theory by directly asking participants for their perceptions of risks and benefits and their expressed (as opposed to revealed) preferences for risk/benefit tradeoffs, resulting in the theoretical framework now known as the psychometric paradigm. 1) Early work in this area led to the development of factor-analytic representations of hazards (mapping of hazards across dread and unknown risk) as well as the identification of the signal potential of an event or the potential social impact. 2) Recent developments include replications of early work across a wider range of respondents and a wider range of hazards and risk characteristics. 3) New methods of analysis include exploratory multivariate methods like principal components factor analysis and INDSCAL, and confirmatory multivariate methods like covariance structure analysis and partial least squares analysis. A new form of risk impact has also recently been developed, based on the concept of stigma. Stigmatization was found to be closely associated with risk perceptions through the stigma dimension of peril, or the level of danger associated with the event or activity.

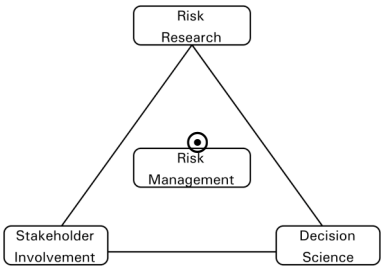
The author concludes the chapter with a discussion of the need for a multidisciplinary approach to risk perceptions and society's response to hazards. He suggests that future research regarding risk perceptions should focus on 1) incorporating value-laden considerations into risk definitions regardless of whether they appear rational, 2) utilizing risk analysis techniques that integrate technical, economic, and social factors into risk definitions, and 3) exploring the role of trust in defining risk and creating risk perceptions.

REFERENCE NO. 134

CITATION:

Slovic, P. 1993. Perceived risk, trust, and democracy. Risk Analysis **13**:675-683.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

This article examines two fundamental trends pertaining to risk perception and risk management. First, although American society on a whole has become healthier and safer on average, the American public has become more concerned about risk. Second, as time has passed, risk assessment and risk management has become more—not less—controversial. In discussing these trends, the author draws upon recent research focusing on the roles played by social values and trust in risk perception and risk management.

Early risk perception studies identified the public's sensitivity to several dimensions of risk that were not accounted for in technical risk assessments. Qualities such as uncertainty in risk assessments, aversion to exposure to involuntary risks, and perceived inequity in the distribution of risks and benefits colored the public perception of risk. Additionally, numerous studies have identified trust as a critical factor in risk perception and risk management. The author identifies an asymmetry between the difficulty of creating trust and the ease of destroying it. This "asymmetry principle" is reflected by four fundamental mechanisms of human psychology:

1. Negative (trust-destroying) events are more visible or noticeable than positive (trust-building) events,
2. Trust-destroying events carry much greater weight than trust-building events,
3. Sources of bad (trust-destroying) news are often seen as more credible than sources of good news, and
4. Once initiated, distrust tends to reinforce and perpetuate distrust.

In addition, two contributing factors in society amplify distrust in risk situations. First, powerful technological changes have given electronic and print media the capability to inform us of news almost as it happens. Much of the news reported in the media is "bad" (trust-destroying) news. A second contributing factor is the rise of powerful special-interest groups using their own experts and the media to influence risk policy.

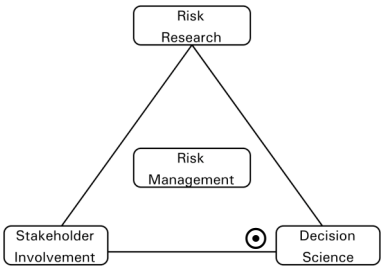
To address the two trends identified at the beginning of this review, the author identifies two possible approaches to risk management. On the one hand, *less* public participation and more centralized control (such as with nuclear power generation in France) may remove much of the public focus from risk management activities; this option is unlikely to be acceptable in the U.S. A second option—advocated by a variety of federal agencies—requires a higher level of power sharing and public participation that has yet to be implemented in most risk-management processes thus far.

REFERENCE NO. 135

CITATION:

Slovic, P. 1995. The construction of preference. American Psychologist **50**:364-371.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

Studies of decision making emerged in the 1950's within the field of psychology. The first theories of choice and decision making assumed that decision- makers were completely informed about the various courses of action and the associated consequences, that they were sensitive to differences among alternatives, and that they were rational in the sense that they could make choices in their best interest (maximizing their own utility or expected utility in choices made under uncertainty). Another basic assumption was that individual preferences did not depend on the way that options were described (descriptive invariance) or the method of elicitation (procedural invariance). In more recent years, studies have shown that preferences are actually quite dynamic and sensitive to the way that a choice or problem is framed and to the mode of response used to express preferences. This constructive nature of preference is now the prevailing view regarding the way that people make decisions, especially complex, risk-laden decisions.

This article reviews the history of research on preference reversals, which are changes in preference for two equivalent options induced by the type of elicitation or response mode. These preference reversals were first identified by studies in the late 1960's and early 1970's where participants were asked to make choices about a pair of gambles, and they often indicated a higher preference for one option, but placed a higher dollar value on the other option. These early preference-reversal studies established the robustness of the phenomenon, but the cause for it remained unclear. A second wave of studies in the 1980's attributed the majority of preference reversals to the compatibility hypothesis (that the compatibility between a cue and the required response will affect the importance of the cue in determining the response) and the prominence effect (that the more important attribute will weigh more heavily in choice responses than in matching).

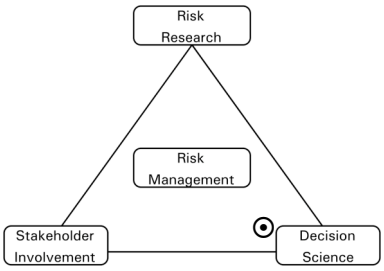
Practically speaking, understanding preference construction, and specifically preference reversals, is important when incorporating both experts and non-experts in a decision-making process. The inconsistent preferences of decision-makers can bias the results of a participatory decision process unless someone (namely the facilitator) is able to structure the process in a way that elicits informed, value-based judgments from the participants. Due to the constructive nature of preferences, it is possible to achieve this goal through decision aiding and analysis techniques that encourage the responsible management of preferences.

REFERENCE NO. 136

CITATION:

Slovic, P., and R. Gregory. 1999. Risk analysis, decision analysis, and the social context for risk decision making. Pages 353-365 in J. Shanteau, B. A. Mellers, and D. A. Schum, editors. Decision Science and Technology: Reflections on the Contributions of Ward Edwards. Kluwer Academic. Boston, MA.

REFERENCE TYPE: Book [Chapter]



SYNOPSIS:

Risk analysis has become increasingly prominent among government agencies and industries as they try to address public concerns for a safer and healthier environment. However, despite the effort to decrease risk perceptions, the public has become increasingly concerned about risk issues, believing that as a society we are facing greater risks in our daily life than in the past. The authors believe that the inability of risk analysis techniques to adequately address public concerns about risk may be due to a failure of risk-analysis to address the complexity of risk and the social perceptions or definitions of risk. They contend that decision-analysis techniques may be more useful for assessing risk (i.e., choosing risk measures, framing risk information, addressing the multiple dimensions of risk).

The authors address four potential advantages of decision analysis techniques over a risk-analysis approach. 1) Decision-analysis techniques are grounded in a social context for decision making. 2) Decision-analysis techniques respect the subjective nature of risk, while risk-analysis techniques view risk as real and objective with risk perceptions being perceived as emotional and irrelevant. 3) Risk-analysis efforts are largely expert-centered while decision analysis seeks out a wide range of stakeholders (both experts and non-experts) as part of the decision-making process. 4) Decision analysis recognizes that there are no universally acceptable risk levels while risk analysis seeks out a specific number to define the acceptable level of risk.

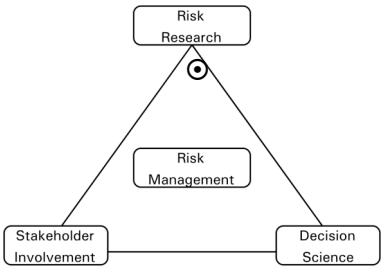
Additionally, the context-specific nature of decision analysis has advantages over risk analysis in regards to risk management. Decision analysis is process-based, which increases the level of trust that participants have in the final outcome or decision. Decision analysis can also provide concrete answers to questions that are often unanswerable through risk analysis (i.e., directly asking stakeholders which measure of mortality is best for the specific situation).

REFERENCE NO. 137

CITATION:

Slovic, P., and E. Peters. 1998. The importance of worldviews in risk perception. Risk, Decision & Policy **3**:165-170.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

In this article, the authors emphasize the importance of worldviews in relation to the perception of risk and describe the four primary worldviews that have been identified by past studies to significantly impact risk perception. Worldviews are general attitudes toward the world and its social organization that serve as guides to orient people's responses to complex situations. They emerge due to people's attitudes toward social relations and past experiences. The authors provide brief descriptions of the four worldviews that have been shown to impact risk perception: 1) A *hierarchal* worldview places great trust in organized social structure and the establishment, and discourages the appearance of social deviance. 2) An *individualist* worldview values individual achievement, self-regulation, and the belief that people should be rewarded for their efforts. It is also characterized by disdain for social rules that constrain individual initiative. 3) An *egalitarian* worldview emphasizes distrust in organized social structures and the establishment, and is centered on the belief that wealth and power should be evenly distributed in the world. 4) Finally, a *fatalist* worldview views nature as uncontrollable and dangerous and favors the implementation of strict regulations on personal behavior.

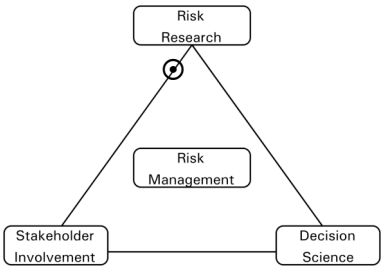
The authors suggest that recent criticisms of the empirical significance of worldviews in the context of risk perception discounts the measurement of effect-size between the two variables, which has been found to be substantial in magnitude. In addition, this criticism disregards the important role that worldviews play in helping people to navigate a complex world, and the insight they provide into the failure of technical information to address risk controversies between the lay public and technical experts.

REFERENCE NO. 138

CITATION:

Slovic, P., N. Kraus, and V. T. Covello. 1990. What *should* we know about making risk comparisons? Risk Analysis **10**:389-392.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

In this short commentary, the authors examine the use of comparing unrelated risks (typically a relatively benign hazard with a more menacing hazard) in communication efforts that attempt to stress the acceptability of risks that may have negative connotations. An example of this is the comparison of the risks of drinking diet soda (a benign hazard) with the risks of being exposed to low-levels of asbestos (a rather ominous hazard). Often risk comparisons such as the one made above are used as a means for setting policy priorities concerning risk management and determining which risks are acceptable. In other words, they suggest which risks should be ignored, which risks people should be concerned about and how much risk reduction should be sought. The authors suggest that such risk comparisons and the various ways in which they are used in risk-communication processes are inherently flawed. The central problem with these risk comparisons is that they do not account for the fact that risk acceptability depends on a wider range of factors than probabilities or expected fatality or morbidity estimates, which are the typical basis of these comparisons. Factors such as the voluntary or involuntary nature of exposure to the hazard, the level of dread associated with the hazard, the known or unknown nature of the risk associated with the hazard, or the level of control an individual has over the hazard have all been shown to be important to lay audiences' judgments of acceptable risk levels.

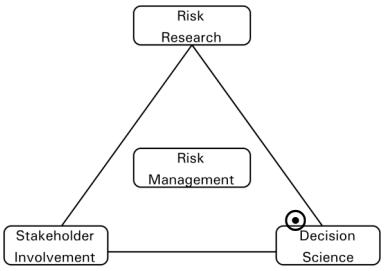
The authors close the article by offering sage advice to those individuals that manage, assess, and communicate risk. Instead of relying on often-misunderstood risk comparisons to communicate risk, they should attempt to relate risk concerns to their constituents over the long term in ways that establish trust, credibility, and mutual respect.

REFERENCE NO. 139

CITATION:

Slovic, P., D. Griffin, and A. Tversky. 1990. Compatibility Effects in Judgment and Choice. Pages 5-27 in R. M. Hogarth, editor. Insights in Decision Making: A Tribute to Hillel J. Einhorn. University of Chicago Press, Chicago, IL.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

This chapter reviews a series of experiments that were designed to test the compatibility hypothesis. This hypothesis states that the weight of a stimulus attribute is enhanced by its compatibility with the response mode. The compatibility hypothesis may be one explanation for the constructive nature of preferences or choice behavior. The authors first investigated this hypothesis in the context of predicting market values and individual course grades. Participants in the first study were given the market value and profit-standing rank for 12 U.S. companies. They were then asked to predict either the following year's market value for each company or their rank. Participants in the second study were given a list of students and their letter grade from one course as well as class rank. They were then asked to predict either the student's grade in a new course or their rank in that same course. The results from both studies supported the compatibility hypothesis. Specifically, the weight given by each participant to the given predictors (market value or rank, course grade or rank) depended on the response mode. For example, subjects who were asked to predict market value for the 12 companies relied more heavily on the market-value predictions than the profit rankings, and vice versa.

The authors then investigated the hypothesis further in the context of gambling choices, specifically testing whether the hypothesis provides an explanation for preference reversals. They believe that when given the choice between a high-probability/low-payoff bet (A) and a low-probability/high-payoff bet (B), individuals will indicate a preference for A but a higher selling price for B because the payoff attribute is more compatible with the selling-price response mode (higher payoff = higher selling price). The authors tested this hypothesis using a contingent-weighting model where the relative weight of an attribute varies with the method of elicitation. The model provided support for the compatibility hypothesis as a means of explaining preference reversals, specifically overpricing of low-probability/high-payoff bets.

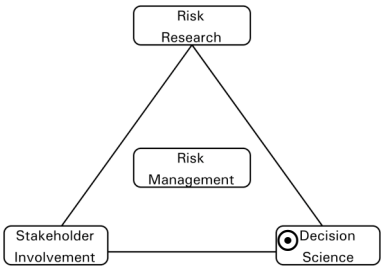
These experiments were the first attempt to directly test the notion of compatibility as a possible cause of preference-elicitation effects. They found that enhancing the compatibility between an attribute and the response mode led participants to place a greater weight on that attribute when making judgments. In regards to risk-management decisions involving the public, it is important to be aware of the impact that compatibility can have on individual preferences and predictions. People are largely unaware of this phenomenon and it can easily lead to biased judgments (poor decisions that do not reflect the true desires of the individual), especially when the decision is risky and complex.

REFERENCE NO. 140

CITATION:

Slovic, P., M. L. Finucane, E. Peters, and D. G. MacGregor. 2002. The affect heuristic. Pages 397-420 in T. Gilovich, D. Griffin, and D. Kahneman, editors. Intuitive Judgment: Heuristics and Biases. Cambridge University Press, Cambridge, UK.

REFERENCE TYPE: Book [Chapter]



SYNOPSIS:

This book chapter introduces a theoretical framework describing the importance of affect in judgment and decision making. Affect is defined as a feeling-state that people experience such as “calmness” or “upsetness” or a quality associated with a stimulus such as its “goodness” or “badness.” These experienced feelings or qualities, in turn, influence judgments, sometimes working in parallel with cognitive processes and sometimes pre-empting them. In particular, use of an *affect heuristic* leads to judgments about objects, activities, and other stimuli shaped by the varying degrees of positive or negative feelings attached to them. Affect has only recently been recognized as an important component of decision making. Psychologists used to believe that feelings, or affective responses, were post-cognitive, that they only came into play after considerable information processing. However, affective judgments are now thought to be an individual’s first reaction during decision making, therefore guiding future processing and judgment.

The authors provide evidence for the role of affective judgments in constructing preferences by enhancing the attractiveness and imagery of an option, enhancing the evaluability of options through affective mapping (more precise affective impressions carrying more weight in judgments), leading to proportion dominance (favoring descriptions of attributes as a proportion or percentage), and creating insensitivity to changes in probability. The authors also describe the role of the affect heuristic in perceptions of risks and benefits, that they have an inverse relationship largely based on the strength of the positive or negative affect associated with the activity. The authors then compare the affect heuristic to the model of “risk as feelings” and dual-process theories, claiming that individuals use two complementary processing modes when making decisions, the analytic or rational system and the deliberative or experiential system. Affective judgments exist within the experiential system, and the use of an affect heuristic results in the dominance of the experiential system during judgments.

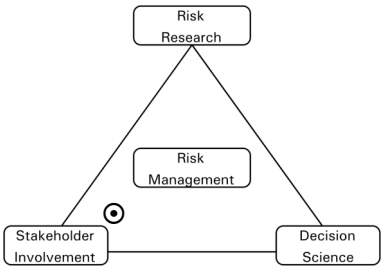
Despite the often beneficial and adaptive nature of affective judgments, they can also be detrimental during decision making because of the ease with which they can be manipulated and the inherent bias that exists within the experiential system. It is necessary to account for and incorporate these affective judgments when making complex policy and management decisions, both because of their importance within human decision-making processes but also because of their ability to bias decisions by overwhelming the equally important and complementary analytic judgments necessary for making informed judgments.

REFERENCE NO. 141

CITATION:

Smith, P., and M. McDonough. 2001. Beyond public participation: Fairness in natural resource decision making. Society and Natural Resources **14**:239-249.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Many attempts at incorporating the public in natural resource decision-making processes have failed to resolve conflicts among the various stakeholders, create support for the decision, or increase the level of trust participants place in decision makers. The authors suggest that theories on distributive and procedural justice support the idea that both the process and the outcome be perceived as fair in order for participants to feel satisfaction with the decision. The three principles of distributive justice (focused on outcomes) are equity (everyone receives rewards that are in proportion with their effort), equality (everyone benefits equally), and need (everyone receives benefits according to their needs). Procedural justice (focused on process) is generally based on the idea that people judge the fairness of a decision process by their level of direct participation in the process and whether or not they had the opportunity to voice their opinions or concerns. According to these theories, trust results from a decision process that is judged to be fair. The authors conducted 53 focus groups, ranging from 3 to 20 participants, in the context of the Northern Lower Michigan Ecosystem Management Project (NLMEMP). Participants were asked what was important to them about northern lower Michigan, what concerns they may have, what visions they may have for the future, whether or not they felt involved in natural resource decision-making processes, and what factors either inhibited or encouraged public participation.

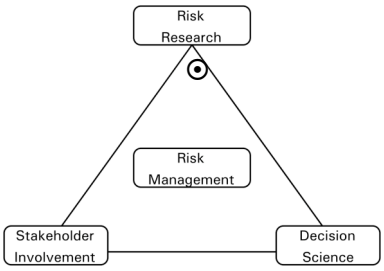
The results of the focus groups highlighted five key fairness themes: 1) representation, 2) voice, 3) consideration, 4) logic, and 5) desired outcome. In general, the participants did not feel involved in natural resource decisions because these principles of fairness were not being met or addressed.

REFERENCE NO. 142

CITATION:

Smith, K., W. H. Desvousges, F. R. Johnson, and A. Fisher. 1990. Can public information programs affect risk perceptions? Journal of Policy Analysis and Management **9**:41-59.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

In the 1980s, the U.S. Environmental Protection Agency (EPA) began to develop risk-communication policies in response to risk situations where 1) a wide disparity existed between scientific risk estimates and the public perception of these risks, 2) where regulatory authority for direct intervention was absent, or 3) where education and public information programs offered the only feasible strategy for reducing risk. One example of this policy is the EPA's radon policy, which emphasizes informing the public about radon risk (including how to test for radon and how to mitigate high radon levels). The policy also sets forth to provide technical assistance to states regarding radon risks. Rather than setting a health standard for radon, in 1986 the EPA issued Action Guidelines for radon. At that time, there was little practical information available on structuring an effective risk-communication program. With the support of the EPA, the research reported here set out to evaluate the effectiveness of risk-information materials about radon in the home.

Monitors were placed in 2,300 homes, and the households received radon readings along with information materials explaining risks from radon. Six different types of informational materials were designed, and households were assigned one type of informational materials, and households were interviewed before and after they received two separate informational materials (from the assigned type) explaining radon risks. These included, first, measurement for a 2-month exposure period, and second, for a one-year exposure period. The results indicate that the information materials sent to the households (and any other information the households may have acquired) generally led to perceptions of lower radon risks that the limited information offered by radon testing companies. Based on these results, the authors offer several recommendations for effectively communicating radon risk information. These recommendations include:

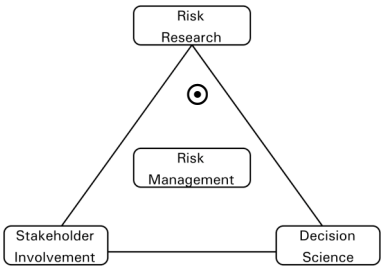
1. Do not try to downplay risks or limit information to avoid misunderstandings or undue alarm.
2. Include quantitative information about the likely range of risk estimates to help people form realistic risk perceptions.
3. Recognize that many people will perceive action levels as safety standards.
4. Don't expect a single information booklet to achieve all the goals of an information program.

.REFERENCE NO. 143

CITATION:

Taylor, S. E., M.E. Kemeny, L.G. Aspinwall, S.G. Schnieder, R. Rodriguez, and M. Herbert, 1992. Optimism, coping, psychological distress, and high-risk sexual behavior among men at risk for Acquired Immunodeficiency Syndrome (AIDS). Journal of Personality and Social Psychology **63**:460-473.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Past research has shown that people are overly optimistic about their likelihood of experiencing positive life events and not encountering negative experiences. In other words, most people see themselves at lower risk than other individuals for developing a terminal illness, being in a car wreck or experiencing other adverse situations. On the other hand, most people also believe that they are more likely to have a successful career, a good marriage, and to experience other positive events than the average person. There is a divergence of opinion in the literature if this unrealistic optimism and perception of personal risk is fundamentally adaptive or maladaptive. It has been suggested that this unrealistic optimism is helpful in maintaining a mentally healthy personality and coping with stress. However, it has also been suggested that unrealistic optimism may prevent people from adequately preparing for the future. The research presented in this article explores the link between unrealistic optimism and personal risk perception with personal health behaviors and coping with stressful situations. The study examines these concepts in the context of men at high risk for acquiring AIDS, their personal health behaviors, and their ability to cope with HIV/AIDS related stress. The researchers surveyed and interviewed 550 bisexual men (238 were HIV seropositive, 312 were HIV seronegative, none had developed AIDS) participating in the Multicenter AIDS Cohort Study (MACS). The study's interview protocol and survey focused on the following topic matters: knowledge of HIV, attitudes and knowledge concerning AIDS, coping with HIV/AIDS, and behaviors to reduce the risk of developing AIDS.

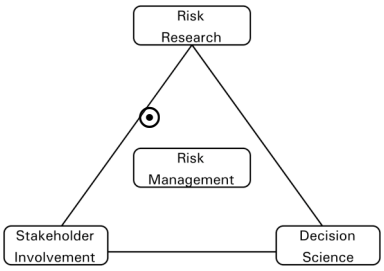
The study found, in general, that those men that reported an optimistic point of view were able to better cope with the stress associated with the possible development of HIV/AIDS, than those individuals that reported a more fatalistic perspective. However, there was no link between an optimistic or fatalistic viewpoint and the practice of health behaviors to reduce the risk of developing AIDS. It was shown that the majority of participants reported that they practiced health behaviors to help reduce the risk of developing AIDS. These findings suggest that an overly optimistic outlook may be psychologically adaptive without compromising personal health behavior.

REFERENCE NO. 144

CITATION:

Vaughan, E. 1995. The socioeconomic context of exposure and response to environmental risk. Environment and Behavior **27**:454-489.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Past research has shown that individuals living in poverty are most vulnerable to the negative effects of many health and environmental risks; however, they have the least amount of control over the management of these risks. In addition, there are few studies that explore how these marginalized individuals respond to this high level of risk. This is a significant problem as regulatory styles of risk management are being replaced by non-regulatory strategies, which rely on individuals across society being active in the risk-management process. In order for such strategies to be effective they need to be sensitive to a variety of social contexts that may influence risk behavior. In this article the researchers present the result of a study that examined the impact of socioeconomic factors on individuals' exposure and response to health or environmental risks in a marginalized population exposed regularly to pesticides, Mexican immigrant farm workers. The study used a social-ecological perspective of health or environmental risk behavior as a framework. This allows for the examination of how socio-cultural variables influence individual adaptation to environmental risks. The study collected data from 437 Mexican immigrant farm workers located in several agriculture regions of California. Each participant took part in structured interviews that consisted of several topic areas: perceived exposure to pesticides and use of self-protection methods, amount of information received about pesticides, perceived risks of pesticides, perceived control over pesticide risk, and general risk beliefs.

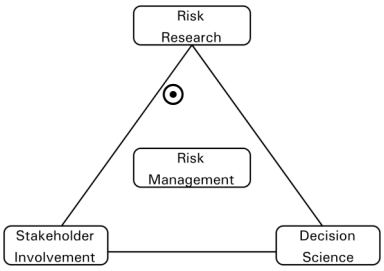
Three primary themes emerged regarding socioeconomic conditions and individual's risk behavior and perception from the study's results: 1) Risk perception and self-protective behavior may vary systematically with socioeconomic context. 2) Socioeconomic factors can directly influence risk perception and self-protective behavior. 3) Socioeconomic factors not only directly impact risk perception and self-protective behaviors, but they also indirectly influence them through other variables. For example, the researcher found that the perception of risk from pesticides was associated with past harm and the perceived difficulty of finding work outside of agriculture. The ability to locate other work is correlated to laborers' socioeconomic context. The researcher also found that despite Mexican farm laborers being homogenous in regard to ethnicity they were heterogeneous in terms of socioeconomic level, which led to intra-ethnic variation in their perception of risk and self-protection behaviors.

REFERENCE NO. 145

CITATION:

Vaughan, E., and B. Nordenstam. 1991. The perception of environmental risk among ethnically diverse groups. Journal of Cross-Cultural Psychology **22**:29-60.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

The qualitative and quantitative aspects of a risk situation influence the perception of and response to environmental risk, at a behavioral, cognitive, or affective level; however, it has also been shown that personal characteristics also effect an individual's reaction to environmental risk. Along these same lines, previous studies have shown that people who share similar life experience, attitudes, and values share similar risk perceptions. While there are numerous variables that could be used to differentiate among individuals in terms of shared cultural values and life experiences, ethnic background is a good starting point that has been previously correlated with life situations relevant to risk evaluation. In addition, a focus on the influence of ethnicity on risk perception is particularly relevant in an increasingly heterogeneous population such as the US. In this landmark article, the authors review the relevant literature that presents evidence of ethnic differences in environmental risk perception in several areas (natural hazards, technological risks, and risks in the context of the ambient environment).

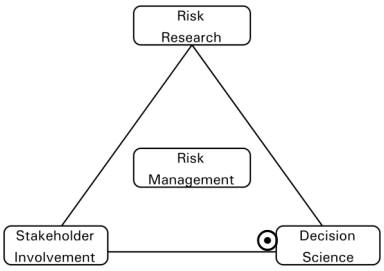
In addition, the authors present three theoretical perspectives that predict and explain why ethnicity should be associated with the appearance of variability in the perception of risk. 1) Differences between ethnic groups in levels of exposure to risks or prior experience should impact their perception of risk. For example, the environmental-justice literature suggests that in the US inner-city minority groups are systematically exposed to a greater amount of environmental hazards than other demographic groups. This theoretical perspective suggests that this exposure will greatly impact the perception of environmental risks. 2) The dissimilarities between ethnicities in the general perspective on risk and the environment should impact risk perception. For example, shared socio-cultural experiences can affect general belief systems and other factors associated with judgment and decision-making. These shared belief systems could greatly influence the perception of risk. 3) The final theoretical perspective suggests that the nonequivalent values that different ethnic groups place on those qualitative dimensions of risk will likely influence lay assessment of environmental risk. For example, it has been shown that Caucasians show greater support for the notion that pollution can cause cancer than African-Americans. According to the third theoretical viewpoint, this finding suggests that Caucasians may associate greater risk with pollution in the context of cancer development than African-Americans.

REFERENCE NO. 146

CITATION:

von Winterfeldt, D. 1992. Expert Knowledge and Public Values in Risk Management: The Role of Decision Analysis. Pages 321-342 in S. Krimsky, and D. Golding, editors. Social Theories of Risk. Praeger, New York.

REFERENCE TYPE: Book [Chapter]



SYNOPSIS:

This chapter describes a multiple-stakeholder approach to decision analysis as a means of successfully incorporating both expert knowledge and public values in risk-management decisions. Public values and expert knowledge are both essential when making risk-management decisions. Experts should not be allowed full control of these socially complex decisions nor is the public capable of making truly informed decisions without expert input. Decision analysis is a procedure that is used to aid decision makers in making wise choices when multiple objectives are involved and the decision involves a level of uncertainty or risk. This approach is helpful because it explores both the technical and value-based side of the problem, and helps decision makers to evaluate the conflicting objectives of the various stakeholders. The author suggests and discusses a multiple-stakeholder approach to decision analysis for risk management that includes the following five basic steps: 1) problem formulation, 2) development of objectives and attributes, 3) estimation of risks, costs, benefits, and other impacts, 4) elicitation of a multiattribute utility model from stakeholders, 5) sensitivity analysis and option invention

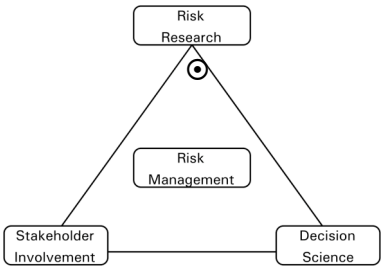
The author concludes the chapter with a discussion of the uses and limitations of this methodology. Specifically, this approach extends past the traditional use of decision analysis as a theory for individual decision making to a method that is based on joint decision making. The multiple-stakeholder approach is also useful for separating the technical and value parts of the problem, specifically addressing the technical components with probabilities and the value components with utilities. The author argues that this approach is needed because public policy in the United States is largely shaped by multiple stakeholders. Additionally, the multiple-stakeholder approach helps incorporate input from both organized and unorganized stakeholder groups.

REFERENCE NO. 147

CITATION:

Weber, E. U. and C.K. Hsee. 1998. Cross-cultural differences in risk perception but cross-cultural similarities in attitudes towards risk. Management Science **44**:1205-1217.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Past research has revealed that there are cross-cultural differences in risk preferences. For example, a study of university students' preferences in risky financial options showed that Chinese participants were less risk-adverse than American participants. This difference in risk preferences was partly attributed to the cushion hypothesis. According to this hypothesis, members of collectivist societies are more risk taking than members of individualistic societies in financial matters due to their extended social network that is there to offer support if a risky financial choice leads to negative consequences. The study presented in this article continues this line of research by examining how differences in risk perception and perceived risk attitudes can influence cross-cultural differences in risk preferences. Risk perception is basically how an individual defines and subsequently perceives the riskiness of distinct choice options. On the other hand, perceived risk attitudes refer to a person's affective response towards a perceived risk or the risk associated with a choice option. In this study the authors examined the influence of an individual's perception of risk and perceived risk attitudes on their risk preferences. The study focused on four countries that varied in terms of the collective-individualistic aspects of their culture (listed from most collectivist to most individualistic): China, Poland, Germany, and United States. Weber and Hsee hypothesized that the more collectivist a country was, the less risk-adverse subjects from that nation would be in terms of risky financial decisions. The researchers were also interested in seeing how risk perception and perceived risk attitudes varied between the nations. Data for the study was collected by surveying university students from each of the nations about their perception of risk, perceived risk attitudes, and their risk preferences in risky financial decisions.

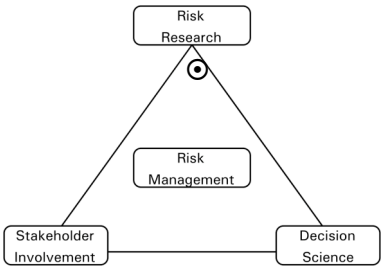
The findings confirmed the researchers' hypothesis and past findings. It was found that those participants from countries with a national collectivist culture were less risk-adverse than individuals from a country that had an individualistic culture. The researchers also found that these differences in risk preferences were linked to an individual's risk perception. Participants from collectivists countries perceived significantly less risk than participants in individualistic countries in the risky financial decisions they evaluated. However, all participants shared similar attitudes concerning perceived risk attitudes. In summary, all study participants regardless of national origin preferred low-risk options (similar attitudes toward perceived risks), but participants from collectivist nations perceived less risk in the financial choice options than participants from individualistic nations, leading to differences in risk preferences.

REFERENCE NO. 148

CITATION:

Weber, E. U. and C. K. Hsee. 1999. Models and mosaics: Investigation of cultural differences in risk perception and risk preference. Psychonomic Bulletin and Review **6**:611-617.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

The psychology profession has largely neglected the importance of cross-cultural studies. This is despite the fact that numerous studies have shown that culture has a significant influence on a wide range of psychological processes, such as the appearance of overconfidence in probabilistic judgment tasks or people's construal of self. Culture has also been shown to have a significant impact on the perception of risk and the development of risk preferences. The authors posit that there is a need for more cross-cultural investigations in the discipline of psychology, and they provide a basic model of efficient operations for these studies. Past research on the differences between Americans and Chinese in terms of risk perception was used to provide concrete examples of how various facets of the model functions. These studies found that Chinese participants were less risk-adverse than American participants when faced with risky financial decisions. The authors suggest that this is due to the cushion hypothesis. According to this hypothesis, Chinese participants have a more extensive personal support network of family and friends than American participants to rely upon in times of financial difficulty, allowing for risky financial behavior.

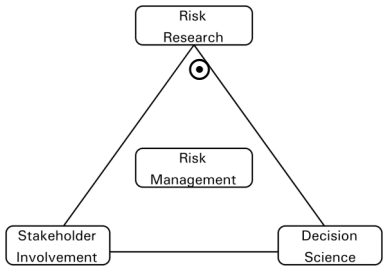
The authors' model of efficient cross-cultural research is based on two fundamental concepts that are further developed by their respective sub-principles. The first concept is that cross-cultural research should be model-based. In order for this to occur cross-cultural studies need a guiding theory. For example, in the American/Chinese risk-perception study, the theory of risk-value tradeoff was utilized. This allowed the researchers to look at the perceived risk-aversion and risk-seeking aspects of a larger theory that encompassed risk-value tradeoff, willingness-to-pay theory. In addition, the theory utilized in cross-cultural studies should be able to differentiate between individual and group differences. For example, while many group factors have been shown to impact risk perception, such as race/ethnicity, many individual factors, such as education, have also been shown as a significant influence. Theory needs to account for these different factors. The final sub-principle for the need of models to guide cross-cultural research is that controlling for the role of cultural differences should test the theory being utilized. For example, culture was no longer a significant variable in terms of explaining the difference in risk preferences in financial matters between Americans and Chinese after the extensiveness of participants' social networks was controlled. The second fundamental concept in the authors' model is that cross-cultural studies should create a "causal mosaic." In other words there is a need to examine multiple dependent variables and to use multiple methodological approaches.

REFERENCE NO. 149

CITATION:

Weber, E. U., C.K. Hsee, & J. Sokolowska. 1998. What folklore tells us about risk and risk taking: Cross-cultural comparisons of American, Chinese and German proverbs. Organizational Behavior and Human Decision Processes **75**:170-185.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

Past studies have shown that there are national differences in risk-taking behavior. Researchers have proposed two possible sources for these behavioral differences: 1) The difference between nations in terms of their longstanding cultural values (i.e., national differences in terms of cultural norms such as collectivism vs. individualism). 2) The differences between nations in current situational circumstances (i.e., current differences between countries in their respective political and economic environments). This article presents the results a study that attempted to gain a better understanding of the sources of observed national differences in risk taking. The study focused on the differences in risk-taking behavior between China and the United States using comparative analysis of the nations' respective proverbs. These two nations were chosen for the study for practical and theoretical reasons. Practically, the nations were chosen due to their substantial impact on global social and economic matters, and their increasing level of negotiations and joint economic ventures. Theoretically, the nations are polar opposite in terms of some significant cultural norms; specifically China exhibits a highly collectivist culture while US culture is incredibly individualistic. Additionally, past research has shown the Americans to be less risk-taking than Chinese subjects in financial matters.

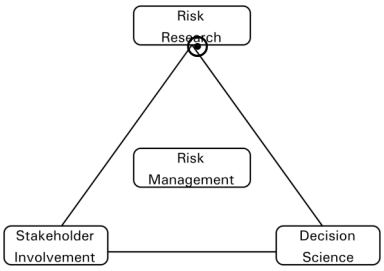
The cushion hypothesis was used as a theoretical framework for the study. According to this hypothesis, members of collectivist societies are more risk taking than members of individualistic societies in financial matters due to the extended social network that is there to offer support if a risky financial choice leads to negative consequences. China was the collectivist society in the study and America the individualistic nation, Germany was used as a control (it has been shown that Germany exhibits a collectivist culture similar to China). The research was guided by the following hypotheses: First, cultures with greater social collectivism (e.g., China and Germany) will generate proverbs that offer more risk-seeking advice in material matters than proverbs from individualistic cultures (e.g., the United States). Second, fewer American proverbs should be applicable to risk-taking in terms of situations involving the maintenance of social networks than Chinese and German proverbs, since individualistic cultures are less concerned with interpersonal relationships. Data was collected by comparative analysis of proverbs by analysts from the proverbs' nation of origin. In addition, the importance of social networks in each country was examined by a survey of students from each of the respective countries' family and friendship ties. It was shown that students from the two nations identified as collectivist (China and Germany) have much more extensive social networks than students in the US. In addition, both hypotheses were supported by the findings suggesting that longstanding national values and norms as expressed in cultural works, such as proverbs, art, or novels, can influence individuals' risk behavior.

REFERENCE NO. 150

CITATION:

Weinstein, N. D. 1989. Optimistic biases about personal risks. Science **246**:1232-1233.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

It is well known that people have great difficulty with estimating the risks associated with some hazards. For instance, people overestimate the harm caused by toxic waste yet underestimate the number of people harmed by asthma. Another problem people have with estimating risks occurs when they are asked about their own chances compared to another person's chances concerning personal risks (such as drug addiction or lung cancer). This consistent optimism bias in comparative risk judgments is widespread, appearing with diverse hazards (e.g., radon, influenza), samples (e.g., people who have not tested their homes for radon, homosexual men), and elicitation techniques (e.g., different types of questions used to elicit risk ratings). In "self-other" comparisons, there are several different ways in which the optimism bias may be manifested. First, some biases occur when people compare themselves to an incorrect norm. Second, optimism may also arise when ambiguous risk factors are interpreted in a biased manner. Finally, people in high-risk groups often downplay the risks or refer to risk-countering practices of little value (e.g., showering after sex to reduce risk of contracting AIDS). In general, optimism is greatest for hazards with which subjects have little personal experience, for hazards rated low in probability, or for hazards judged to be controllable by personal action. These optimism biases in personal risk perceptions are important because they may hinder efforts to promote risk-reducing behaviors.

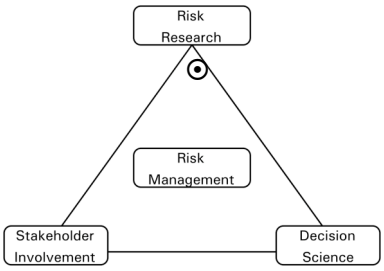
The author proposes several ideas as to why optimism is so prevalent in risk comparisons. First, optimism biases may represent attempts to shield us from the fear of being harmed. This view is not well supported, as life-threatening hazards do not elicit greater optimism that minor illnesses. The second idea focuses on threats to self esteem, competence, and self worth. The third is that optimism biases are produced by cognitive errors. Cognitive errors do not provide a satisfactory explanation for optimism biases, however, because they do not explain why biases associated with pessimism never appear.

REFERENCE NO. 151

CITATION:

Wildawsky, A., and K. Dake. 1990. Theories of risk perception: Who fears what and why? Daedalus **119**:41-60.

REFERENCE TYPE: Journal Article [Research]



SYNOPSIS:

There are numerous theories in the social sciences that attempt to explain why people perceive risk from various products, practices, or places. In this seminal article, the authors report the results of a study that investigated several rival risk-perception theories, and sought to discover which was most adequate in predicting individuals' perception of risk. The study focused on the following theories: 1) *knowledge theory:* people perceive technologies (and other things) to be dangerous because they know them to be dangerous; 2) *personality theory:* some people enjoy taking risks so they take many risks, while others are risk-averse and seek to avoid taking risk; 3) *economic theory:* the rich are able to take more risks associated with technology because they benefit from them and are shielded from negative repercussions, while the poor feel the opposite; 4) *political theory:* people view controversies over risk as conflicts over interests, such as holding office or party advantage; and 5) *cultural theory:* people choose what to fear (and how much to fear it), in order to support their way of life. The authors' used data from an existing database of 300 members of the lay public, from whom data had been collected on a myriad of factors, such as perception of technology, personal values, personal worldviews and more, to collect data for the study.

The authors found that cultural theory, specifically the aspect dealing with worldviews, was the most robust and accurate of the theories examined for predicting people's perception of risk from a wide array of sources. The authors assert that perceptions of technology are predictable given the worldview of the individual who perceives the risk. The other competing theories were found to be too narrow in their explanatory scope, such as personality theory, or to be inaccurate. For example, it was found that those individuals that rate their self-knowledge of certain technologies highly tend to perceive greater benefit and less risk from those technologies, than those individuals that rate their self-knowledge level of those technologies as being low. This finding provides a significant empirical challenge to the knowledge theory of risk perception.

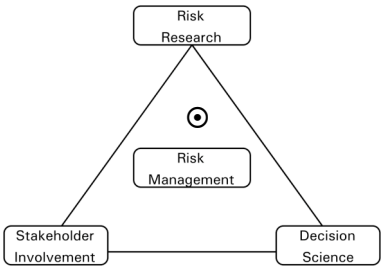
In conclusion the authors suggest that cultural theory and worldviews are accurate and robust predictors of individuals' perception of risk, because they focus on the issue of trust. The authors claim that it is trust in those responsible for creating, managing, or regulating technologies (and other things) that might be seen as sources of risk, and not knowledge of these items, that play a significant role in individuals' subsequent perception of risk.

REFERENCE NO. 152

CITATION:

Wilson, R. 1979. Analyzing the daily risks of life. Technology Review **81**:41-46.

REFERENCE TYPE: Journal Article [Review Article]



SYNOPSIS:

In this landmark article, the author explores some of the daily risks of life. This article briefly introduces many concepts and topics that have become important areas of study in the risk literature in a non-technical, conversational manner. The author contemplates the concept of group risk versus individual risk, the geographic distribution of risk, risk comparisons, environmental risk, the regulation of risk, and the importance of quantifying risk in decision-making processes. The author introduces these concepts by looking at risks associated with such everyday occurrences as traveling to work, exposure to cigarette smoke, drinking tap water, and the use of electric power. The author concludes the article by suggesting that a possible way to manage risk is to tax those products, companies, and individuals responsible for creating risk in proportion to the level of risk they create. For example, cigarette manufacturers would be taxed for producing a product that is associated with an array of risks.

Despite the level of influence this article had on the field of risk analysis, it shows how far we have come in the study of risk management, communication, decision-making. Many of the author's suggestions and assertions are misguided by today's standards. For example, the article suggests that a technical, statistic-based view of risk will help individuals to understand and make decision concerning the everyday risk they face. This assertion has been called into question by numerous studies. This view of risk largely disregards the role of affective factors in risk perception. It also ignores the psychology of decision-making under uncertainty or risk, specifically individual's use of heuristics and biases in the decision process. This and other erroneous suggestions found in the work can be attributed largely to the era in which the article was written, and the fact that it had very little previous research to rely on.