

## Review

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# Risk communication: Towards a rational discourse with the public

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### Abstract

Professional risk managers and the general public strongly disagree about the seriousness of many risks. Most members of the public are concerned about long-term effects of risks, inequitable siting, lack of personal control, and the pace of technological diffusion into their cultural environment, whereas professional risk managers focus on the task to minimize the probability of adverse effects caused by a technology or other human activity. To bridge the gap between the professional mandate and the public perception of risk, a dialogue has to be initiated between risk managers, interest groups and representatives of the affected public. This dialogue should serve the function of reconciling conflicts among various groups. A prerequisite for a successful conflict resolution is the willingness of each group to respect the perspective of all the other participating groups and to include their concerns into the decision-making process. This paper reviews the literature on the three main functions of risk communication: message recognition, inducement of attitude and behavioral changes, and resolution of risk-related conflicts. The paper also discusses the structure of the communication process from a descriptive and a normative point of view, and draws on studies about risk perception and communication to develop some guidelines for successful risk communication.

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### 1. Introduction

The notion of risk preoccupies modern societies. The scale and potential impact of technological developments and the increased sensitivity to health and safety hazards have put risks and environmental quality among the top concerns of the US public as well as many other western industrialized nations [1-3]. This concern highlights, according to the German sociologist, Ulrich Beck, a gradual change of the predominant social conflict in this century ([4]; cf. [5]). The primary conflict in the early twentieth century was focused on

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the distribution of wealth among different social groups; after the second world war, and particularly in the 1960s, the focus changed to the distribution of power in politics and economics. In more recent times the major conflict is about the distribution and the tolerability of risks for different social groups, regions, and future generations.

This shift of focus implies new forms of conflict resolution and underlines the importance of communication as a necessary, though not sufficient, step towards a social equilibrium [6]. In addition, the capability of societal institutions to tame powerful natural sources for economic purposes and reduce the concomitant risks of potential side effects to human health and the natural environment depends largely on communication among institutions and groups [7] and the formation of specialized risk or danger cultures [8].

Professionalization of risk analysis and institutionalization of risk communication are reinforced by the characteristics of the risk issue in the political arena. The process of decision making in most legal and political arenas traditionally relies on deterministic consequence analysis. Anticipating the most likely impacts of a decision, and weighing the associated costs and benefits of different options, in terms of formal analysis or by "bootstrapping" [9] is the major pathway of policy making. The question of how to incorporate relative frequencies in the decision process, i.e. balancing options with different compositions of magnitude and probability, has not been adequately addressed and assimilated by the political decision system. A variety of strategies to cope with this new challenge has evolved over time. They include technocratic decision making through expert committees or ignoring probabilistic information altogether. The incorporation of probability assessments in decision making requires new rationales for evaluating policy options and necessitates a revision of institutional routines [10].

In addition, public perception of probabilities and risks varies considerably from professional analysis [11–13]. Whereas experts usually give equal weight to probabilities and magnitudes of a given risk, the intuitive risk perception reflects higher concern for low-probability high-consequence risks [14]. Thus risk communicators have to face the institutional problems of coping with the new challenge of stochastic reasoning and at the same time with the intrinsic conflict between the perspectives of the scientific community and the public in general. Both reasons justify the already established practice of isolating risk communication from other forms of communication.

As a consequence of this prominence, interest of public institutions and academia in risk communication has grown considerably during the last five years. Risk communication has become a popular topic in the literature. Although originally conceptualized as a follow-up of risk perception studies, the work on risk communication has surpassed the limited boundaries of giving public-relations advice for information programs on risk, but extended its focus on the

flow of information between subsystems of society ([15] p. 275, [16] p. 116, [17] p. 131, [18]).

This review article presents the major concepts of risk communication and explains some of the underlying theories based on research in the areas of communication, risk perception, persuasion and attitude change, and social arena formation. The focus will be on the traditional source-receiver model [19,20] and the recently proposed concept of social amplification of risk [21]. Based on this framework, the paper presents some implications for risk communicators and deduct some normative suggestions. Although the risk communication literature includes an abundance of normative advice, only a few attempts have been made to put normative suggestions in the perspective of several theoretical concepts.

## 2. Definition and objectives of risk communication

What is risk communication? After reviewing several suggested definitions, the definition of risk communication by Covello, Slovic and Von Winterfeldt [22] seems to be the most appropriate for this article:

Risk communication is defined as any purposeful exchange of information about health or environmental risks between interested parties. More specifically, risk communication is the act of conveying or transmitting information between parties about (a) levels of health or environmental risks; (b) the significance or meaning of health or environmental risks; or (c) decisions, actions, or policies aimed at managing or controlling health or environmental risks. Interested parties include government agencies, corporations and industry groups, unions, the media, scientists, professional organizations, public interest groups, and individual citizens (p. 172).

Thus risk communications fits into classic definitions of communication as a purposeful exchange of information between actors in society based on shared meanings ([23], p. 133). Purpose is required to distinguish the sending of a message from noise in the communication channel. The term "message" implies that the informer intends to expose the target audience to a system of meaningful signals, which in turn may change their perception of the issue or their image of the sender. Acoustic signals without any meaning do not constitute communication.

If one accepts the premise that risk communication implies an intentional transfer of information, one must specify what kind of intentions and goals are associated with most risk communication efforts. The literature offers different sets of objectives for risk communication, usually centered on a risk management agency as the communicator, and groups of the public as target audiences ([17] pp. 131-132, [22] p. 172, [24,25]). Some controversy exists as to the general purpose of risk communication: should it aim at changing be-

havioral responses or should it be confined to the exchange of information about pending dangers and potential remedies? [26] p. 80).

Most authors clearly favor the former proposition ([12], [22] p. 172, [27] p. 151). Hence, the list of legitimate objectives, so the common accord, should not only include the transmission of information, but also persuasive messages intended to trigger behavioral changes of individuals as well as social group responses. Accepting this premise, risk communication can serve many purposes ranging from enlightenment to inducing behavioral changes. For the purpose of this paper, the variety of objectives can be collapsed into three general categories (cf. [17] p. 131, [25]):

- (1) to make sure that all receivers of the message are able and capable of understanding and decoding the meaning of the messages sent to them;
- (2) to persuade the receivers of the message to change their attitudes or their behavior with respect to a specific cause or class of risk;
- (3) to provide the conditions for a rational discourse on risk issues so that all affected parties can take part in an effective and democratic conflict-resolution process.

The following sections are organized according to these three objectives. Each section introduces major theoretical issues, presents empirical results related to the discussed objective, and articulates some conclusions for risk communication.

### **3. Understanding risk messages: the social and psychological context of risk communication**

#### *3.1 The source-message-receiver model*

The traditional approach to study and analyze risk communication is based on the communication model of information transfer among sources, transmitters, and final receivers. Although the model was originally developed in the late 1940s [19,20], it is still the most prevalent framework for communication studies up to date and has been recommended by risk managers [28]. In a recent review of 31 communication textbooks, P.J. Schoemaker concluded that nearly half of the books used the sender-receiver model [29] p. 120). Another approach is the transactional view that emphasizes the creation of shared meaning among senders and receivers. Both approaches can obviously be combined.

Figure 1 illustrates the classic sender-receiver model. A message is composed by the communication source and then sent to a transmitter. The transmitter decodes the message and recodes it again for its target audience. The new message is then forwarded to the final receivers who decode the message and decipher its meaning. The receivers may respond to the message by sending out their own message either to the original sender or to other constituents. They may also feel compelled to take direct actions in response to the message(s)

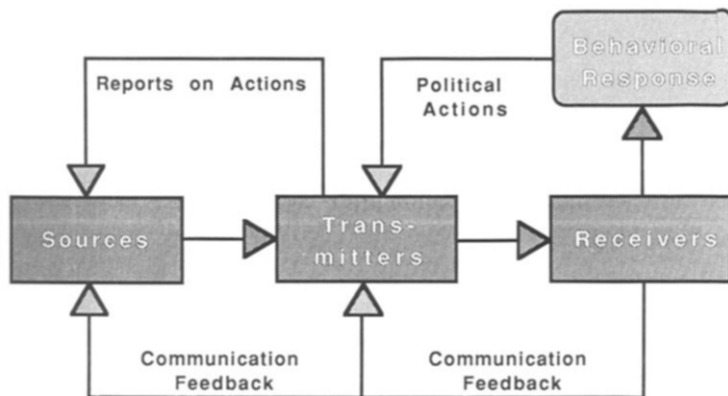


Fig. 1. Basic communication model. This is the classical communication model. A message is composed by a source and then sent via a transmitter station to the receiver. The receiver may respond to the message by initiating feedback communication or behavioral reactions.

received. The original source may collect or process the receiver's responses. Feedback messages may pass through a transmitter station before they reach the original sender. The original messages, and even more so the feedback messages, are distorted with background noise when they are sent through several channels via transmitters and signal amplifiers (see [30] for an detailed discussion of the signal amplifying process).

The sender-receiver model has drawn fire for promoting a mechanistic understanding of communication and for emphasizing a one-way communication route [31,32]. Yet if the model is used only as a sequential illustration of the transfer of messages from one party to another, and if the roles of sources and receivers can be mutually exchanged, it can serve as a powerful tool in the analysis of communication processes. It is a structuring tool to illustrate the communication process, and not an empirical model of how communication is factually organized in a society.

Figure 2 shows the major actors of risk communication as embedded into the classical communication model. Sources for risk-related information are basically scientists or scientific institutions, public agencies such as the US Environmental Protection Agency (EPA), interest groups such as industries or environmentalists, and, in the case of hazardous events (physical changes caused by hazardous activities), eyewitnesses. These primary sources code information in the form of reports, press releases, or personal interviews, and send them to transmitters or occasionally directly to the final receivers ([33] p. 101ff).

The second step of communication is the coding and recoding procedure at the transmitting stations. The media, other public institutions, interest groups and opinion leaders are potential transmitters for risk-related information. A press release from EPA may stimulate industry to hold a press conference or

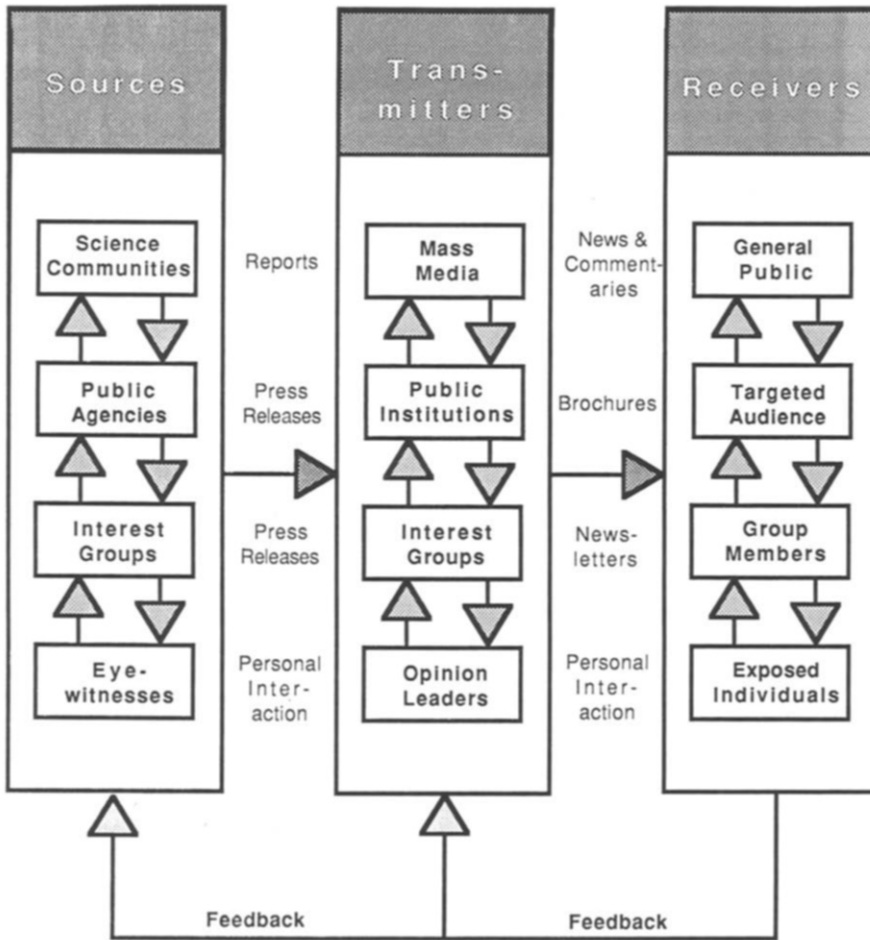


Fig. 2. Organizational structure of communication. In risk communication one can identify the major actor in each step of the communication process. Primary sources are usually related to scientific communities or agencies; secondary sources are political institutions and interest groups. Both organizational types of sources may compete with eyewitnesses of hazardous events. The mass media are the principal transmitters, but stakeholder groups also act as information brokers. The receivers of information are the general public (usually the target of mass media), specific target audiences, members of social groups, and affected individuals.

to write an open letter to the agency. Interaction among social groups, in particular among adversaries, often takes place through the media and not via direct communication. The goal is to mobilize public support and to initiate public pressure ([34] pp. 304, [35]).

The last step is the processing of the recorded messages at the receiver. Again, it is helpful to distinguish between different types of receivers. The media usually serve the general public, but many journals are targeted to specific audi-

ences within the general public. Specialized journals are either appealing to professional standards (science communities, business circles, risk assessors), avocational activities (culture, sports, travelling, etc) or value groups (environmentalists, religious groups, political camps, etc). The information will be framed for each audience in a different manner to assure their attention and to please their expectations.

### *3.2 The sources of messages*

The first stage of communication is the framing of a message by an information source. As H.P. Peters has pointed out, topics can be brought and sustained on the public agenda only if the mass media report about the topic and a social institution or group adopts the topics as part of its own agenda ([36] p. 9).

Indoor radon is a good example. In spite of good relationships with the national press, Joel Nobel, a physician of Philadelphia, who detected a concentration of 55 pCi/l (nearly 14 times the benchmark of 4 pCi/l often regarded as the 'safe' level) in his private home in 1981, was unable to gain more than cursory attention from public institutions and the press because he could not interest an agency or social group to share his concern ([37] p. 89). Not before the State of Pennsylvania, alarmed by another even more dramatic case in 1985, acknowledged the problem and initiated a state-wide survey program did the national press cover the topic in length and trigger more attention of federal agencies, such as the EPA ([37] p. 90, [38] pp. 27-28).

In addition to the social support a message receives, the components of the message themselves play a vital role for the effectiveness of the communication effort. Among the most important are symbols and metaphors, which trigger the attention of potential receivers and shape the decoding process ([21], [39] p. 371). If, for example, the information source is described as a group of Nobel laureates, the content of the message may well command public attention. Messages from such sources may successfully pass through the selection filters of the transmitters and receivers, and be viewed as credible. A press release by the nuclear industry, by contrast, may command much less credibility unless other aspects of the message compensate doubts about the impartiality of the source.

Sources or transmitters can amplify the different components of the message by taking advantage of the symbolic connotations. Assume an industrial announcer provides the information that a specific chemical substance has been leaking from a waste repository for two years. One journalist may portray this incident by using phrases such as "leak in waste disposal at a high-tech-park" or "state-of-the-art technology for monitoring emissions", another journalist may describe the same incident by using phrases such as "air pollution by toxic waste dump" and "poisoning the air we breath and the water we drink".

The following subsections will deal with each of the three major communi-

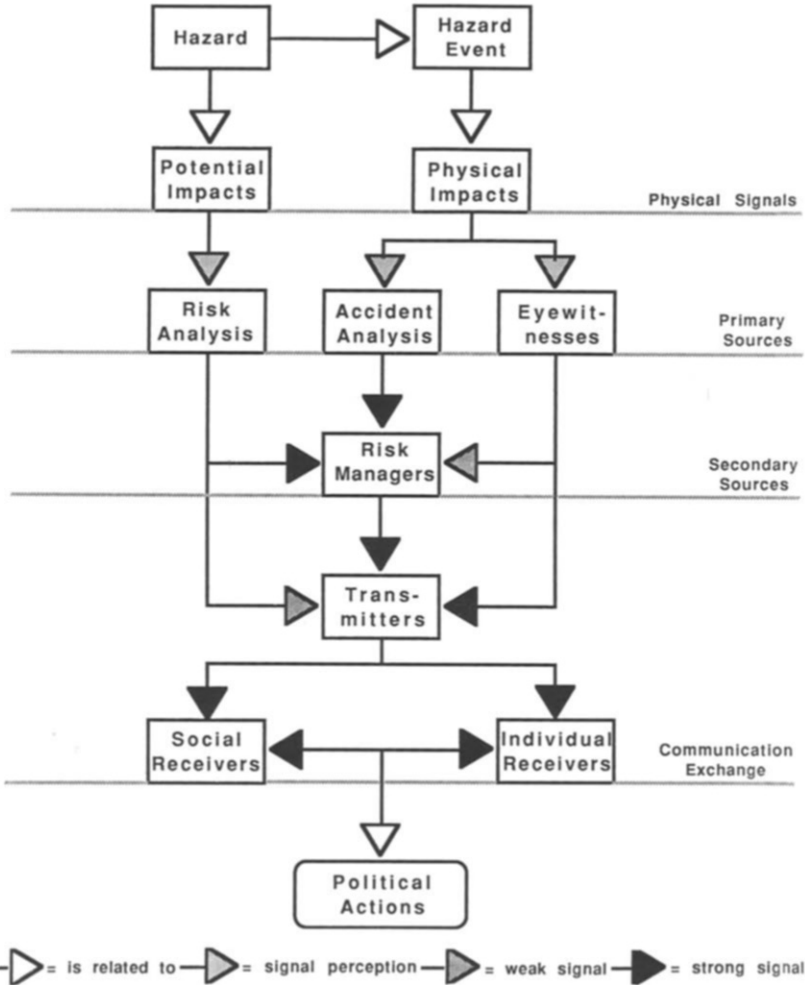


Fig. 3. A model of signal flow in risk communication. Primary sources for risk communication are scientific communities and eyewitnesses in the case of hazardous events. Through observation of actual impacts of hazardous events or through risk assessments of potential impacts, scientists select a special set of signals and code them into communicative signals. Whereas scientists focus on the typical and general aspects of a hazardous event, eyewitnesses focus on the uniqueness of the situation and the concrete sufferings experienced in a disaster. Secondary sources, such as risk managers function, select and amplify those signals that shed positive light on their own performance or help them to find public support. Professional transmitters, in particular the media, receive these, often controversial, messages as well as the eyewitness reports. Based on the selection rules of the media, the recorded information will very likely emphasize conflict, dissent, interest-driven interpretation, and controversy when it reaches the final receiver, i.e. individuals and social groups.



cation stations separately. The focus will be on the roles and functions of sources, transmitters and receivers in coping with risk information. The special circumstances of risk communication are illustrated in Fig. 3, which serves as a basic guide for the verbal explanations in the following subsections.

### *3.3 The primary sources of risk communication*

Nature and technology are both sources of hazardous events, such as earthquakes, fires, explosions, pollution, or radiation. Scientific analyses attempt to determine the physical impact of such events (accident analyses) or to hypothesize about the magnitude and the probability of potential impacts (risk analyses). Observation and analysis of actual events and simulation of potential events lead to an estimate of the magnitude of the impacts, the probability of their occurrence, and the distribution of these impacts over time, space and population subgroups [40]. These estimates are coded in the language that the target group, usually other scientists or regulators, use for communication.

In the risk field, as in many other scientific areas, mathematical expressions and special jargon dominate the professional communication process. Such a specialized language is not—as many observers have speculated—a tool to keep outsiders from entering the elite community of scientists, but serves a valuable function by providing a common and precise meaning of all expressions used within the community. The inner scientific communication process is usually not meant to convey information to the public, but to transit messages to peers. However, in a plural society such messages are screened by public interest groups and professional transmitters for “hidden” messages [35]. One of the consequences of this mismatch between intention and availability, is the wariness of experts to share information with nonscientists and the distrust of many public groups toward the scientific community [41].

In addition to the problem of shared meaning of messages between an expert community and outside observers, the communication process is further complicated by the difference in assigning importance to different segments of events or pieces of information. Each physical event is a source for millions of signals that an observer can collect and process. The collection, however, is necessarily selective and subjective. If two people witness the same event, such as a car accident, seldom do their reports match. The selection of what types of signals are collected from a physical event or are created by a hypothetical simulation of hazardous events, involves individual or group judgments about relative importance. The scientific convention to restrict one’s attention to probabilities and magnitude reflects a special strategy, i.e. to abstract and deduct the typical and universal characteristics from a unique event as a means for comparing this event with other similar events or designing measures for reducing the risk of future similar events [35] p. 13).

Scientific risk assessment constitutes a deliberate selection of signals that, based on past experience, provides information about the relative potential of

hazardous events to produce adverse effects. Events, such as earthquakes or chemical spills, are scanned for signals that provide the data to construct probability distributions of adverse effects. Other signals about human sufferings, responsibility for the disaster, inequities in the experience of risk, and political implications are deliberately excluded from the signal collection process [42].

A parallel signal selection and transformation process of an event occurs in the perception of direct eyewitnesses or affected persons. These individuals produce anecdotal evidence of the hazardous event [12]. This evidence is coded in another language consisting of elements with a different signal value. Here one encounters expressions for personal anxieties and fear, courage and heroism of individuals, anger and blame, compassion and charity. Anecdotal evidence competes with the systematic and abstract evidence provided by scientists. Both forms of evidence stem from the identical physical phenomena, but they differ in the selection of signals from that event and their mental processing. The language used by both groups to describe the event and its consequences are reflections of different clusters of shared meaning [43]. These reflections are governed by cultural norms and values that characterize the self-image and world view of different groups or society as a whole. The search for human involvement, be it in the form of exceptionally brave behavior or blame for the culprits, characterizes the common cultural sensitivity of the contemporary Western societies for an activist perspective. This world view implies that human interventions are capable of preventing, mitigating, or aggravating any type of disaster. Other cultures or predecessors of modern Western cultures have perceived disaster frequently as signs of inevitable fate or God's punishment, and have searched accordingly for signs of collective sins rather than individual faults ([44] p. 13ff).

The selection process is part of the cultural process of constructing reality. Social constructions harmonize the mental models of the world with the actual observations [42,45]. The deliberate, axiomatic nature of the selection rules holds true for the scientific community as well as for any other social group. For example, the scientific convention of assigning equal weight to probability and magnitude in risk equations is a "nonscientific" value judgment that can be derived neither from purely logical reasoning nor from empirical evidence [46]. Primary sources therefore collect and select signals from the physical world, re-code them into verbal expressions according to their mental models and assign them different degrees of significance and often symbolic value. Some properties of the risk situation may evoke special attention, while others may easily be ignored or attenuated.

### *3.4 Social amplification of risk*

The process of amplifying some signals of the physical event while attenuating others has been a major element of the recently developed metaphor of social amplification of risk [21,30]. The concept rests on the thesis that events

pertaining to hazards interact with psychological, social, institutional, and cultural processes in ways that can intensify or attenuate individual and social perceptions of risk and shape behavioral responses. Behavioral responses, in turn, generate secondary social or economic consequences. These consequences extend far beyond direct harms to human health or the environment and may include significant indirect impacts such as liability, insurance costs, loss of confidence in institutions, or alienation from community affairs [21]. Integrating the communication model into the social amplification concept provides a useful model of signal transformation.

As a starting point, the transformation of physical signals into meaningful verbal expressions forms messages, which are then transmitted through various channels of communication by different societal actors who partially amplify or attenuate them during several transformation processes. The transformed and amplified messages exert a specific incentive for social groups or individuals to take actions or modify behavior. Individuals and social actors serve as amplification stations, which process and respond to the information in various ways. Attitudes may change, institutions may decide to redirect their efforts, political pressure may be exerted to imitiate political changes, and the risk management system may be reformed. Ultimately, social actions result in changes in the social structure and the physical world. These secondary and tertiary effects of the amplification process can then result in technological and social change. This change triggers the development of new technologies, new control institutions, and risk policies. The cycle can start anew. This process is illustrated in Fig. 4.

On the level of primary sources of communication, the selection of signals by at least two divergent groups, the scientists and the eyewitnesses, leads already to different routes of social amplification. Scientific conventions focus on specific aspects of risk. They help to identify the typical elements of all covered risk situations, but may obscure the uniqueness of the specific event or hazard under consideration. Reversely, anecdotal evidence seems to center on the uniqueness of the situation and the specific circumstances of the event and to neglect the typical patterns that characterize risk in general. One major problem of risk communication is, therefore, the integration of scientific and anecdotal evidence, a problem that is aggravated by the stochastic nature of risk [12,47].

### *3.5 The secondary sources of risk communication*

Following the process of risk communication, illustrated in Figs. 3 and 4, the messages of the primary sources are sent to secondary sources, mainly risk managers, but also scientific institutions and special interest groups [33]. These organizations are interested primarily in the scientific investigations focusing on dose–effect relationships and probabilities of adverse events. The main objectives of the concerned institutions are to forecast, analyze, or manage the

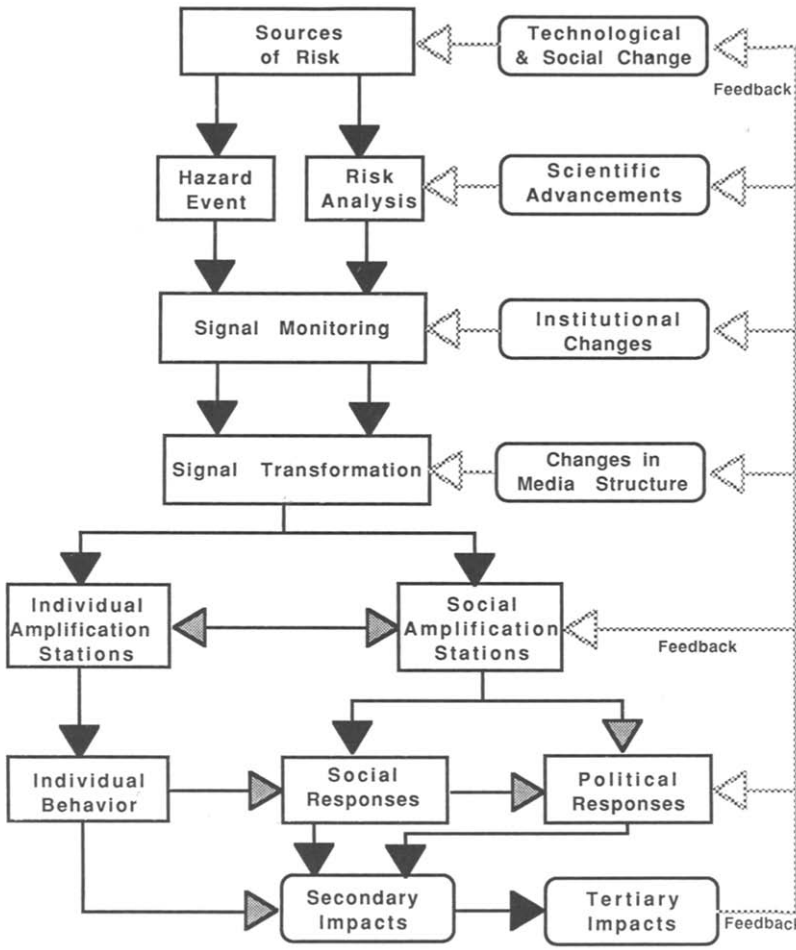


Fig. 4. Risk communication in the concept of social amplification. Signals from physical events are transformed into communication signals and forwarded to social and individual amplification stations. These stations process the information and respond to the messages by sending out new information or acting upon the content of the received message. Individuals may form or change their opinions on an issue or demand changes with regard to risk management practices. Social and political stations may use the incoming information to promote structural and institutional innovations that would help to cope with the respective hazard. All these social actions trigger secondary and tertiary impacts: economic losses, institutional changes, social mobilization and other consequences may occur. Finally, the amplification process evokes new social and technological changes, which in turn start a new cycle of amplification.

hazard. In this respect, they act on the basis of a similar mental model as the scientific community.

However, transmitters and the public are, in general, more interested in the specific circumstances of the one incident reported or the consequences of a

single hazard event. The intention of the source to communicate the common lessons and to put the risk in perspective, conflicts with the interest of the receiver to learn more about the incidence and the real or potential victims [35]. Furthermore, each institutional source will quite likely collect and pass on information that supports its designated service and provides good arguments to legitimize its existence and performance ([48], [49] p. 54f). Since institutions have different purposes, they will be likely to differ in the selection and processing of signals stemming from primary sources. This difference in interpretation may be aggravated by different competing risk assessments which reflect adversarial science camps or result from scientific advocacies within interest groups. But even if all these sources relied on the same primary sources or cited the same evidence, the messages would still look as though they were drawn from completely unrelated data bases.

Industry, regulators, scientists, and environmental watchdogs focus on different aspects of the problem, amplify signals that each of them regards as confirmation of their basic philosophy and that emphasize their role and function in the assessment and management of the respective risk [13]. In most cases, competing messages are not a product of misinformation, manipulation or even lying. Rather, every communicator has a different perspective in perceiving and evaluating the issue and is interested in conveying that perspective to the outside world. Fragmentation of information is therefore an inevitable side effect of plural interest articulation [35]. The process of signal reception and re-coding in this stage is less related to the properties of the hazard, although this information may be packaged within the message, but, rather, more to the efforts of the institution to assess, analyze, or manage the respective risk.

### 3.6 Reception of risk information

The mechanisms and mental processes of individual risk perception have been one of the most studied topics in risk psychology [11,14,50–52]. Risk perception studies focus on two major subjects: the qualitative characteristics of risk, which influence the perceived seriousness of risk and their perceived acceptability, and the perception and processing of probabilities [14,53]. Psychometric methods have been employed to explore these qualitative characteristics of risks. The following aspects of risk have been found to affect the perceived riskiness of objects or activities [11,14,52,54]:

- (1) *The expected number of fatalities or losses*: although the perceived average number of fatalities correlates with the perceived riskiness of a technology or activity, the relationship is weak and generally explains less than 20 percent of the declared variance. The major disagreement between technical risk analysis and risk perception is not on the number of affected persons, but on the importance of this information for evaluating the seriousness of risk.
- (2) *The catastrophic potential*: most people show distinctive preferences among

choices with identical expected values (average risk). Low-probability high-consequence risks are usually perceived as more threatening than more probable risks with low or medium consequences.

(3) *The context in which the risk is taken:* surveys and experiments have revealed that perception of risks is influenced by a series of perceived properties of the risk source or the risk situation. Among the most influential factors are: the perception of dread with respect to the possible consequences; the conviction of having personal control over the magnitude or probability of the risk; the familiarity with the risk; the perception of equitable sharing of both benefits and risks; and the potential to blame a person or institution responsible for the creation of a risky situation.

(4) *The beliefs associated with the cause of risk:* the perception of risk is often part of an attitude that a person holds about the cause of the risk, i.e. a technology, human activity, or natural event. Attitudes encompass a series of beliefs about the nature, consequences, history, and justifiability of a risk cause. Due to the tendency to avoid cognitive dissonance, i.e. emotional stress caused by conflicting beliefs [55], most people are inclined to perceive risks as more serious and threatening if the other beliefs contain negative connotations and vice versa. A person who believes that industry policies are guided by greed and profit, is more likely to think that the risks of industrial waste sites are only the "tip of an iceberg". On the other hand, a person who believes that industry provides consumers with goods and services they need and value, is likely to link industrial waste sites with unpleasant, but essentially manageable, by-products of industrial production.

In addition, equity issues play a major role in risk perception. The more risks are seen as unfair for the exposed population, the more they are judged as severe and unacceptable [56,57]. It should be noted that the estimation of severity and the judgment about acceptability are closely related in risk perception. The analytical separation in risk estimation, evaluation, and management, as exercised by most technical risk experts, is not paralleled in public perception. Most people integrate information about the magnitude of the risk, the fairness of the risk situation, and other qualitative factors into their overall judgment about the (perceived) seriousness of the respective risk.

This list of factors demonstrates that public understanding of risk is a multidimensional concept and cannot be reduced to the product of probabilities and consequences. Empirical studies about experts' and laypersons' estimates of the seriousness of risks indicate the different conceptualization of the meaning of risk [11,53,58]. Although risk perceptions differ considerably among social and cultural groups, the multidimensionality of risk and the integration of beliefs related to risk, the cause of risk, and its circumstances, into a consistent belief system appear to have common characteristics of public risk perception in almost all countries in which such studies have been performed [52].

In addition to the circumstances and qualitative aspects of risks, the meaning and understanding of probabilities have been subjects of numerous studies. The processing of probabilities is influenced by the following intuitive heuristics [33,53,59–61]:

- (1) *Availability*: events that come to people's mind immediately are rated as more probable than events that are less mentally available.
- (2) *Anchoring effect*: probabilities are adjusted to the information available or the perceived significance of the information.
- (3) *Representativeness*: singular events experienced in person or associated with properties of an event are regarded as more typical than information based on frequencies.
- (4) *Avoidance of cognitive dissonance*: information that challenge perceived probabilities that are already part of a belief system will either be ignored or downplayed.

Because probabilities are vital components of risk communication, one must account for the overt biases of processing probabilistic information. Furthermore, the terms used in framing probabilities, for example, chance of lives lost versus lives saved, or the probability of dying versus survival, lead to different reactions by the receivers [62].

### 3.7 Role and functions of the transmitters in communication

The transmitter has two roles in the communication process: first, transmitters receive and process information. In addition to personal selection filters and evaluation strategies, professional and institutional rules govern the selection of received signals and their interpretation. Journalists, for example, follow specific professional guidelines such as hearing both sides in a controversy, as well as institutional rules such as the required editorial style and the expectations of the perceived target audience of the respective medium.

Second, the transmitter acts as an information source by sending information to the final receiver. The re-coding of messages involves conscious or unconscious changes of the original information material. Messages from several sources may be integrated into one new message or comments may be added. Obviously, both processes take place simultaneously, i.e. understanding and re-coding the incoming message is an integral part of the transmitting process.

Study of the transformation of messages flourished in communication research. The theoretical literature suggests many different concepts about the nature of this transformation ([27, p. 175, [29] p. 125, [34,35], [63] pp. 129–30, [64], [65] p. 30). Most of these concepts are related to two crucial questions. First, are the media creating new messages or are they reflecting existing messages; second, how biased are journalists in their coverage *vis-à-vis* their own social biases and external pressures? Neither question has found a final answer yet ([37] p. 86, [63] pp. 140–141, [66]).

Communication research in the 1950s and 1960s suggested a strong influ-

ence of the media on public opinion. Extensive testing in recent years, however, showed that the media are more likely to set the agenda rather than creating new issues or changing the issues on the agenda ([63] p. 140, [66,67]).

With respect to the the second question, evidence exists to support almost all possible viewpoints ranging from political and commercial pressures to courageous news reports in conflict with all vested interests. Cultural biases within the journalistic community have been found, but also a variety of different political and social attitudes among journalists. Some journalists perceive their job as a mere translation of events into verbal or visual expressions, while others believe they should play a more active role in shaping and explaining the issue (cf. the controversy about the studies of Kepplinger in the review by Lichtenberg and MacLean [66], pp. 37–45, Köcher [68] and Peters [35]).

In short, the extremes that media are mere reflectors of reality or that they are docile instruments of social pressure groups may occasionally be true, but they are not the rule. In reality, the situation is more complex: media coverage is neither a product of external pressures nor an autonomous subsystem within society [69,70]. It reflects internalized individual values, organizational rules, and external expectations. The issue itself, the institutional context, and the political salience of the issue determine which of these three factors is likely to dominate the transformation process. A universal theory that explains how transformation takes place is therefore not likely to evolve.

All transmitters convert the original message into a new message according to institutional rules, professional standards, role requirements, anticipated receivers' interests, and personal preferences. The final product is a mix of original and re-coded messages, thus leaving it to the final receivers to distinguish between the informational elements provided by the original source and the additions or deletions undertaken by the various transmitters.

### *3.8 The transmitters of risk-related information*

Is there any evidence about specific media treatment of risk-related information? The media elicit information from direct eyewitnesses of hazard events (anecdotal evidence). They have access usually to the primary scientific reports (scientific evidence) but may prefer to use its popular derivations (such as articles in popular science journals). In addition, they will be exposed to a bombardment of press releases and other information from managing institutions or socially relevant groups. This abundance of material has to be collected, selected, digested, dissected, and finally re-coded.

The transmitters face a diversity of incoming message caused by different perspectives on the nature of the risk and its best management. This diversity itself is useful to convey to the final receivers and to add to the impression that the risk issue is a controversial topic with lots of confusing and often contradictory messages. The widely accepted rule of fairness in news coverage demands equal treatment for all points of views. This conflicts with the widely



accepted rule in scientific conflicts that professional dissent should be reconciled through methodological conventions, factual evidence, and peer review, notwithstanding genuine uncertainty about predictions. It also conflicts with the political conflict resolution mechanism of majority vote. The media, in contrast, transmit the claims of the different camps to the audience regardless of how much scientific evidence each of them has been able to compile and whether it represents a majority or minority opinion. Transmitters in a pluralistic society tend to reinforce diversity, dissent, and relativity of values ([71] p. 53). Even specialized journals tend to focus on controversies that fit into their general philosophy. Thus, dissent and ambiguity are inevitable and irreversible parts of risk information in addition to the uncertainty of the consequences.

In contrast to the scientific community, the nature and the magnitude of the original hazard are only of minor interest to most transmitters who prefer to focus on the way institutions handle risks and communicate about their activities. Empirical studies demonstrate that neither the number of victims in an event nor the expected number of fatalities are correlated with the volume and intensity of media coverage ([26] p. 84, [65] pp. 36–37, [72], [73] p. 14). As Singer and Endremy have pointed out, the media emphasize hazards that are relatively serious and relatively rare; it is the combination that gives them their punch ([73] p. 13). For example, the Chernobyl accident with 31 acute deaths cases received 129 minutes of CBS News coverage while the 1976 Tanshan earthquake leaving 800,000 people dead received less than 9 minutes on the average TV evening news ([65] p. 37).

The literature contains endless lists of factors that are assumed to determine the attractiveness of risk-related signals for transmitters. Such factors include: technologically induced hazard (versus natural hazard), possibility to blame someone for the outcome ([74] p. 105), cultural distance from the place of occurrence [72] human interest component, drama and conflict, exclusiveness of coverage ([63] pp. 137–138), proximity to politically hot issues, prestige of information source and degree of conflict among stakeholders [34,35].

Reviewing the abundance of theoretical suggestions and partially confirmed empirical results, one might conclude that the information processing in the media is almost random, or at least void of any systematic pattern. However, some insights have been gained as a result of the media studies undertaken so far. The major components of risk studies, probabilities and magnitudes, seem to play only a minor role in the media coverage; they are hence attenuated. Intensified, however, are signals relating to conflicts among social groups, contradictions between primary and secondary sources of information, risk events that could have been prevented or mitigated, and the involvement of individuals or organizations with high prestige and political influence.

choices with identical expected values (average risk). Low-probability high-consequence risks are usually perceived as more threatening than more probable risks with low or medium consequences.

(3) *The context in which the risk is taken:* surveys and experiments have revealed that perception of risks is influenced by a series of perceived properties of the risk source or the risk situation. Among the most influential factors are: the perception of dread with respect to the possible consequences; the conviction of having personal control over the magnitude or probability of the risk; the familiarity with the risk; the perception of equitable sharing of both benefits and risks; and the potential to blame a person or institution responsible for the creation of a risky situation.

(4) *The beliefs associated with the cause of risk:* the perception of risk is often part of an attitude that a person holds about the cause of the risk, i.e. a technology, human activity, or natural event. Attitudes encompass a series of beliefs about the nature, consequences, history, and justifiability of a risk cause. Due to the tendency to avoid cognitive dissonance, i.e. emotional stress caused by conflicting beliefs [55], most people are inclined to perceive risks as more serious and threatening if the other beliefs contain negative connotations and vice versa. A person who believes that industry policies are guided by greed and profit, is more likely to think that the risks of industrial waste sites are only the "tip of an iceberg". On the other hand, a person who believes that industry provides consumers with goods and services they need and value, is likely to link industrial waste sites with unpleasant, but essentially manageable, by-products of industrial production.

In addition, equity issues play a major role in risk perception. The more risks are seen as unfair for the exposed population, the more they are judged as severe and unacceptable [56,57]. It should be noted that the estimation of severity and the judgment about acceptability are closely related in risk perception. The analytical separation in risk estimation, evaluation, and management, as exercised by most technical risk experts, is not paralleled in public perception. Most people integrate information about the magnitude of the risk, the fairness of the risk situation, and other qualitative factors into their overall judgment about the (perceived) seriousness of the respective risk.

This list of factors demonstrates that public understanding of risk is a multidimensional concept and cannot be reduced to the product of probabilities and consequences. Empirical studies about experts' and laypersons' estimates of the seriousness of risks indicate the different conceptualization of the meaning of risk [11,53,58]. Although risk perceptions differ considerably among social and cultural groups, the multidimensionality of risk and the integration of beliefs related to risk, the cause of risk, and its circumstances, into a consistent belief system appear to have common characteristics of public risk perception in almost all countries in which such studies have been performed [52].

miliarity can partially be compensated by better functional knowledge about the risk and the associated technology.

With respect to the transmitters, risk communicators should be aware of the major selection rules of the media. Media report about events, not continuous performance. Hardly any journalist is interested, for example, in writing a story about a long safety record of a hazardous waste facility. If such a facility, however, faces an accidental release of hazardous material, one can be sure that this event will become headline news. To get a message across, communicators need to link their message to events, not necessarily physical events. Social events such as a celebration of 25 years of safe performance or a completion of a scientific study can also meet the event requirement.

Another major characteristic of the media is their interest in eyewitness reports. These testimonies relate abstract issues or events to unique human experience (which journalists assume help readers to identify with the victims or managers of the risk). Information that emphasizes the human component and personalizes abstract material is more likely to be accepted by the media than documents about the sequence of events or organizational competence [64]. However, risk communicators should be aware that “packaging” the information for the purpose of pleasing the transmitter always faces the risk of creating suspicion and distrust. Transmitters often associates good packaging with the intent to manipulate the audience. One should never forget that social stations of information processing are not computers or radios that operate according to prestructured rules [75], but they constitute thinking beings who reflect the messages they receive and change their selection rules to fit the circumstances.

Interaction among transmitters, plural input from different sources, the co-existence of personal, professional, and institutional selection and amplification criteria, and interaction among different target audiences create enough complexity and uncertainty that the final effect of the communication process can hardly be measured at all, let alone be effectively controlled. Even the rather simple step of making a message known to and understood by the target audience faces the chaotic conditions of the communication market. Guidelines and recipes to improve risk communication can help to increase the probability that a message will reach its audience, but will never guarantee its success.

#### **4. Risk communication as persuasion: the route to attitude and behavioral changes**

##### *4.1 Research results on persuasion*

Psychological research has shed some light on the conditions under which receivers of information believe the message and alter their opinions or attitudes accordingly. In attitude theory, opinions refer to mental responses to an issue, an object, or a person, whereas attitudes denote a stabilized and more

enduring position with respect to an issue, an object, or a person [44,76,77]. Attitudes can be substructured into a cognitive (what I think is true about the object), affective (all what I feel about the object) and conative (what I intend to do in relation to the object) component. People's opinions change frequently as more information becomes available. Attitude changes require a strong incentive such as new personal experiences or compelling arguments that one cannot deny or suppress.

Most empirical research on attitude change is predominantly framed in the context of persuasion: What elements of a message or a communication context are likely to enhance or diminish the persuasive effect of a message? What elements of the message are remembered and which trigger changes in opinions or attitudes? Before presenting the results of this research, one note of caution is warranted. Most of the research in attitude change has been performed in laboratory settings with student populations. Most experiments were done with a limited set of issues or topics so that it is not clear whether the revealed relationships can be extended to other topics or audiences [77,78]. But at the same time many of the research findings are consistent over long time periods and have been tested with a variety of subjects and topics [79–81]. So they can be regarded at least as well founded hypotheses for application in risk communication.

In addition to attractiveness, sympathy, credibility, and anticipation of honest motives—all rather plausible factors for improving the persuasiveness of a message—more counter-intuitive findings deserve special mentioning (cf. [47]):

- (1) High credibility sources, such as scientists or opinion leaders, produce more opinion change, but no difference in message learning. The learning of a message is more related to the similarity of the message with one's own reasoning style than to existing attitudes and beliefs [77,82].
- (2) Perceived expertise depends on many factors. Among them are status, education, perception of technical authority, age, and social class. If expertise of a communicator is challenged in public, people tend to focus on substitutes for expertise, such as perceived interests or reliance on reference group judgments [44,83].
- (3) Stating explicitly the persuasive intent is usually more convincing than hiding such an intent and leaving it to the members of the audience to make their own inferences. People like to know what the communicator wants them to believe. If it is not openly stated, they will suspect a hidden agenda [27,77].
- (4) Perceived fairness and social status are both variables that can compensate for lack of objectivity. Even if people are aware that the communicator has a vested interest in the issue and argues from a specific viewpoint, they may trust the message or develop confidence in the communicator provided that the information presented appears to be fair to potential counter-arguments and that it is presented with technical authority [27,77].

(5) Being explicit in conclusions and presenting counter-arguments to potential objections have proven more effective than operating with implicit conclusions or presenting only one side of the story. The two often conflicting goals of fairness to the opponents of the communicator's views and of honesty about one's own motives, have to be reconciled in each communication effort in order to be most persuasive [27,77].

(6) The perception that the goals and motives of the source serve a common interest or refer to highly esteemed social values, such as protection of the environment or public health, enhances public confidence in the communicator but reinforces distrust if the mandated performance of the communicator is perceived as weak. People invest more trust in these institutions in the beginning, but tend to be more disappointed if the outcome does not match their expectations [84].

(7) Agreeing to listen to disliked sources increases the probability of attitude change. Although being likable usually enhances the persuasive effect, the mere acceptance of listening to a nonlikable source may motivate the audience to focus on the message instead of the source of communication. The psychological mechanism involved here is avoidance of cognitive dissonance [55]. One can justify spending time with a disliked source only if at least the message is worth the effort. However, the motivation to engage in communication with a disliked person may also serve as a reassurance of how bad the source and the message are [85,86].

All these insights are helpful in designing communication programs and training communicators for their task. Industry announcers, for example, are more likely to persuade their audience if they admit that their objective is to persuade members of the audience to consider at least their viewpoint. In addition, they should not shy away from the question of self-interest. Furthermore, the fair treatment of opponents' arguments (particularly if they are not present) and references to commonly-shared values and interests enhance the likelihood of a persuasive effect.

#### *4.2 The elaboration likelihood model and its application to risk communication*

One of the most prevalent models of attitude and opinion change is the "elaboration likelihood model of persuasion", developed by Petty and Cacioppo in the late 1970s (overview in [87]). The major component of the model is the distinction between the central or peripheral route of persuasion. The central route refers to a communication process in which the receivers examine each argument carefully and balance the pros and cons in order to form a well structured attitude. The peripheral route refers to a faster and less laborious strategy to form an attitude by using specific cues or simple heuristics. When is a receiver likely to take the central route and when the peripheral route? According to Petty and Cacioppo, route selection depends on two factors: ability and motivation. Ability refers to the physical possibility that the receiver

can follow the message without distraction, motivation to the readiness and interest of the receiver to process the message.

Three conditions have to be met to satisfy the criterion of ability: the information has to be accessible, the receiver must have the time to process the information, and other sources of distraction should be absent [88]. Several factors influence the motivation of a receiver to process actively the information. The information content has to be relevant (referring to personal interests, salient values, or self-esteem) and it should trigger personal involvement (with the issue, the content or the source). Both motivational factors are reinforced if the receivers have some prior knowledge or interest in the subject or are in need for new arguments to back up their point of view. The model would also suggest that high-ego involvement (i.e. the match between message content and the recipient's functional or schematic predispositions) increases the likelihood that the central route be taken.

The *peripheral route* is taken when the issue is less relevant for the receiver and/or the communication context is inadequate to get the message across. In this case, the receiver is less inclined to deal with each argument, but forms an opinion or even an attitude on the basis of simple cues and heuristics. In Fig. 5 these peripheral cues are integrated into the source-receiver model and assigned to each step in this model (source-related, message-related and transmitter-related cues). In addition, the context in which the communication occurs provides additional cues for the receiver to generate interest in the message (context-related cues).

With respect to the source, aspects such as credibility, reputation, and social attractiveness are important cues for receivers to adopt a specific message. It also helps to have the message sponsored by multiple sources [89]. The message factors include the length of a message, the number of arguments, the package (color, paper, graphic appeal and others), and the presence of symbolic signals and cues that trigger immediate emotional responses [21]. The transmitter of a message may also serve as carrier for specific cues: the perceived neutrality and fairness, the personal satisfaction with the transmitter in the past ("this magazine is always right"), the similarity with the political or ideological position of the transmitter, and the social credibility assigned to a transmitter are major elements in the formation of opinions or attitudes. In addition, specific channel-related aspects, such as visual impressions from the TV screen, are readily accessible cues.

Social context variables that serve as peripheral cues are often neglected in the discussion of the peripheral route. The social climate for trust and credibility and the image of institutions in a society may evoke a specific predisposition to accept or reject the arguments of a source [41]. With respect to the risk arena, the dominant impression of expert controversy and the presence of competing messages are significant cues that initiate a skeptical or at least cautious reception mode [11]. Other variables can be added to this category,

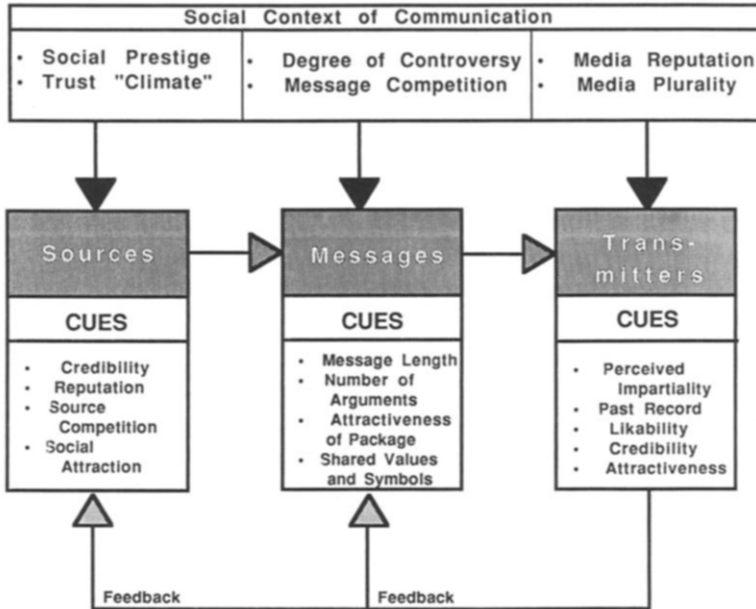


Fig. 5. Peripheral cues of persuasion in communication. Heuristic cues are signals that help the receiver to estimate the credibility and importance of a message. These cues can be categorized in source-related, message-related, transmitter-related, and context-related items. All cues are independent of the arguments used in the information; they rather rely on symbolic or situational signals, which help the receiver to evaluate the information faster and to keep one's personal involvement lower than in the case of the central route of persuasion.

as, for example, the plurality of transmitters or the social reputation of specific media.

#### 4.3 A modification of the elaboration likelihood model

Inspired by the elaboration likelihood model and based on our previous work on modelling stages of attitude formation, Debra Levine and the author have developed a modified version of the elaboration likelihood model [47]. This model is less specific in terms of identifying the factors that lead either to a central or peripheral route of information reception, but more elaborate with respect to the different sequential stages in selecting, assimilating, and evaluating information. The major thrust of this model is the simultaneous presence of central and peripheral elements in the different stages of attitude formation.

Figures 6 and 7 illustrate this model of attitude formation or change. The left column describes the sequential steps of attitude formation starting with the reception of a message and ending with the post-rationalization of the beliefs (the cognitive components of an attitude). This multistep decomposition of the attitude formation process is based on attitude theories by Rokeach [76]

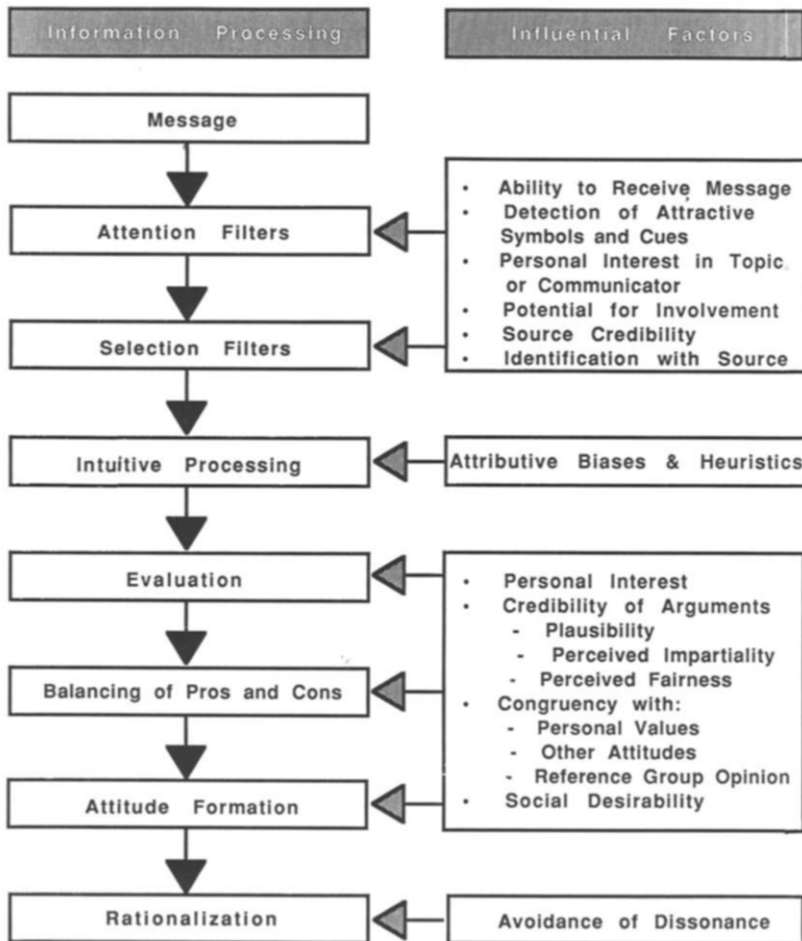


Fig. 6. The central route of persuasion. Based on the elaboration likelihood model by Petty and Cacioppo [87], the central route of persuasion entails a conscious effort on the part of the receiver to evaluate each argument of the information source. However, the assignment of credibility for each argument, the passing of the attention filters, and the intuitive heuristics and biases are also influenced by peripheral cues.

and Fishbein and Ajzen [90], and was developed and graphically displayed in [44]. The right column lists the factors that influence each stage of this process and that determine whether the attitude formation process is terminated prematurely. In concordance with the elaboration likelihood model, two routes of persuasion exist: a central and a peripheral route.

The first three stages are identical for both routes of persuasion. They refer to the process of becoming aware of the information (attention filters), selecting the relevant parts of the information, and processing its cognitive con-



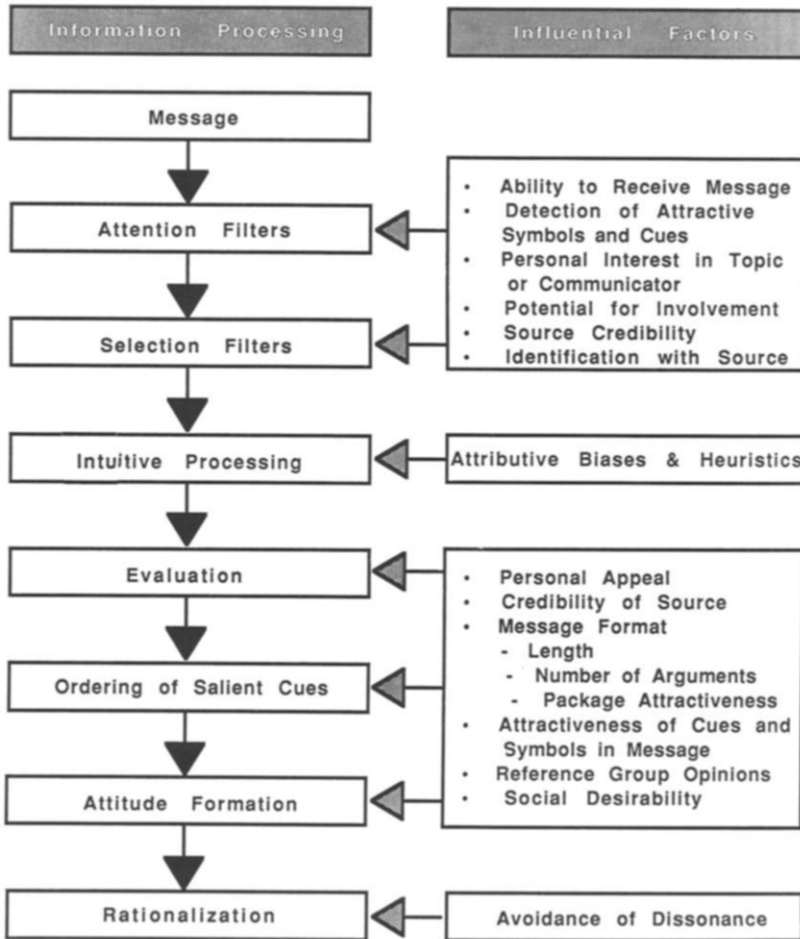


Fig. 7. The peripheral route of persuasion. The peripheral route of persuasion relies heavily on cues. These cues are used to evaluate the credibility of the source and the relevance of the information rather than to deal with each argument separately.

tent. The receivers will decide during these three stages whether the issue is of central interest to them and whether they will terminate the further processing of the information. If the interest is low and if other compensatory cues are missing, then the person is likely to reject or ignore the information. Medium interest or the presence of specific cues will initiate a peripheral route to process the information further. High interest and the presence of many reinforcing cues are likely to produce enough involvement for a recipient to choose the central route. The important factor here is that both routes, the central and peripheral route, are dominated by peripheral cues in the early process of attitude formation. In addition to the receiver's prior experience and interest in

the subject, awareness of a message is enforced by a special set of peripheral cues, such as novelty of the information, the mentioning of prestigious persons or institutions, or specific symbolic keywords or clues that link emotional involvement to the subject [91].

The third step of intuitive processing of cognitive information refers to the heuristics and common sense mechanisms of drawing inferences or attributing linkages to the information received (see Section 3.7). Although one cannot classify these heuristics as peripheral cues, they are still representations of simple rules to cope with complex information. In the peripheral route, these cognitive heuristics may be replaced partially by even simpler cues like credibility of the source. If cognitive information is processed at all, these heuristics will govern the intuitive generalization process regardless what route of information processing is pursued.

The major difference between the peripheral and the central route lies in the process of evaluation, the fourth step of the model. In the central mode, the receiver performs two types of evaluations: first, an assessment of the probability that each argument is true; and second, an assignment of weight to each argument according to the personal salience of the argument's content. The credibility of each argument can be tested by referring to personal experience, plausibility, and perceived motives of the communicator. In modern societies with highly professionalized and differentiated knowledge, experience and plausibility are often weak instruments to evaluate the truth of a statement [92]. No lay person, for example, has any empirical evidence to prove or disprove an expert's claim that low-level radiation causes cancer. Rather recipients use secondary cues, such as prestige of the source and suspicion of vested interests, to evaluate the accuracy of a statement [83,93]. It is important to note that in these instances, where personal experience is lacking, both the central and the peripheral route are almost identical because they rely on judgment of trust or credibility. However, this judgment is made for each argument in the case of the central route but is made for the total message or holistically for the source in the case of the peripheral route.

The evaluation of the salience of each argument is performed by a comparison of the message with one's personal interests, one's own value system, other major attitude and beliefs, reference group judgments and the perceived social desirability of the intent of the message [86,94]. This process may be more or less pronounced and not all comparisons have to be made for each argument. But the major incentives for changing an attitude in the central mode are the proximity with and the affinity to one's own interests, values, and world views. In the peripheral mode, receivers do not bother to deal with each argument separately, but look for easily accessible clues to make their judgment on the whole package.

The last two stages refer to attitude formation and rationalization. After the formation process, in which the receiver incorporates the message into their

attitude system, the potential negative arguments are frequently suppressed or re-directed into a positive view. This is done more intensely if the balancing act requires more mental work and pain. This process of bolstering helps to avoid cognitive dissonance and post-decisional regret [95]. The two routes do not differ in these last two stages.

#### 4.4 Attitudes and behavior

Once attitudes are formed, they generate a propensity to take actions. As known from many attitude studies, the willingness to take actions, however, is only partly related to overt behavior [76,90,96,97]. A positive or negative attitude is a necessary but not sufficient step for corresponding behavior. A person's decision to take action depends on many other variables, such as behavioral norms, values, and situational circumstances. Hence, the communication process will influence the receiver's behavior, but the multitude of sources, the plurality of transmitters, and the presence of situational forces on personal behavior render it almost impossible to measure, not to mention to predict, the effect of a single communication activity.

The weak correlation between attitudes and behavior is one of the major problems in risk communication that aims to change behavior (for example, for emergency responses). Most analysts agree that it is difficult enough to change or modify attitudes through information, but that it is even more difficult to modify behavior. Some success stories ([98], [99] pp. 47ff, [100,101]) in the area of health risks (for example, reducing cholesterol and pesticide use) as well as some failures [37,74] to promote actions (for example, protection against indoor Radon) suggest that three factors are crucial for increasing the probability of behavioral changes:

- (1) the continuous transmission of the same information even after a positive attitude has been formed towards taking that action (*need for constant reinforcement*);
- (2) the unequivocal support of most relevant information sources for the behavioral change advocated in the communication process (*need for consistent and consensual information*);
- (3) adoption of the behavioral changes by highly esteemed reference groups or role models (*social incentive for imitation*).

Information about emergency responses may, in addition, require actual exercises or practices before the desired behavioral responses are internalized [102]. Behavioral changes, particularly if they involve painful changes of habits, are rarely triggered by information alone. Rather, information may be effective only in conjunction with other social factors, such as changes of social norms, roles, and prestige.

#### 4.5 Application of persuasion studies to risk communication

How can the elaboration likelihood model and the attitude-behavior studies help communicators to analyze and design risk communication programs? An

effective risk communication program must contain a sufficient number of peripheral cues to initiate interest in the message, but also enough “rational” argumentation to satisfy the audience with central interest in the subject. The problem is how to avoid anger and rejection by centrally interested persons if they are confronted with “superficial” cues, such as advertising gimmicks, and how to sustain the interest of the peripherally interested persons if they are confronted with lengthy arguments. The problem can be resolved if the message eschews “obvious” cues, but includes cues that are acceptable for both types of audiences.

What cues are acceptable for both audiences? First, cues that make information easier to understand, digest, and apply are always appreciated by both audiences. Second, cues that relate to commonly shared beliefs and values will enhance the interest of the centrally concerned receiver and improve the change for finding attention among the peripherally concerned receivers. Third, cues that link highly esteemed individuals, groups, or institutions to the issue will normally be welcome by both groups, unless the link appears unnatural (for example, having a well-known football player advertise nuclear power).

Another major application of the elaboration likelihood model is to tailor the content of the communication process to the interests and concerns of the target audience. This is not only a pathway to avoid the fuzziness of peripheral cues in persuasion, but also to tailor the message to the needs of the audience. Although two-way communication helps to identify the audience’s concerns, it is important to know what kind of concerns are usually expressed in the risk arena and in which way these different concerns can be addressed. Based on the work of Funtowicz and Ravetz, S. Rayner has proposed a division of risk debates in three levels [43,103]. The risk debate involves a factual level about probabilities and extent of potential damage, a clinical mode about institutional arrangements and experience to deal with these risks, and a world-view perspective that is focused on values and lifestyles in dealing with risks in general. The system uncertainty and the decision stakes increase with the order of the three levels.

Figure 8 is a graphical representation of this model using a modified version of the original Rayner categories (taken from [47]). On the lowest level, risk debates may focus on actual evidence and scientific findings. This requires a technical style of presentation and the involvement of experts in the communication program. The second level represents the realm of professional judgment and experience. Past record of reasonable decision making, personal experience, and social recognition of performance are major elements for discussion here. The third level involves the personal identification with a set of values and lifestyles. Communication on this level relies on finding and establishing a shared meaning of the risk and its management.

Communication on the first level serves the purpose of convincing the audience that the factual knowledge compiled by independent scientists support

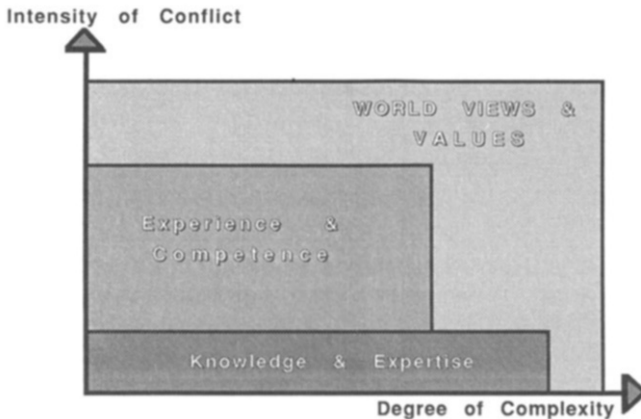


Fig. 8. The three levels of conflict in risk debates. Based on a model by Funtowics and Ravetz [103] and its application by Rayner [43], the three levels help to distinguish three different types of risk debates. On the first level, debates focus on technical issues such as engineered safety or probability estimates. The second level refers to personal or institutional performance. The focus is on the ability of the risk management institution to monitor and control risks effectively. Third-level debates place the risk issue in a larger context of world views and lifestyles. If conflicts on the third level remain unresolved, it is unlikely that any solution can be found on the first or second level.

the case of the communicator. First-level debates require factual evidence to induce attitude or behavioral changes, but attitudes are rarely based on factual information alone. Rather they focus on vested interests, distribution of risks and benefits, and the adequacy of the proposed solution in terms of economic and social compatibility. Although scientists and many risk management agencies are most comfortable with technical debates, they should be aware that attitudinal or behavioral changes require more than technical information, but additional communication efforts on the second and third level.

The second level of debate (clinical expertise) does not rely on technical expertise, but on personal and institutional judgments and experience. A debate on this level requires input from interest groups and affected populations. The issue of conflict is not so much the magnitude of the risk, but the distribution of risk and the tolerability of such a risk *vis-à-vis* the potential benefits that the risk source is able to provide. Trust in this situation cannot be accumulated by demonstrating technical skills and expertise, but by compiling evidence that the communicator has been cost-effective in the allocation of resources and has been open to public demands and requests. Competent management and openness towards social demands are the two major factors in providing incentives for attitudinal or behavioral changes on this level.

If the participants in a risk debate focus on values and future directions of societal development (third level), neither technical expertise nor institu-

tional competence and openness are sufficient conditions for inducing any attitudinal or behavioral changes. They can only result from a more fundamental consensus on the issues that underlie the risk debate. As long as value issues remain unresolved, even the best expertise and the most profound competence cannot overcome the distrust that people will have in the task performance of the acting institution and consequently see no incentive to change their attitudes or behavior.

The preoccupation of society with environmental problems, the perceived ambiguity of technical change, and the overall decline of trust in public institutions predestine risk debates to evolve to third-level controversies and to become issues of lifestyle and world view [43,47]. The risk issue has evolved from a technical to an institutional debate and furthermore to a struggle on world views and lifestyles. The resulting conflict produces conflicting evidence, further erosion of trust, and personal frustration. In this situation, risk communication has to meet an almost impossible task: to develop a framework of mutual trust and confidence so that conflicts can be reconciled in a rational and democratic way. How to accomplish this goal will be the topic of the next section.

## **5. Conditions for a rational risk discourse**

### *5.1 The characteristics of a rational discourse*

The third major objective of risk communications is to provide the conditions for organizing a rational discourse on risk issues [17,22,25]. A rational discourse is defined as a communication process in which all affected parties resolve a conflict by:

- (1) reaching a consensus on the procedure that the participants want to employ in order to derive the final decision or compromise, such as majority vote or the involvement of a mediator [104];
- (2) basing their factual claims on the “state of the art” of scientific knowledge and other forms of legitimate knowledge; in the case of scientific dissent all relevant camps should be represented [105];
- (3) interpreting factual evidence in accordance with the laws of formal logic and argumentative reasoning [106];
- (4) disclosing the values and preferences of each party, thus avoiding hidden agendas and strategic game playing [107];
- (5) attempting to find a fair solution whenever conflicting values or preferences occur, including compensation or other forms of benefit exchange [108] pp. 42ff).

There is no doubt that such a discourse can only be the ideal goal for reconciling social and political conflicts. But it is one of the major challenges of modern democratic societies to find a process that facilitates the involvement of all affected parties and at the same time produces a prudent and informed

judgment based on expertise and knowledge [109,110]. The success or failure of a rational discourse depends on many factors. Among the most influential are ([7], [108] pp. 190–194, [110–113]):

1. *Time*: a discourse cannot be organized in a week or even a month. It is advisable to allocate sufficient time for a discourse before the actual decision has to be made. This is not always politically feasible, because many decisions have to be made instantaneously. Most risk conflicts, however, have provided enough evidence that insufficient consultations with the affected parties delay the decision process much longer than the preparation time needed to organize a discourse prior to the decision [15].

2. *Openness of result*: a discourse will never accomplish its goal if the decision has been made (officially or secretly) and the purpose of the communication effort is to “sell” this decision to the other parties. Individuals have a good sense whether a decision maker is really interested in their point of view or if the process is meant to pacify potential protesters [114]. As stated in the previous sections, at some point decisions have to be made and then explained to the public, but this should not be done in the context of a discourse (regardless of whether this is a hearing, a community gathering, or another form of organized dialogue pretending to incorporate public concerns in the decision).

3. *Equal position of all parties*: a discourse needs the climate of a “powerless” environment [7]. This does not mean that every party has the same right to intervene or claim a legal obligation to be involved in the political decision-making process. However, the internal rules of the discourse have to be strictly egalitarian; every participant must have the same status in the group and the same rights to speak, make proposals, or evaluate options [112]. Two requirements must be met. First, the decision about the procedure and the agenda must rely on consensus; all parties need to agree. Second, the rules adopted for the discourse are binding for all members and no party is allowed to claim any privileged status or decision power. The external validity of the discourse results are, however, subject to all legal and political rules that are in effect for the topic in question.

4. *Willingness to learn*: all parties have to be ready to learn from each other. This does not necessarily imply that they have to be willing to change their preferences or attitudes. Conflicts can be reconciled on the basis that parties accept other parties’ positions as a legitimate claim without giving up their own point of view. Learning in this sense entails:

- Recognition of different forms of rationality in decision making [7,48].
- Recognition of different forms of knowledge, be it systematic, anecdotal, personal, cultural, or folklore wisdom [106].
- Willingness to subject oneself to the rules of logical reasoning and argumentation, i.e. provide factual evidence for claims; obey the rules of logic for drawing inferences; disclose one’s own values and preferences *vis-à-vis* potential outcomes of decision options, and others.

5. *Resolution of allegedly irrational responses*: discourses in which the public interest groups or affected individuals are represented frequently demonstrate a conflict between two contrasting modes of evidence (see also Section 3.2): the public refers to anecdotal and personal evidence mixed with emotional reactions, whereas the professionals play out their systematic and generalized evidence based on abstract knowledge [12,13,42]. A dialogue between these two modes is rarely accomplished because experts regard the personal evidence as a typical response of irrationality. The public representatives perceive the experts often as uncompassionate technocrats who know all the statistics, but “who couldn’t care less” about a single life lost. This conflict can only be resolved if both parties are willing to accept the rationale of the other party’s position and to understand, and maybe even empathize, with the other’s party view ([108] p. 191, [115]). If over the duration of the discourse some familiarity with the process and mutual trust among the participants have been established, role playing can facilitate that understanding. Resolving alleged irrationalities leads to the discovery of an hidden rationality in the argument of the other party.

6. *De-moralization of positions and parties*: the individuals involved in a discourse should agree in advance to refrain from moralizing each other or each other’s arguments ([108] p. 191). Moral judgments impede compromise. Something cannot be 30 percent good and 70 percent bad; either it is good, bad, or indifferent. As soon as parties start to moralize issues, they cannot make tradeoffs between their allegedly moral position and the other parties’ immoral position without losing face. A second undesired result of moralizing is the violation of the equality principle stated above. Nobody can assign equal status to a party that is allegedly morally inferior to the other parties involved. Finally, moralizing masks deficits of knowledge and arguments. Even if somebody knows nothing about a subject or has only weak arguments to support their position, assigning blame to other actors and making it a moral issue can help to win points in the public arena and to become a respected participant in the dispute [92,116]. Many parties in a discourse try this route if they feel they are not taken seriously or their rationality is not accepted. Given that Conditions 1–5 are met, there is a good chance that participants voluntarily agree to refrain from the “unfair” instrument of moralization. The absence of moralizing other parties or their position does not mean to refrain from using ethical arguments, such as “this solution does not seem fair to the future generation” or “we should conserve this ecosystem for its own sake”. Ethical arguments are essential for resolving environmental disputes.

### 5.2 *The need for participation*

Is there any procedure that would meet the requirements for such a discourse and at the same time assure the incorporation of expertise and social values? Many models for public participation have been suggested in the literature that



promise to facilitate a rational discourse ([113,117–120]; see reviews in [110,121,122]). This is not the place to discuss these models in detail, but one model of citizen participation developed by P.D. Dienel deserves some special attention [123,124]. With several modifications, the author applied this model to studies on energy policies in West Germany and to sludge-disposal strategies in the United States [107,125,126]. The model entails three consecutive steps:

1. *Identification and selection of concerns and evaluative criteria.* The identification of concerns and objectives is best accomplished by asking all relevant interest groups (i.e. socially organized groups that are, or perceive themselves as being affected by the decision) to reveal their values and criteria for judging different options. It is crucial that all relevant value groups be represented and that the value clusters be comprehensive and include economic, political, social, cultural, and religious values. To elicit the values and criteria for such a list, the technique of value-tree analysis has prove appropriate [127–129]. The resulting output of such a value-tree process is a list of hierarchically structured values that represents the concerns of all affected parties.

2. *The identification and measurement of impacts and consequences related to different policy options.* The evaluative criteria derived from the value tree are operationalized and transformed into indicators by the research team or an external expert group. These operational definitions and indicators are reviewed by the participating stakeholder groups. Once approved by all parties, these indicators serve as measurement rules for evaluating the performance of each policy option on all value dimensions. Experts from varying academic disciplines and with diverse perspectives on the topic of the discourse are asked to judge the performance of each option on each indicator. For this purpose, a modification of the Delphi method has been developed and applied [130,131]. This method is similar to the original Delphi format [132], but based on group interactions instead of written responses. The objective is to reconcile conflicts about factual evidence and reach an expert consensus via direct confrontation among a heterogeneous sample of experts. The desired outcome is a specification of the range of scientifically legitimate and defensible expert judgments and a distribution of these opinions among the expert community with verbal justifications for opinions that deviate from the median viewpoint.

3. *Conducting a rational discourse with randomly selected citizens as jurors and representation of interest groups as witnesses.* The last step is the evaluation of potential solutions by one group, or several groups, of randomly selected citizens [123,124]. These panels are given the opportunity to evaluate and design policy options based on the knowledge of the likely consequences and their own values and preferences. The participants are informed about the options, the evaluative criteria, and the consequence profiles. The representatives of interest groups and the experts take part in the process as witnesses; they provide their arguments and evidence to the panels who ultimately decide on the various options. This deliberation process takes time: citizen panels are

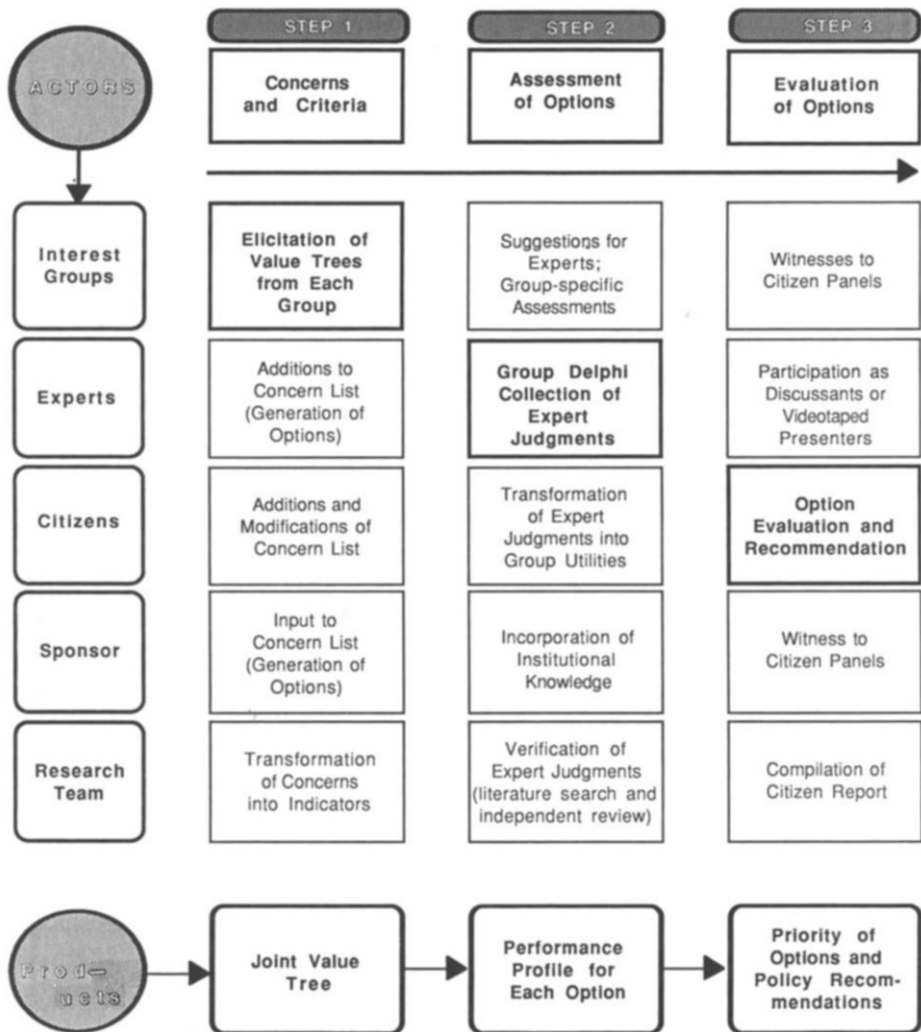


Fig. 9. The three-step participation model. Based on a participation model by P. Diemel [123], this procedural concept tries to integrate interest group values, expert knowledge and public preferences for evaluating and designing policies. In a first step, values and criteria to judge policies are elicited from representatives of interest groups; in a second step, option profiles are generated by asking experts to rate each policy option on the criteria identified in Step 1; and in a third step, randomly selected citizens are given the opportunity to evaluate these options on the basis of their utilities and preferences.

and cultural sociologists have investigated the social response to risk issues and have identified four or five patterns of value clusters that separate different cultural groups from each other [43,133–136]. These different groups have formed specific positions on risk topics and have developed corresponding at-

conducted as seminars over three to five consecutive days. All participants are exposed to a standardized program of information, including hearings, lectures, panel discussions, videotapes, and field tours. The process is similar to a jury trial with experts and stakeholders as witnesses and advisers on procedure as “professional” judges.

Figure 9 illustrates the functions and procedure of this model. The figure shows that all three groups (experts, interest groups, and the general public) play a role in each step, but that they are encouraged to impact the decision process with the specific knowledge with which they are most proficient. This division of labor provides a check-and-balance process and a sequential order for multiple actor involvement.

This is only an example of a procedural specification of a rational discourse. To have a procedure in place is important for organizing a successful discourse, but the choice of the appropriate procedure depends on the context, the type of initiating agency, the scope of the problem, and the spatial extent of the proposed solution [42]. Whatever procedure is selected, it is crucial to have all involved parties agree on the conditions for conducting a discourse. Otherwise, the discourse is likely to fail.

### 5.3 Constraints of a rational discourse

The organization of a rational discourse is a difficult task and is constrained by many psychological and social factors. Risk communicators should be especially aware of the following problems:

1. *The inference trap for risk issues.* Finding a viable compromise in conflicts requires an agreement about factual evidence. Often such an agreement entails involving a third, noninterested party to investigate the factual basis for competing claims and to test its empirical validity. In risk issues this is extremely difficult, because the stochastic nature of the potential consequences (uncertainty) does not allow any inference with respect to a single facility or event. Consequently, there are competing and rationally defensible strategies for coping with risk, such as using the expected value as an orientation for risk acceptability or taking the minimax approach (minimize your maximum regret). Choosing one strategy over another obviously makes a major difference in the evaluation of risks. Furthermore, the time horizon for falsifying claims about risks is longer (in theory infinite) than any decision maker can wait. Any highly improbable event can occur today or tomorrow. Its early occurrence does not necessarily mean that the professional assessment to categorize this as a low probability event was flawed. Single events cannot be predicted by probability statements. As a consequence, resolution of risk conflicts may require substantial discussion and debate about the meaning and normative validity of probability statements and reconciliation of strategies to cope with uncertainty.

2. *Cultural barriers to discourse participation.* In recent years, anthropologists

titudes and strategies. For this article, the five group structure proposed by M. Thompson [136] rather than the four group composition has been selected since the fifth group (the hermits) may play an important role in facilitating discourses on risk. The five groups are illustrated in Fig. 10. The groups differ in the degree of group cohesiveness (the extent to which someone finds identify in a social group), and the degree of grid (the extent to which someone accepts and respects a formal system of hierarchy and procedural rules).

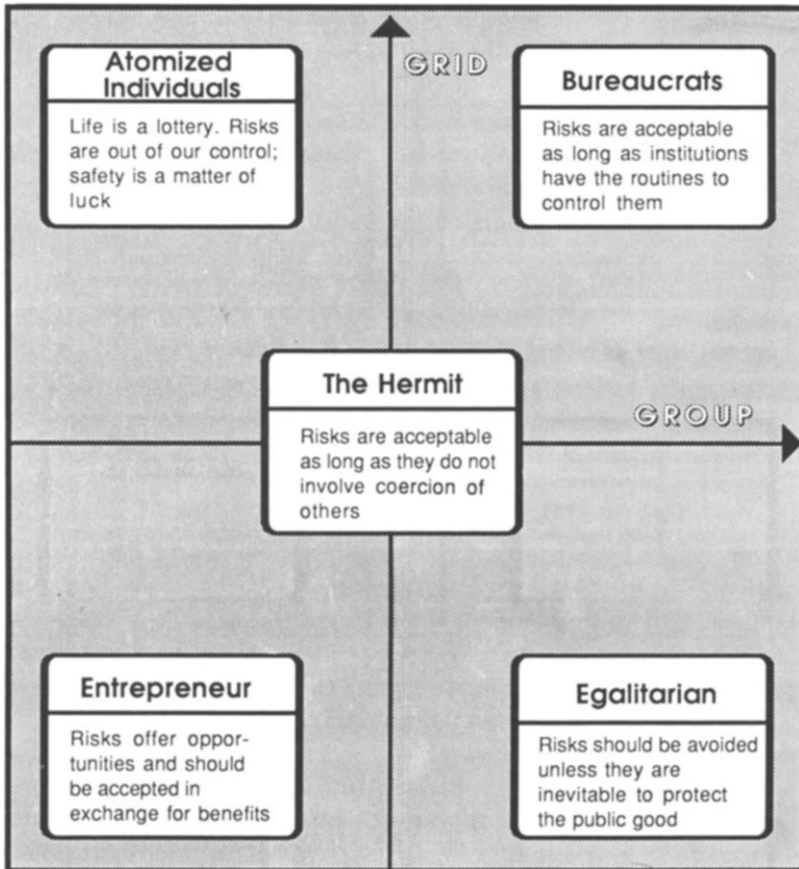


Fig. 10. Risk taking in the context of five cultural prototypes. In accordance with the cultural theory of risk [136], the receivers of risk information can be classified in five groups. The group of the entrepreneurs is risk-prone and regards risks as opportunities to gain future benefits. The group of the egalitarians is risk-averse and not willing to trade risks against benefits, particularly if the distribution of risks is inequitable. The group of the bureaucrats accepts risks if the source of the risk is effectively controlled by a public institution. The atomized individuals perceive risks as inevitable fate and are difficult to mobilize in a risk debate. Members of the last group, the hermits, have alliances to different groups and may be the ideal facilitators for a risk debate aimed to bridge the gap between the other cultural groups.

Members of the entrepreneurial group are convinced that risk taking provides them with opportunities to succeed in a competitive market and to pursue their personal goals ([43] p. 13). They are less concerned about equity issues and would like the government to refrain from extensive regulation or risk management efforts. This group contrast most with the egalitarian group, which emphasizes cooperation and equality rather than competition and freedom. Egalitarians focus on long-term effects of human activities and are more likely to abandon an activity (even if they perceive it as beneficial to them) than to take chances. They are particularly concerned about equity. The third group, i.e. the bureaucrats, relies on rules and procedures to cope with uncertainty. As long as risks are managed by a capable institution and coping strategies have been provided for all eventualities, there is no need to worry about risks. Bureaucrats believe in the effectiveness of organizational skills and practices, and regard a problem as solved when a procedure to deal with its institutional management is in place. The fourth group, the atomized or stratified individuals, are either part of a hierarchy or principally believe in hierarchy, but they do not identify with the hierarchy to which they belong. These people trust only themselves, are often confused about risk issues, and are likely to take high risks for themselves, but oppose any risk that they feel is imposed on them. At the same time, however, they see life as a lottery and are often unable to link harm to a concrete cause [136]. Finally, the last group is the group of autonomous individuals. In contrast to Thompson's description of autonomous individuals as self-centred hermits and short-term risk evaluators, they can also be described as potential mediators in risk conflicts, since they build multiple alliances to the three other groups and believe in hierarchy only if they can relate the authority to superior performance or knowledge.

It is very helpful for any risk manager to be aware of these different groups, since they will respond only to some types of arguments and reject or ignore others. However, the communication effort can still reach these groups. All cultural groups might be integrated in a rational discourse if an attempt is made to translate their respective rationales to each other. This translation service may be performed best by members of the autonomous group or strong adherents of one of the groups who have the desire to cross cultural boundaries.

3. *The success rules of the political arena.* Beyond the problem of cultural divisions, risk debates take place in a political context in which participation in a rational discourse may not be rewarded or may hurt a party in its strife for social resources [108]. Using the metaphor of an arena (cf. Fig. 11), social conflicts can be described as a struggle between various actors on the arena stage, controlled by a rule enforcement agency (usually a governmental institution) and observed by professional "theater critics" or issue multipliers (the media) who interpret the actions on the stage and transmit their reports to a larger audience [137-139]. The arena metaphor is strongly influenced by conflict theory [140] and social mobilization theory [141,142].

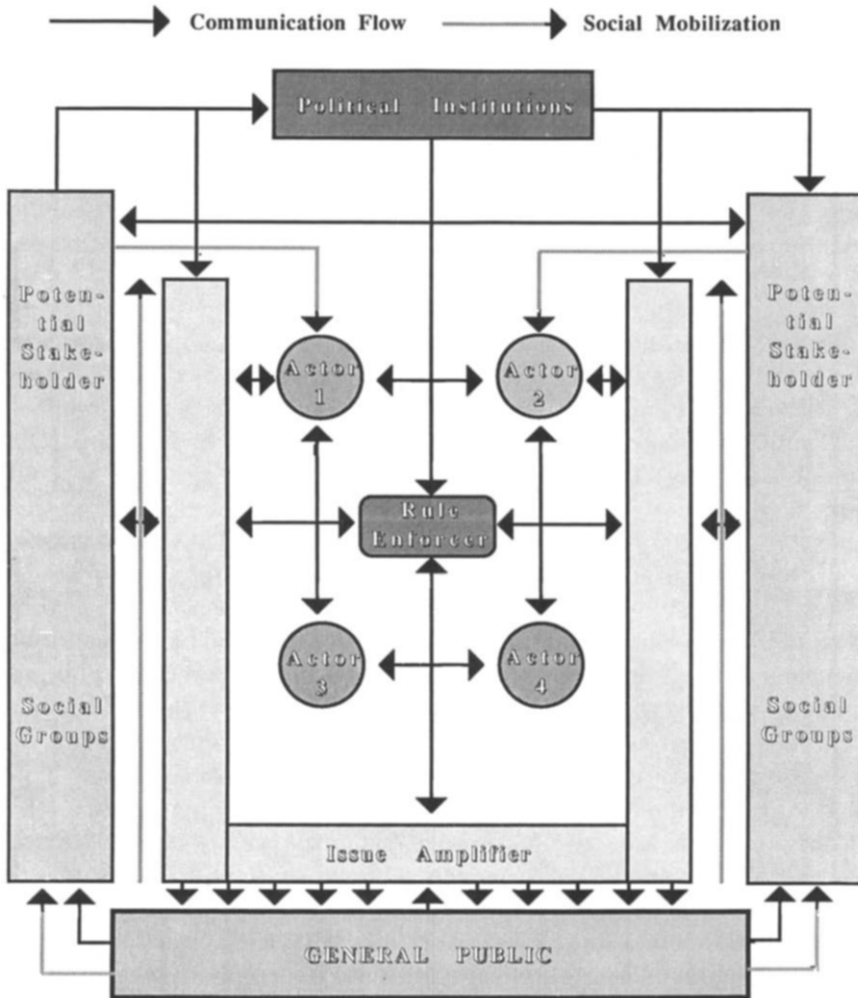


Fig. 11. Graphical representation of the arena metaphor. Social actors communicate with each other on the arena stage in order to gain more social resources (i.e. money, power, social influence, cultural commitment, and evidence). Actors are interested in conflict resolution discourses only if they perceive this involvement as a strategy to increase their reservoir of resources. Professional issue amplifiers or transmitters report all the actions on the stage to the general audience. This communication results in support or rejection of claims by other social groups and may help to mobilize groups or individuals to join the arena. Public institutions act as rule enforcers or, in some arenas, as final decision makers, but despite their legal powers rely on the availability of resources like any other actor on stage. The fewer resources they possess they more the actors will take advantage of this weakness and define their own arena rules.

To be successful in a social arena, it is necessary to mobilize social resources. These resources can be used to gain attention and support of the general public, to influence the arena rules, and to “score” in the arena in competition with

the other actors. Social resources include: money, power, social influence, value commitment and evidence [143,144]. Money provides incentives (or compensation) for gaining support; power is the legally attributed right to impose a decision on others; social influence produces a social commitment to find support through solidarity; value commitment induces support through persuasion and trust; and evidence can be used to convince persons about the likely consequences of their own actions. Resources are not the ends of the actors, but the means to accomplish their goals.

Actors will enter risk arenas if they expect this will provide them with an opportunity to gain more resources [42,145]. Beyond their reservoir of resources at any time, they can gain more resources by exchanging one resource for another (for example, winning public trust by sharing power through participation or exchanging evidence for prestige) and by communicating to other actors and the issue multipliers. The objective of communication is to receive public support and to mobilize other groups for one's own cause. The more resources a group can mobilize in an arena, the more likely it is that it dominates the conflict resolution process and gets its point of view incorporated in the final decision.

The inherent uncertainty of risk assessments (as stated above) provides sufficient flexibility to "support" conflicting evidence and claims. Risk management agencies often lack trustworthiness, because they are unable to mobilize social resources beyond their power reservoir [146]. In particular, they have difficulties exchanging evidence for trust, since evidence is so contested. Because of the weak position of the rule enforcement agencies, risk arenas tend to experience more rule innovations than other arenas in which strong enforcement agencies are present. In arenas with high ambiguity of the political issue, weak status of the rule enforcement agency, and a lack of immediate personal experience about the potential consequences of political decisions, the distribution of resources relies almost entirely on the success of one's communication efforts. The recent emphasis on risk communication is a clear indicator of this situation.

If actors in an arena can win only by mobilizing resources, they will not engage in a rational discourse unless they are convinced that this route will help them to add resources to their reservoir. Although resource mobilization is not a strict zero-sum game, actors are aware that not every participant can win in a discourse. For this reason, they will cautiously evaluate their opportunities and risks, and then decide whether to participate or stay outside. Actors with lots of resources available are particularly reluctant to get involved in a discourse in which their equal footing with all other parties would erode their position of strength.

#### *5.4 How to cope with the political constraints*

Given the strategic goals of the actors in an arena, is it realistic to try to implement a rational discourse on risk? Should we strive only for the goals of

message understanding and persuasion in risk communication and leave the conflict resolution process to the political market of strategic game-playing in the risk arena?

In view of the potential disasters that can result from making the wrong choices in risk policies, it is essential that every effort should be made to transform at least parts of the risk arena into a rational discourse. Some political analysts would disagree and claim that “muddling through”, i.e. leaving it to the political free-market assures a rational solution to political problems, as does the economic free-market for the rational allocation of material and human resources [147]. Collective decision making under uncertainty, however, can not afford the “trial and error” process of the free market, because error in this context is too ‘expensive’ in terms of human lives and material resources on stake. Anticipating potential errors and correcting them before they manifest themselves in disasters is the only humane strategy to deal with modern technological risks [46]. This task cannot be performed by the market which relies on errors for learning. In addition, muddling through favors policies that put risk burdens on future generations and produces NIMBY (not in my backyard) responses [148].

The necessity for a rational discourse does not mean that such a discourse can be implemented effectively. If actors do not perceive any advantage in participating in such an endeavor, how might they be convinced to take part? Three major strategies are available that might help to persuade potential actors get involved in a rational discourse (cf. [108] pp. 193, 126ff):

(1) Wait until actors are frustrated with the arena outcome. In arenas with actors having a similar arsenal of social resources, the struggle continues over long time periods without any resolution in sight. The deadlock results in political paralysis as none of the actors is able to mobilize enough resources to force others to accept a compromise [44]. In this situation all actors lose unless “doing nothing” is in the strategic interest of one or more of the parties involved. The frustration over the immobility of the political system to respond to the competing claims creates a favorable climate to engage in negotiations based on the rational discourse model.

(2) Emphasize the openness and fairness of the process. Many actors are convinced that their point of view would prevail in a social contest if they only had a fair chance to have their arguments and claims presented to an unbiased audience. A rational discourse promises such a fair forum and helps all parties to make their viewpoint known to other parties.

(3) Create social support for the discourse idea. This is probably the most powerful instrument for promoting a rational discourse. If participation in a discourse is associated with gaining more social resources, and refusal to participate is linked to losing vital resources, actors may feel they can only win by participating in the discourse.

The arena metaphor does not imply that all actors in a risk arena are power-



driven group-centered egoists with no concern for the common good. It rather refrains from any assumption about the actors' goals and motives; they may be truly altruistic or purely egoistic. Success in a political arena, however, is contingent on the availability of social resources. The most altruistic goals cannot be accomplished without the possession of these resources. All actors are therefore compelled to mobilize resources. In the interest of pursuing their goals, they are bound to evaluate any proposal to get involved in a conflict resolution process on the grounds of the potential of this process to improve their resource mobilization capability.

## 6. Suggestions for successful risk communication

The preceding sections have offered some general suggestions for improving risk communication. This section specifies these general suggestions and provides some normative advice to risk communicators. On the basis of risk perception and risk communication studies, several authors have already developed guidelines for designing and evaluating risk communication [12,17,22,24,25,33,149,150]. These guidelines are not all substantiated by empirical research; they rely to a large extent on common sense, expert judgment, and personal experience, and provide some useful criteria for developing an effective and consistent information and communication program.

The following suggestions are practical delineations from the theoretical and empirical results described in the previous sections (cf. also [33]). They include common sense reasoning, but each suggestion is linked to one of the theoretical concepts discussed in this article. The suggestions are not substructured according to the three major objectives of risk communication, since many of them help to meet all three objectives simultaneously. Rather they are ordered according to their degree of sophistication: from the relatively simple task of message construction to the more complex task of organizing a rational discourse.

(1) *Be clear about your intentions and make them the central message of your communication effort.* As obvious as this may sound, many risk information attempts are clear violations of this principle. Many agencies are forced to react before they have made up their mind about an issue. Sometimes different departments voice different opinions and the text of the information constitutes a poor compromise between the diverse viewpoints. If a fast reaction is required, the message of the first response may be that there is still too much uncertainty about risk to produce sound judgments and that the institution needs more time to assess the data. Although this message may not be very attractive, it is still better than pretending to have a degree of certainty which is unjustified. Clarity and unequivocal position are two major conditions to pass the attention filter of the respected audience.

(2) *Simplify your message as drastically as you think you can do without being*

*inaccurate*. Messages will be simplified regardless how well written the text may be. Rather than have the transmitters and final receivers simplify the text their way, the sender may perform a more accurate simplification in accordance with their original intentions. Simplification is a very delicate job and needs careful editing and re-editing. Factual information should be made as simple as possible, but information about the decision process, the values that were used to assign tradeoffs to different options, and the remaining uncertainty should not be omitted, as this information is crucial for building credibility and trust.

(3) *Place your simple messages in the beginning of a text and gradually add the complex issues.* Although simplicity is a virtue for the whole information process, it is advisable to start with the simple and easily understandable messages and add more complex and detailed information at the end. This structuring of the information serves two purposes: gaining the attention of the peripherally interested audience and at the same time pleasing the centrally interested audience, which expects detailed argumentation and sufficient evidence. One way to please both audiences (aside from splitting the information) is to give the general information first and add the specifics later.

(4) *Anticipate the interests of your target audiences and design your communication program to match their needs.* This guideline is the most often violated rule in risk communication. Experts in institutions often yield to the irresistible tendency to package a whole education program in each attempt to communicate with the public. But most people have neither the desire nor the time to become nuclear engineers, immune system specialists, or experts on radon. Most people want to know the consequences of a risk, the circumstances of its occurrence, the possibilities for mitigating the risk, and the management efforts by the respective institutions. Depending on the level of the risk debate, the communication should focus on the scientific evidence, the management record of the institution, or the world views and philosophies that govern the institutional performance.

(5) *Devise different communication programs for different target audiences but do not change the message.* In addition to structuring texts, a communication program can operate with different packages containing the same message, but using different channels for transmission. A message to the national wire services should contain only the basic facts and some general conclusions, a press release to a daily newspaper may also incorporate some discussion of the results, anecdotal evidence if suitable, and reference to actual events (otherwise it will not pass the selection filters of these transmitters). Manuscripts for science supplements in newspaper or specialized journals should be more problem oriented and offer a novel or interesting perspective in the analysis of the issue.

(6) *Messages should be distributed on different channels and feedback communication should be stimulated and encouraged as much as possible.* A good com-

munication program should not only address different audiences by using different transmitters, but should also take advantage of the different available channels. Press release are one major medium for communication, but press conferences, participation in talk shows, appearances at hearings and public events, letters to the editor, and direct mailings are often complementary ways of conveying a message. Press conferences and talk shows allow immediate feedback from the transmitter so that the information can be better tailored to the needs of the receiver. Sending out brochures with reply envelopes is another method of collecting information about the communication needs of the public and bypassing the transmitters. Models for public involvement have been proposed and tested to assure constant feedback from the risk bearers and bystanders. In addition, monitoring the process of re-coding (through content analysis of media messages) and of receiver's responses (through evaluating letters to the editor or direct survey methods) provides valuable information about the comprehensibility of the original information and its effects on the receiver.

(7) *Be honest, complete and responsive in the composition of your message.* Honesty is a vital condition for gaining credibility. Honesty will not automatically be rewarded, but dishonesty will certainly create negative repercussions among transmitters and final receivers. The same effect will take place when sources withhold relevant information or tell only one side of the story. The goals of honesty and completeness include another, often overlooked aspect. Institutions with vested interests should put their cards on the table and justify their position. Credibility is often assigned by speculating about the true motives of the source. If profits or other vested interests are obvious motives, it is better to address these issues and make clear that such interests do not automatically preclude public interest or the common good. Industries could, for example, make the argument that companies with a good risk reduction and control program are more likely to attract better qualified personnel, to enhance their corporate reputation, and to avoid costly litigation.

(8) Try to escape from role expectations by using a personal approach and by framing the communication to the personal experience of the addressed receiver. Receivers, in particular peripherally interested persons, are inclined to select information that contains surprises or unexpected insights. Even if the material of the message does not offer anything new, communicators can attract attention by avoiding the stereotypes of their role and by personalizing the message. This is particularly effective in face-to-face interactions, press conferences, or talk shows. Without denying their home institution, communicators may report about their personal feelings and what kind of actions they took to protect themselves. They even may convey their own concerns and show compassion for the anxieties and worries of the addressed audience. In addition, avoiding role stereotypes confronts the audience with some cognitive dissonance that may be resolved by accepting the new message. To be honest

is an absolute condition for such an attempt because most people have developed a good sensitivity for detecting acting or fake feelings.

(9) *Allocate enough time for packaging your message, but do not change your message in order to make the package more attractive.* The packaging of the message is important for the success of the communication effort. A good package implies that the formal requirements for a news story are met and that the message contains the relevant clues that are attractive to your target audience. But packages are not ends in themselves. If the message has been simplified and tailored to the needs of the receiver, it should not be further compromised by adjusting it to the most attractive package. This is the major difference compared to advertisement where people do not expect truthful information but entertaining persuasion.

(10) *Be careful in selecting the right cues for appealing to the peripheral audience without offending your central audience.* Peripheral cues should be confined to commonly shared symbols, appealing formats, and surprises in openness and honesty. They should definitely avoid negative labelling of potential opponents or typical advertising gimmicks. Peripheral cues are important for successful communication, but they have to be selected carefully to please the peripherally and centrally interested audience alike.

(11) *Explain the risk rationale to your audience and demonstrate the logic and adequacy of this rationality without claiming superiority.* Explaining the rationale of risk analysis and its role for risk management prepares the audience to acknowledge the basic principles of risk management decisions. The decision-making process and the past record of the institution should also be included in the message so that people can assign competence to the actors and get a better feeling of the tradeoffs that had to be made in meeting the specific objective. Evidence of competence, fairness towards other viewpoints, and references to commonly shared values and beliefs will make a message more attractive and could help to address the centrally and peripherally interested audience at the same time. Conveying probabilistic information is a real challenge, but can be done in reference to everyday experience of budget constraints and consumer products. Furthermore, evidence of successful use of risk analyses in hazard management can serve as demonstration to define the role and limitations of risk analysis in improving public health and the environment.

(12) *Place risk in social context and report numerical probabilities only in conjunction with verbal equivalents.* The functioning of the intuitive heuristics and biases in processing probabilistic information mandates a verbal explanation of numerical probabilities since most people have difficulties in understanding the meaning of probabilities and tend to focus on the maximum perceivable consequences. This verbal explanation should attempt to put risk in perspective to other risks. Risk comparisons create often confusion and are likely to be rejected by the audience if they do not match the receivers' perception of

comparable risks. Therefore a few rules for using these comparisons are appropriate [151–153]:

- Risk comparison should rely only on risks that are perceived as comparable by the public. Risks with identical benefits are certainly better suited to risk comparisons than risks with divergent benefits. The major point is the purpose of risk comparison. Comparisons should only serve the purpose of illustrating the meaning of abstract probabilities. Risk comparisons for the purpose of suggesting judgments about acceptability should be avoided because they are neither logically defensible nor convincing in the eyes of the public.
- Risk communication must address the basic qualitative properties of different risks such as dread and personal control, and explain how deficiencies in those qualities have been compensated or will be compensated.
- It may be useful to insert anecdotal evidence or reports about identifiable victims when communicating about familiar and unspectacular risks, such as radon or high blood pressure (publically attenuated risks). Attention is almost assured if the receivers perceive the risk as a potential threat to themselves or their primary group.
- It seems advisable to use both, numerical probabilities and verbal expressions of likelihood or risk comparisons. The perception of probabilities is characterized by so many biases that verbal explanations help to put risks in perspective. The more interested and well-educated audience also demands numerical information and will suspect an attempt to hide relevant facts if the numerical data is withheld.

(13) *Institutional performance is the major key to trust and credibility.* The more you can demonstrate that you did a good job the more you can expect trust in your message. Confidence has to be gained by meeting the institutional goals and objectives. Credibility is linked to the evidence of being cost-effective and open to public demands. These two goals are often in conflict with each other [154], but they have to be treated as complementary and not as substitutional goals. Fairness and flexibility are major elements of openness. In addition to assuring sufficient external control and supervision, public participation may be implemented as a means to demonstrate the compliance with the political mandate and to avoid the impression of hidden agendas. On the premise of good performance, communication programs can be designed that reflect these accomplishments.

(14) *Risk managers have to learn from the public as much as the public can learn from them.* Risk communication has to address public expectations and public knowledge about the risk management rationale first before it can deal with actual management results and before it can ask for trust in the management effort. Such an educating approach is only acceptable to most people if the education process is mutual and if the essence of public concerns is adequately addressed [87,22,25]. Two-way communication is clearly a prerequisite of successful information campaigns, but it is often hard to implement and requires

flexibility and the willingness to adapt to public concerns on the side of the communicating institution.

(15) *You can convince the receivers of your message only if it addresses their concerns and interests.* Try to investigate in advance on what level the risk communication will occur. If public concerns are focused on technical issues (first level), your message should contain mainly factual evidence. Communicators on this level should be technical experts. You should be aware, however, that many risk debates appear to be on the first level, but the underlying conflict is about issues of the second or third level. A debate on the second level has to address the institutional qualifications and the past performance record for risk management. The desired communicators here are the institutional policy makers or risk managers. Risk debates on the third level require a consensus building exercise focusing on values and fundamental policy directions. Most institutions will have problems to conduct such exercises; a political facilitator or mediator may be needed to initiate a discourse aimed at a consensus building.

(16) *Encourage or initiate attempts to conduct a rational discourse, in particular for third-level debates.* Rational discourses are one of the very few means to overcome conflicts on the third-level debates. They are also useful in second-level debates, if institutional performance and management capabilities are uncertain and controversial. They require careful planning and preparation, and rely on the willingness of the communicator to learn from the participants and to adjust one's own position to their preferences if deemed necessary. Several procedures lend themselves to organizing a discourse, such as public hearings, mandatory participation requirements, or conflict mediation processes. An interesting novel model of participation has been described in Section 5.2. However, it is not so much the structure of the process that determines the success or failure of a risk discourse as the willingness of all participants to meet the conditions of adequate time allocation, openness of the process, willingness to learn, acceptance of different rationalities, and the agreement to refrain from moralizing the positions of other participants.

These suggestions should not be regarded as recipes, but as normative information of what to take into account when approaching the public with risk-related information. Social interaction is too complex for designing "fool-proof" guidelines. Different hazards and risks demand different approaches. But the most important reservation is that the best communication process will not lead to any success if it is meant to compensate for shortcomings or failures in the task performance of the communicator or to hide management mistakes.

## **7. Conclusions**

The objective of this article was to review the current knowledge about risk communication, to present several psychological and sociological models or

metaphors aiding the analysis of risk communication, and to delineate some practical guidelines for risk communicators based on psychological or sociological research.

Almost all risk communication studies are quick to point out that risk communication is not a public relations problem. Advertisement and packaging of messages can help to improve risk communication, but they cannot overcome the problems of public distrust in risk management institutions or cope with the incapability of the present risk arena to produce rational and consistent risk policies. The potential remedies for these two problems lie in a better performance of all institutions dealing with or regulating risks, and in a restructuring of the risk debate to meet the requirements of a rational discourse.

With respect to a good performance record as a prerequisite for credibility, many risk management institutions face the problem that their specific task is not well understood and that public expectations do not match the mandate or the scope of management options available to these institutions. This is certainly not unique for risk management agencies. Lipset and Schneider [41] found out that elites in the United States complain regularly about the ignorance and misconceptions of the public with respect to their mandate and performance. Regardless of whether this claim is true, a clear gap separates the self-perception of most institutions and the public perception of these institutions. This is specifically prevalent in the risk arena because health and environment top the concerns of the American public, and because the stochastic nature of risk impedes an unambiguous evaluation of management success or failure.

In spite of these difficulties, careful management, openness to public demands, and continuous effort to communicate are important conditions for gaining trustworthiness and competence. They cannot guarantee the success, but they make it more probable. Therefore, the first requirement of risk communication is to *start with a critical review of one's own performance*. Is the performance good enough to justify public trust? Are mechanisms in place that help to discern the needs and requests of stakeholders and the general public? Is a two-way communication program implemented? Is the communication honest, clear, comprehensive, and timely?

If these questions can be positively answered, the designing of communication can be optimized. The second requirement of risk communication is to *tailor communication according to the needs of the targeted audience* and not to the needs of the information source. Providing information that people request is always more effective than providing answers to questions that nobody has asked. Most of the guidelines in Section 6 specify the premises and conditions for a communication program focused on the receiver.

The third requirement of communication is to *adjust and modify one's communication program as a result of an organized effort to collect feedback* and to sense changes in values and preferences. Many successful programs of the past

have turned out to be inappropriate to address the audience of today. Constant adjustment requires efforts to collect systematic feedback from the community, the relevant stakeholders, and the general public.

By carefully reviewing in-house performance, by tailoring the content of the communication to the needs of the final receivers, and by adjusting the messages to the changes in values and preferences, risk communication can convey a basic understanding for the choices and constraints of risk management, and thus create the foundations for a trustworthy relationship between the communicator and the audience. Although many receivers of risk information may not agree with the actual decisions institutions have made in setting priorities or selecting management options, they may realize that these decisions are results of open discussions and the assignment of painful tradeoffs.

Even if all these suggestions are followed, risk communication may not work. External influences, the overall climate of distrust, management failures in the past, and specific incidents can transform risk communication into a never-ending frustration. This frustration—so familiar to most risk managers—is an indication of the need for a more fundamental risk discourse. Such a discourse can help to resolve the fundamental choices with respect to basic values and preferred lifestyle, i.e. the contents of a third-level debate.

Until the third-level issues are addressed in risk communication, all communication on the second and first level will fail or succeed only temporarily. The transformation of the risk arena into a rational risk discourse seems to be an essential and ultimately inevitable step to improve risk policies and risk communication. The ideal target of risk communication is not the person who readily accepts and believes all the information given, but who processes all the available information to form a well-balanced judgment in accordance with the factual evidence, the arguments of all sides, and one's own interests and preferences. To accomplish this goal, a rational discourse is needed to provide the necessary information to all participants and empower them to be equal partners in making decisions about risk. The ultimate goal of risk communication is to reconcile expertise, interests, and public preferences.

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