CHAPTER 3

Concepts of Risk: A Classification

Ortwin Renn

During my studies at the School of Social Sciences at Cologne University, I earned some extra income by doing survey work for a German polling institute. Every week I drove out to meet preselected people to ask them questions ranging from sexual preferences to attitudes toward government. Meeting hundreds of strangers over the long period of my undergraduate and graduate studies changed my attitudes toward people as well as my appreciation for the social sciences. I found in many of my respondents much wisdom and curiosity, both of which were largely ignored by my research instruments. I was bound to my prestructured, standardized questionnaire and forced to use categories that my respondents felt inappropriately described their opinions and values. Remote from the actual field work, the social scientists of the polling institute used the numerical data to draw conclusions about people's feelings and behavior. Often these conclusions appeared superficial or inadequate, since I had been exposed to the social context in which the responses were given.

This experience had a lasting effect on my academic career. First, it brought me closer to the "rational actor paradigm," which was very unpopular in the early 1970s in sociology circles at German universities. The dominant sociological paradigms in those days were either Marxist or systems theories (particularly Parsons and Merton), both of which emphasized structural factors for social behavior rather than individual or group actions. Second, it encouraged my interest in communication. I observed that many individual as well as group decisions were made without adequate information about potential consequences of the selected actions. This appeared to be particularly true for decisions or actions with respect to technological risks. Translating the results of scientific studies into everyday language and expressing the interests and values of the affected social groups to decision makers was, in my eyes, a prerequisite for rational decision and policy making. Third, it provided me with the incentive to experiment with novel social research methods that would capture the "hidden" wisdom of many people and be more appropriate to decipher the preferences of the respondents. In the course of

this pursuit, I became an ardent proponent of citizen participation. Together with other colleagues, in particular Peter Dienel from the University of Wuppertal, I conducted participation-oriented social research aimed at measuring public preferences in a social context, in which all participants had the opportunity to learn more about their options and expected consequences prior to the elicitation of their preferences.

My experiences with public participation, particularly the times when the process failed to accomplish its goals, encouraged me to think again about the structural variables and their influence on people's behavior and collective decision making. I have become convinced that the complexity of social life cannot be adequately addressed by one perspective alone. The major goal of this chapter, therefore, is to argue in favor of an integration of inter- and intradisciplinary perspectives. The chapter compares the various perspectives and determines the functions and limitations of individual versus structural and objective versus constructivist concepts in risk analysis.

A major function of all social systems is to reduce complexity and select those areas of concern for which it appears worthwhile to spend scarce resources. This is also true with regard to risk. Social systems need to define criteria that allow them to prioritize their actions and to neglect those risks that appear trivial.

What criteria are appropriate for dealing with risks? How safe is safe enough? Should society adopt a set of uniform criteria for all types of risk regardless of context? Who should be involved in designing these criteria? Who should be held accountable if the criteria prove inadequate? These questions are at the core of the present risk debate. The responses to these questions depend on the perspectives of the different actors in society (Bradbury 1989). If risk is seen as an objective property of an event or activity and measured as the probability of well-defined adverse effects, the policy implications are obvious. Order risks according to "objective" measures of probability and magnitude of harm, and allocate resources to reduce the greatest risks first. If, on the other hand, risk is seen as a cultural or social construction, risk management activities would be set according to different criteria, and priorities should reflect social values and lifestyle preferences. These two positions represent extremes in a spectrum of risk perspectives.

As with most extreme positions, the positivistic view of risk and the social constructivist view are poor descriptions of reality (Short 1989; Dietz, Frey and Rosa, forthcoming). To my knowledge, there is not a single society in which uniform criteria for all risk types have been established. Graham and Vaupel (1981) calculated that, depending on risk type and content, risk policies in the United States reflect implicit values of life ranging from several thousand to several million U.S. dollars. Similarly, the relativistic view of social constructivism is difficult to justify upon observing that many nations have adopted very similar standards and risk reduction priorities in spite of major cultural and social differences (Coppock 1985; Jasanoff 1986;

Bauman and Renn 1989). A theoretical framework somewhere between these two extremes should be able to provide a more adequate approach to explain social responses to risk.

This chapter reviews the major candidates for risk perspectives that fall within the spectrum of the two extremes and explains the rationale behind each perspective. My goal is to describe, analyze, and evaluate the various risk concepts in order to match the appropriate tool to the problem. In the first sections, I explain the perspectives, discuss the prospects and limitations of each perspective, and describe their realm of application. Based on this comparison, in the final section I deduce the need and potential for an integrative perspective.

OVERVIEW OF RISK PERSPECTIVES

There can be no theory or scientific investigation without classification (Blumer 1931). Classification defines the conceptual tools necessary to select and order the phenomena a researcher attempts to study. The literature provides an array of classifications. Some are based on hazard types (Lowrance 1976; Hohenemser, Kates, and Slovic 1983, 1985), others on definitions of risks (Vlek and Stallen 1980; Fischhoff, Watson, and Hope 1984), others on risk characteristics (Starr 1969; Slovic, Fischhoff, and Lichtenstein 1981; Slovic 1987), others on risk conflicts (von Winterfeldt and Edwards 1984), and some on semantic images revealed through risk perception studies (Renn 1989a). All of these classifications have specific merits but provide little insight into the philosophies and mind-sets that underpin different concepts of risk.

Few attempts have been made to develop a transdisciplinary taxonomy of risk perspectives. Bradbury distinguished two types of risk concepts: risk as a physical attribute and risk as a social construct (Bradbury 1989; see also Wynne 1984a and Rayner 1987b). From a sociological point of view, May lists three perspectives on risks: cultural, individual choice, and systems approaches (May 1989). Several other sociological classifications have been proposed, but they focus exclusively on sociological or cultural concepts (see discussion below). A broader classification has been developed by Dietz, Frey, and Rosa (forthcoming) that distinguishes between technical (subdivided into assessment, evaluation, and management), psychological, sociological (subdivided into contextual and organizational), anthropological, and geographical perspectives. Their classification is more descriptive than analytical. In a recent review on the risk communication literature, Markowitz (1991, 2) concludes, "All these risk strategies [for conceptualizing risks and risk communication] cannot deny the fact that, although the growing risks of societal development have been the central focus of modern society, there is no approach in sight that could integrate the variety of

definitions and concepts and offer a common conceptual denominator" (translation by author).

A classification may not offer one common conceptual denominator, but it may provide a framework for comparison and analysis of the different risk concepts and thus help to define common elements and distinctions between different concepts. Based on earlier work (Renn 1991c; Häfele, Renn, and Erdmann 1990), there appear to be seven approaches to the conception and assessment of risk, largely grounded in the various academic disciplines:

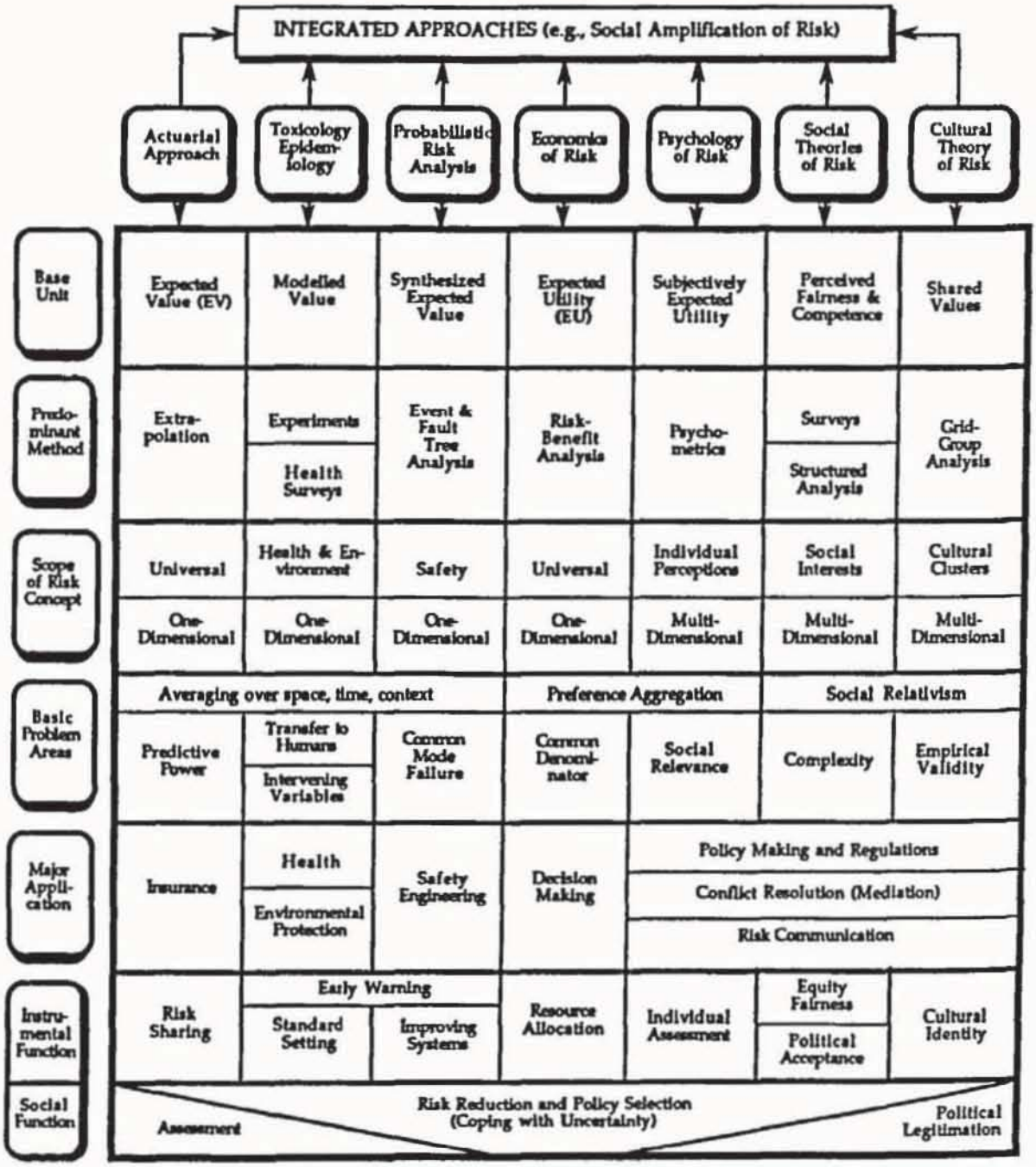
- the actuarial approach (using statistical predictions);
- the toxicological and epidemiological approach (including ecotoxicology);
- the engineering approach (including probabilistic risk assessment, PRA);
- the economic approach (including risk-benefit comparisons);
- the psychological approach (including psychometric analysis);
- social theories of risk; and
- cultural theory of risk (using grid-group analysis).

All these concepts vary in the selection of the underlying base unit (i.e., operational definition), the choice of methodologies, the complexity of risk measures, and the instrumental and social function of the risk perspective. Figure 3.1 illustrates the seven different risk perspectives and lists the characteristics of each perspective. In addition, the figure includes the basic problems and applications of each perspective.

All risk concepts have one element in common: the distinction between reality and possibility (Markowitz 1991; Evers and Nowotny 1987). If the future is either predetermined or independent of present human activities, the term *risk* makes no sense. This may seem obvious, but only in the context of fairly recent developments in our own culture; it contrasts sharply with more fatalistic views of nature and society. For example, a recent tunnel collapse in Saudi Arabia was considered inevitable, and it was assumed that the victims of this accident would have died in some other way if the accident had been prevented by human activities. If one's fate is predetermined, there is no need for anticipating future outcomes other than to please one's curiosity, because negative consequences cannot be avoided.

If the distinction between reality and possibility is accepted, the term *risk* denotes the possibility that an undesirable state of reality (adverse effects) may occur as a result of natural events or human activities (see NRC 1983; Fischhoff, Watson and Hope 1984; Luhmann 1990). This definition implies that humans can and will make causal connections between actions (or events) and their effects, and that undesirable effects can be avoided or mitigated if the causal events or actions are avoided or modified. Risk is therefore both a descriptive and a normative concept. It includes the analysis

Figure 3.1
A Systematic Classification of Risk Perspectives



of cause-effect relationships, which may be scientific, anecdotal, religious, or magical (Douglas 1966); but it also carries the implicit message to reduce undesirable effects through appropriate modification of the causes or, though less desirable, mitigation of the consequences.

The definition of risk contains three elements: undesirable outcomes, possibility of occurrence, and state of reality. All risk perspectives provide different conceptualizations of these three elements. They are paraphrased in the following three questions:

1. How can we specify or measure uncertainties?
2. What are undesirable outcomes?
3. What is the underlying concept of reality?

In this chapter, these three questions—the conceptualization of uncertainty, the scope of negative effects, and the degree to which human knowledge reflects reality—serve as guidelines for distinguishing the different perspectives.

TECHNICAL RISK ANALYSES

The actuarial approach (first column in Figure 3.1) provides a straightforward answer to these questions. The base unit is expected value, that is, the relative frequency of an event averaged over time. The undesirable events are confined to physical harm to humans or ecosystems, which can be objectively observed or measured by appropriate scientific methods. An application of this approach may be the prediction of fatalities in car accidents for the coming year. The expected value can be extrapolated from the statistical data about fatal accidents in previous years. This perspective of risk relies on two conditions. First, enough statistical data must be available to make meaningful predictions. Second, the causal agents that are responsible for the negative effects must remain stable over the predicted time period (Häfele, Renn, and Erdmann 1990). The resulting risk assessment is reduced to a single dimension representing an average over space, time, and context.

The assessment of health and environmental risks (second column in Figure 3.1) is similar to the actuarial analysis but differs in the method of calculating the possibility of undesirable effects. In risk assessments, causal relationships have to be explored and modeled explicitly. Based on toxicological (animal experiments) or epidemiological studies (comparison of a population exposed to a risk agent with a population not exposed to the risk agent), researchers try to identify and quantify the relationship between a potential risk agent (such as dioxin or ionizing radiation) and physical harm observed in humans or other living organisms (Lave 1987; Renn 1985). Modeling is used to isolate a causal agent from among several in-

tervening variables. These risk assessments can serve as early warning signals to inform society that a specific substance may cause harm to humans or the environment.

Probabilistic risk assessments (third column in Figure 3.1) attempt to predict the probability of safety failures of complex technological systems even in the absence of sufficient data for the system as a whole (Lowrance 1976; Hauptmanns, Herttrich, and Werner 1987; Morgan 1990). Using fault-tree or event-tree analyses, the failure probabilities for each component of the system are systematically assessed and then linked to the system structure. All probabilities of such a logical tree are then synthesized in order to model the overall failure rate of the system. A probabilistic risk assessment provides the same product as the actuarial analysis, that is, an average estimate of how many undesirable events one can expect over time as a result of a human activity or a technological failure. Its major problems lie in the modeling of common mode failures, that is, the simultaneous breakdown of technical components, and of human-machine interactions. Probabilistic risk assessments have been specifically valuable in detecting deficiencies in complex technical systems and in improving the safety performance of the technical system under consideration (see Figure 3.1).

These three perspectives have much in common and can be grouped together as technical perspectives. They anticipate potential physical harm to human beings or ecosystems, average these events over time and space, and use relative frequencies (observed or modeled) as a means to specify probabilities. The normative implication is obvious: since physical harm is perceived as an undesirable effect (at least for most people and society as a whole), technical risk analyses can be used to reveal, avoid, or modify the causes that lead to these unwanted effects. They can also be used to mitigate consequences, if causes are yet unknown, remote from human intervention or too complex to modify. Their instrumental functions in society are, therefore, oriented to risk sharing and risk reduction, through mitigation of consequences, standard setting, and improvements in the reliability and safety of technological systems (see Figure 3.1).

The technical analyses of risk have drawn much criticism from the social sciences (Hoos 1980; Douglas 1985; Mazur 1985; Beck 1986; Freudenburg 1988; Clarke 1989; Meyer-Abich 1989). First, what people perceive as an undesirable effect depends on their values and preferences. Second, the interactions between human activities and consequences are more complex and unique than the average probabilities used in technical risk analyses are able to capture. Third, the institutional structure of managing and controlling risks is prone to organizational failures and deficits which may increase the actual risk. The interaction between organizational malfunctions and risk is usually excluded from technical risk analyses. Fourth, the numerical combination of magnitude and probabilities assumes equal weight for both components. The implication is indifference between high-conse-

quence/low-probability and low-consequence/high-probability events with identical expected values. However, people show distinct preferences for one or the other (Fischhoff, Goitein, and Shapiro 1982; Slovic 1987; Renn 1990).

From the normative perspective, the practice of risk minimization implies a clear distinction between experts and laypersons. Risk reduction or mitigation is based on the assumption that risk should be reduced in proportion to the expected or modeled harm to humans or ecosystems (Morgan 1990). This assumption is highly contested: social actions to cope with risk are not confined to the single goal of risk minimization but include other objectives such as equity, fairness, flexibility, or resilience (Short 1984; Nowotny and Eisikovic 1990). The inclusion of these complementary objectives requires participation by interest groups and the affected public. Furthermore, technical risk analyses can provide only aggregate data over large segments of the population and long time duration. Each individual, however, may face different degrees of risk depending on the variance of the probability distribution (Beck 1986). A person who is exposed to a larger risk than the average person may legitimately object to a risk policy based on aggregate calculations. The extent to which a person is exposed to a specific risk also rests on lifestyle factors and anecdotal knowledge, both of which are mostly unknown to scientists performing risk analyses. Brian Wynne (1991a) documented the failure of risk experts to recognize the extensive knowledge of local farmers about sheep habits and the physical environment when they conducted a risk analysis of the Chernobyl fallout in Scotland (see Chapter 12 for further details). Finally, some critics argue that the dominance of science in risk policy making provides too much power to an elite that is neither qualified nor politically legitimated to impose risks or risk management policies on a population (Jasanoff 1982).

How valid are the criticisms by social scientists? In my opinion, all the critical remarks are well taken and point to the problem that technical risk analyses represent a narrow framework that should not be the single criterion for risk identification, evaluation, and management. In contrast to many risk analysts, most notably the National Academy of Sciences (National Research Council 1983; see also Lowrance 1976; Rowe 1977), I believe that the above limitations of technical risk analyses apply not only to risk evaluation and management, but also to identification and quantification (see Hattis and Kennedy 1990; Brown and Goble 1990). Technical risk analyses rest on many "trans-scientific" assumptions (Weinberg 1972), such as the selection rules for identifying undesirable effects, the choice of a probability concept, and the equal weighting of probability and magnitude (Renn and Kals 1990). All of these conventions in risk analyses can be defended through logical reasoning, but they represent only parts of what individuals and society experience as risk (Renn and Swaton 1984; Jasanoff 1986; Kasperson, Renn, et al. 1988). Complementary risk analyses by the

social sciences are necessary to capture the areas of risk experience that are either ignored or dismissed by technical risk analyses.

This does not mean, however, that technical risk analyses are unnecessary or less relevant than broader concepts of risk. They do serve a major purpose. After all, people are getting hurt or killed in accidents, in natural disasters, or through pollution. I agree with Short (1989), who insists that risk cannot be confined to perceptions and social constructions alone, but that objective outcomes are an integral part of the social processing of risk. Technical risk analyses help decision makers to estimate the expected physical harm. They provide the best knowledge about actual damage that is logically or empirically linked with each possibility of action. In terms of the three guiding questions stated above, technical analyses rely on relative frequencies as a means to express probabilities. This definition excludes unexpected events and aggregates data over space, populations, and time. The undesired effects are confined to physical harm to humans and ecosystems, thus excluding social and cultural impacts. Technical analyses assume a mirror relationship between observation and reality and do not consider that causes of harm and the magnitude of consequences are both mediated through social experience and interaction.

The narrowness of this approach contains both its weakness and its strength. Abstracting a single variable from the context of risk taking makes the concept of risk one-dimensional but also universal. Confining undesirable consequences to physical harm excludes other consequences that people might also regard as undesirable, but physical harm may be the only consequence that (almost) all social groups and cultures agree is undesirable. The evaluation of consequences differs considerably among groups when undesirable effects include value violations, inequities, or social interests. All these additional effects may or may not be more relevant than physical harm to different actors in society, but they always rely on subjective preferences. Physical harm on the other side appears to be universally accepted as a negative effect, which should be avoided. The exclusion of social context and meaning from technical risk analyses provides an abstraction that enhances the intersubjective validity of the results but at the price of neglecting the social processing of risk (see Brehmer 1987).

ECONOMIC PERSPECTIVES ON RISK

All risk concepts of the social sciences have in common the principle that the causes and consequences of risks are mediated through social processes. The concept closest to the technical approach is the economic concept of risk (fourth column in Figure 3.1). The major difference here is the transformation of physical harm or other undesired effects into subjective utilities (Just, Heuth, and Schmitz 1982; V. K. Smith 1986). The base unit of utilities describes the degree of satisfaction or dissatisfaction associated with a pos-

sible action or transaction. Whether physical harm is evaluated as pleasure or disaster remains irrelevant in the technical understanding of risk. Not so in economics: the relevant criterion is the subjective satisfaction with the potential consequences rather than a predefined list of undesirable effects.

The shift from expected harm to expected utility serves two major purposes. First, subjective (dis)satisfaction can be measured for all consequences, including psychological or social effects that are deemed undesirable. Second, and more important, the common denominator "personal satisfaction" allows a direct comparison between risks and benefits across different options (Merkhofer 1987). The question, How safe is safe enough?, cannot be answered by the three technical concepts unless there is a threshold of exposure between zero risk and some risk or unless the benefit of each option is identical (if so, you should choose the one with the lowest risk). Using utilities instead of physical harm provides a common denominator that enables each individual to compare options with different benefit profiles according to overall satisfaction (see Derby and Keeney 1981; Shrader-Frechette 1984). Utility is universal and one-dimensional (see Figure 3.1).

If risks can be expressed in terms of utilities, which some authors contest (see the debate between Kelman 1981a and Butters, Califee, and Ippolito 1981), they can be integrated into a decision process in which costs and benefits are assessed and compared. Since risks denote possible costs rather than actual costs, they have to be weighted by the probability of their occurrence. Furthermore, since risks and benefits may not materialize until years after implementing the desired option, the consequences have to be discounted (Hyman and Stiftel 1988). Economic theory perceives risk analysis as part of a larger cost-benefit consideration in which risks are the expected utility losses resulting from an event or an activity. The ultimate goal is to allocate resources so as to maximize their utility for society (V. K. Smith 1986).

The economic risk concept constitutes a consistent and coherent logical framework for situations in which decisions are being made by individuals and in which decision consequences are confined to the decision maker. In the risk area both conditions are rarely met (Coase 1960; Hyman and Stiftel 1988). First, most decisions on risks are collective decisions (public or meritocratic goods), which require the aggregation of individual utilities. How to measure the welfare of society, however, remains a major problem, since the subjective nature of utility does not provide a logically valid method to aggregate individual utilities into a single societal welfare function (see Figure 3.1). Averaging over expressed preferences is a common but unsatisfactory method for determining the utility of collective goods. Second, many transactions between individuals imply the imposition of risks on third parties, who may not benefit or benefit only marginally from the transaction itself (social costs or external effects).

Another major issue of critique is the underlying philosophy of the economic approach. The two basic foundations of economics are the rational actor paradigm and the reliance on utilitarian ethics (Freeman 1986; see Sen 1977 for a thorough critique of these foundations). People, for example, do smoke or drink, buy foolish things, or engage in activities that do not provide any utility to them. At the same time, people show compassion for others and may seek to increase the utility of other people even at their own expense. This behavior is contrary to the naive version of the rational actor paradigm, which postulates that people with full information will act in accordance with their own interests. Economic theory is, however, compatible with a modified and more realistic version of the rational actor paradigm, which assumes that people have subjective motives for performing an action and that they try to assess consequences of their action in the light of these motives (Jungermann 1986).

The reliance on utilitarian or contractual ethics is a more serious problem. This can be highlighted by the example of siting a hazardous waste facility. Economic theory would suggest an auction among potential host communities for determining the site for a hazardous waste facility. The lowest bidder in such an auction is likely to be the community with the highest marginal utility for increased revenues, that is, the poorest community in the pool. As a result of this difference in marginal utility, all the poor communities will end up having all the nasty facilities. From a utilitarian viewpoint, this is not a problem, because the poor community increases its utility by accepting a risk in exchange for money, and the rich community also wins by spending money for not being exposed to the risk. Other ethical perspectives, especially deontological ethics (normative values derived from introspection rather than evaluation of consequences), would postulate that a fair distribution of risks and benefits is a value in itself and should not be subject to bargaining (MacLean 1986).

Although the economic perspective promises a one-dimensional risk measure that is supposed to make benefits and risks commensurable, the problems of aggregating individual utilities, the existence of individual preferences for probabilities, the problem of finding an appropriate discount rate for risk consequences in the future, the effects of transactions on third parties, and the reliance on the rational actor model and utilitarian ethics impede the application of this concept in risk policies (see Baram 1980). This is aggravated by the fact that utilities are often measured in monetary units, which are perceived as incommensurable with the risk of serious health impediments or even death. In spite of these criticisms, the economic approach serves several vital functions in risk policies:

1. It provides techniques and instruments to measure and compare utility losses or gains from different decision options, thus enabling decision makers to make more informed choices (not necessarily better choices).

2. It enhances technical risk analyses by providing a broader definition of undesirable events, which include nonphysical aspects of risk.
3. Under the assumption that market prices (or shadow prices) represent social utilities, it provides techniques to measure distinctly different types of benefits and risks with the same unit.
4. It includes a model for rational decision making, provided that the decision makers can reach agreement about the utilities associated with each option.

In terms of the three guiding questions, the economic concept of risk is based on probabilities, a social definition of undesirable effects based on individual utilities, and the treatment of these effects as real gains or losses. In contrast to the technical approaches, probabilities are not only conceptualized as relative frequencies but also as strength of beliefs (Fischhoff, Lichtenstein, et al. 1981).

PSYCHOLOGICAL PERSPECTIVES ON RISK

The psychological perspective on risk expands the realm of subjective judgment about the nature and magnitude of risks in three ways (Column 5 in Figure 3.1). First, it focuses on personal preferences for probabilities and attempts to explain why individuals do not base their risk judgments on expected values (Pollatsek and Tversky 1970; Lopes 1983; Luce and Weber 1986). One of the interesting results of these investigations was the discovery of consistent patterns of probabilistic reasoning that are well suited for most everyday situations. People are risk averse if the stakes of losses are high and risk prone if the stakes for gains are high (Kahneman and Tversky 1979). Furthermore, many people balance their risk-taking behavior by pursuing an optimal risk strategy which does not maximize their benefits but assures both a satisfactory payoff and the avoidance of major disasters (Tversky 1972; Simon 1976; Luce and Weber 1986). Portfolio theory is one example of this kind of strategy. According to this theory, investors should select a portfolio of stocks in which the risk of losing money on one share is balanced by the probability of gaining money on another share. This example and many others show that deviations from the rule of maximizing one's utility are less a product of ignorance or irrationality than an indication of one or several intervening contextual variables, which often make perfect sense when seen in the light of the particular context and the individual decision maker's values (Lee 1981; Brehmer 1987).

Second, more specific studies on the perception of probabilities in decision making identified several biases in people's ability to draw inferences from probabilistic information (Festinger 1957; Kahneman and Tversky 1974, 1979; Ross 1977). These biases refer to the intuitive processing of uncertainty. For example, events that come to people's mind immediately are rated as more probable than events that are less mentally available. Although

these biases constitute clear violations of logical rules, their implications might have been overrated in the literature (Fischhoff, Lichtenstein, et al. 1981). A major reason for this is that many laboratory situations provide insufficient contextual information to provide enough cues for people on which they can base their judgments (Lopes 1983). Relying on predominantly numerical information and being unfamiliar with the subject, many subjects in these experiments revert to "rules of thumb" in drawing inferences. In many real life situations, familiarity with the context provides additional information to calibrate individual judgments, particularly for nontrivial decisions (see Heimer 1988).

Third, the importance of contextual variables for shaping individual risk estimations and evaluations has been documented in many studies on risk perception (Jungermann 1986; Slovic 1987; Renn 1990). Psychometric methods have been employed to explore these qualitative characteristics of risks. The following contextual variables of risk have been found to affect the perceived seriousness of risks (Slovic, Fischhoff, and Lichtenstein 1981; Vlek and Stallen 1981; Renn 1983, 1990; Covello 1983; Gould et al. 1988; Jungermann and Slovic, in press):

- *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 (Renn 1983; Jungermann and Slovic, in press).
- *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 (von Winterfeldt, John, and Borcherding 1981).
- *qualitative risk characteristics:* 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 (Slovic, Fischhoff, and Lichtenstein 1981; E. J. Johnson and Tversky 1984). 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. In addition, equity issues play a major role in risk perception.
- *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, that is, a technology, human activity, or natural event. Attitudes encompass a series of beliefs about the nature, consequences, history, and justifiability of a risk cause (Otway 1980; Thomas, Maurer, et al. 1980; Otway and Thomas 1982; Renn and Swaton 1984). Often risk perception is a product of these underlying beliefs rather than the cause for these beliefs (Clarke 1989). In a recent cross-cultural comparison of risk perceptions, environmental versus technical beliefs of the respondents were better predictors for perceived seriousness of risk than national differences or other explanatory variables (Rohrmann 1991).

This list of factors demonstrates that the intuitive understanding of risk is a multidimensional concept and cannot be reduced to the product of probabilities and consequences (Allen 1987b). Risk perceptions differ considerably among social and cultural groups. However, it appears to be a common characteristic in almost all countries in which perception studies have been performed that most people perceive risk as a multidimensional phenomenon and integrate their beliefs with respect to the nature of the risk, the cause of the risk, the associated benefits, and the circumstances of risk taking into one consistent belief system (Renn 1989a).

In terms of the three guiding questions listed above, the psychological perspective on risk includes all undesirable effects that people associate with a specific cause. Whether these cause-effect relationships reflect reality or not is irrelevant. Individuals respond according to their perception of risk and not according to an objective risk level or the scientific assessment of risk. Scientific assessments are part of the individual response to risk only to the degree that they are integrated in the individual perceptions. Furthermore, relative frequencies or other (scientific) forms of defining probabilities are substituted by the strength of belief that people have about the likelihood that any undesirable effect will occur.

The focus on the individual and his/her subjective estimates is also the major weakness of the psychological perspective (Mazur 1987; Plough and Krimsky 1987). The broadness of the dimensions that people use to make judgments and the reliance on intuitive heuristics and anecdotal knowledge make it hard, if not impossible, to aggregate individual preferences and to find a common denominator for comparing individual risk perceptions. Furthermore, these physical studies fail to explain why individuals select certain characteristics of risks and ignore others (Dietz, Frey, and Rosa forthcoming).

From a normative perspective, knowledge about individual perceptions of risk cannot be translated directly into policies (Renn 1990). If perceptions are partially based on biases or ignorance, it does not seem wise to use them as yardsticks for risk reduction. In addition, risk perceptions vary among individuals and groups. Whose perceptions should be used to make decisions on risk? At the same time, however, these perceptions reflect the real concerns of people and include the undesirable effects that the technical analysis of risk often miss. Facing this dilemma, how can risk perception studies contribute to improving risk policies? They can

- reveal public concerns and values;
- serve as indicators for public preferences;
- document desired lifestyles;
- help to design risk communication strategies; and
- represent personal experiences in ways that may not be possible in the scientific assessment of risk.

In essence, the psychological studies can help to create a more comprehensive set of decision options and to provide additional knowledge and normative criteria to evaluate them (Fischhoff 1985). Similar to the other perspectives, the psychological perspective on risk contributes valuable information for understanding risk responses and for designing risk policies, but it is limited in its comprehensiveness and applicability.

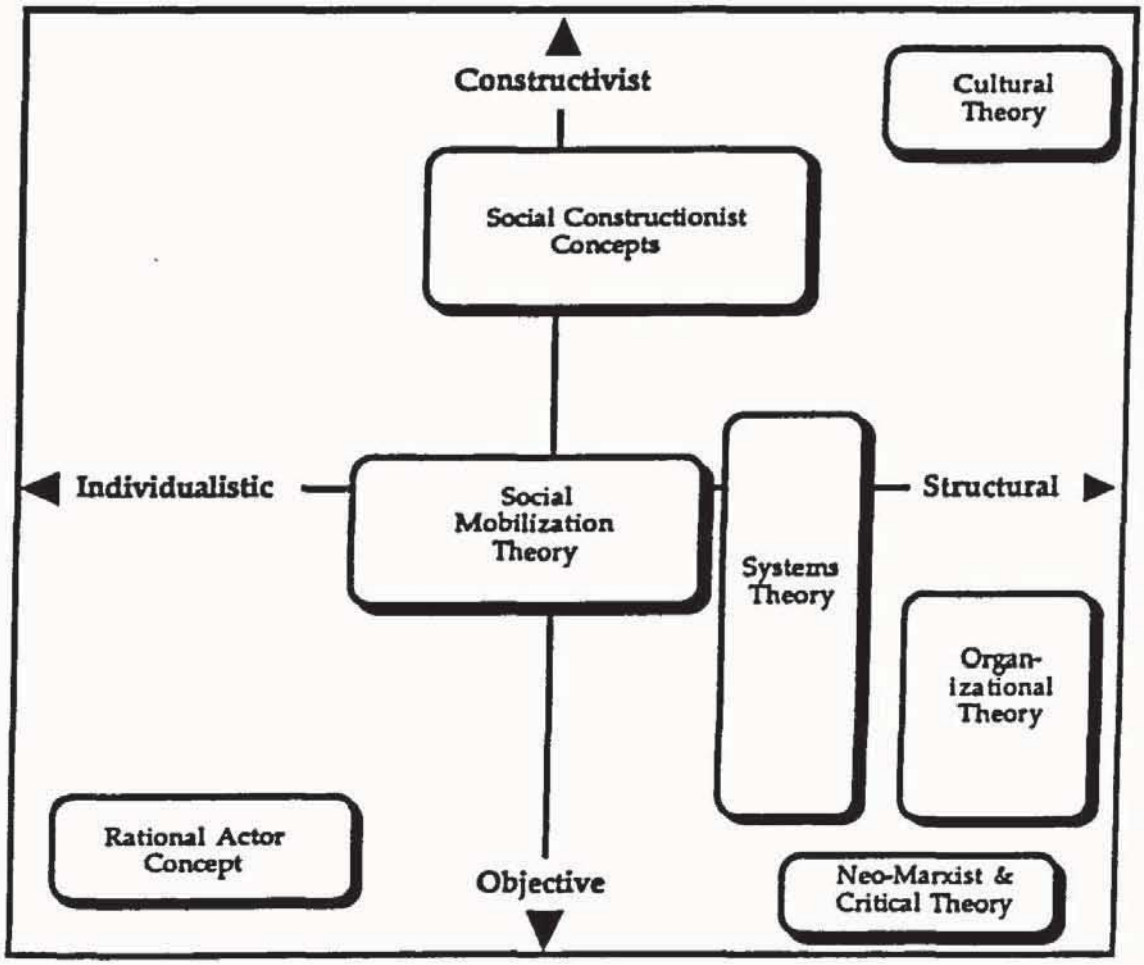
SOCIOLOGICAL PERSPECTIVES ON RISK

Classifications in sociology face the insurmountable problem that there are as many perspectives within sociology as there are sociologists. Since the demise of the structural-functionalist school in sociology, no dominant camp has evolved, which leaves the field open to an array of competing approaches ranging from an adaptation of the rational actor approach to Marxist and structural analyses. All sociological and anthropological concepts of risk, however, do have in common the notion that "humans do not perceive the world with pristine eyes, but through perceptual lenses filtered by social and cultural meanings transmitted via primary influences such as the family, friends, superordinates, and fellow workers" (Dietz, Frey, and Rosa forthcoming). The social sciences present a patchwork of different concepts focused on special aspects of risk or the circumstances of the risk situation. Some examples are

- studies on organizational aspects of risk (Perrow 1984; Clarke 1989);
- studies in the sociology of disasters (see the edited volume by Dynes, De Marchi, and Pelanda 1987);
- analyses of media coverage and communication (Mazur 1981, 1984; Raymond 1985; Lichtenberg and MacLean 1988; Peltu 1988; Stallings 1990; Peters 1990);
- investigations of risk conflicts and their causes (O'Riordan 1983; von Winterfeldt and Edwards 1984; Edwards and von Winterfeldt 1986; Dietz, Stern, and Rycroft 1989);
- analyses of equity and fairness (Kasperson and Kasperson 1983; MacLean 1986; Rosa 1988; Brion 1988);
- analysis of risk distribution among classes and populations (Schnaiberg 1986; Beck 1986, 1990);
- studies on the epistemology or legitimation of risk knowledge (Rip 1985; Jasanoff 1986; Dietz and Rycroft 1987; Evers and Nowotny 1987).

Any attempt to classify these studies and link them to underlying theoretical concepts is like trying to find order in chaos. Notwithstanding the frustrations that are likely to evolve when sociologists try to classify sociological schools of thought, the literature offers a wide variety of taxonomies, even in the narrow field of risk and disaster research (see Stallings

Figure 3.2
Major Sociological Perspectives on Risk



1987; Kreps 1987; May 1989; Bradbury 1989; Short 1989; Dietz, Frey, and Rosa forthcoming). However, they all use different frameworks and classification criteria.

Rather than reviewing the reviews, I venture to add an additional taxonomy, which is shown in Figure 3.2. This taxonomy orders the sociological approaches with respect to two dimensions: (1) individualistic versus structural and (2) objective versus constructivist. The major reasons for this classification are as follows:

- The classification is simple and straightforward (hence open to critique).
- The classification fits the overall framework of risk perspectives developed above.
- All sociological studies fall within the boundaries of these two dimensions.
- The two dimensions appear to be sufficient to separate concepts that are clearly distinct from each other.

What are the meanings of the two dimensions? The two attributes *individualistic* and *structural* indicate the base unit of the analysis. It is either the individual or a social aggregate such as an institution, a social group, a subculture, or a society. Structural concepts emphasize that complex social phenomena cannot be explained by individual behavior alone but that they rest on interactive, often unintentional effects among individuals and between these larger units. *Objective* and *constructivist* concepts differ in their view of the nature of risk and its manifestations. Whereas the objective concept implies that risks and their manifestations are real, observable events, the constructivist concept claims that risks and their manifestations are *social artifacts* fabricated by social groups or institutions. Figure 3.2 indicates the location of some major theoretical approaches to the social processing of risk. Not included are case studies, problem-oriented studies without reference to a theoretical concept, purely normative or ethical approaches, and (the ever popular) conspiracy ideologies. Given these limitations, the dominant approaches are the rational actor concept, social mobilization theory, organizational theory, systems theory, neo-Marxist and critical theory, and social constructionist concepts.

Rational actor concept. This concept is widely used in economical analyses of social behavior and in a variety of social science applications (Dawes 1988). Social actions are seen as a result of deliberate intentions by individual or social actors to promote their interests. Social groups and institutions experience a social conflict if the interests of one group conflict with the interests of another group. The stakes of social actions are real, and the actors are individuals who may also represent groups and institutions. If members of one party perceive risks as a threat to their interests, they will mobilize political actions to reduce or mitigate the risk. This protective behavior may contrast with the interests of another party who benefits from the risk source. Institutional and individual behavior is governed by strategies to select the best means for accomplishing a predefined goal (Stallings 1987).

Social mobilization theory. Social mobilization theory focuses on two questions: Under which circumstances are individuals motivated to take actions (McCarthy and Zald 1977; Watts 1987), and what are the structural conditions necessary for social groups to succeed, that is, to accomplish their goals (Gamson 1990)? The relevance to the risk problem is obvious. The first question refers to the elements of the social experience of risk that trigger actions by individuals; the second to the results of social processing of risk among different social actors (McAdam, McCarthy, and Zald 1988). In the early development of social mobilization theories, most studies were based on the objective-individualistic approach and the rational actor concept, but later researchers favored a structural analysis of motivation and group performance (Klandermanns 1984; McCarthy and Zald 1977). Joining social movements such as environmental groups cannot be fully ex-

plained by comparing payoff and participation costs (regardless of whether benefits are expressed in monetary units or other terms). Being attracted to a movement may be the result of relative deprivation, imitation of peer group behavior, socially held convictions, or other structural factors (Marx-Ferree and Miller 1985). The same is true for performance of social groups and institutions. Success and failure may be less related to effort or strategies of each social actor than to arena rules and interactive (unintended) consequences of all actors' communication and behavior in the arena (see my Chapter 7 in this volume).

Organizational theory. Organizational theory emphasizes two structural aspects of institutions: the routinization of tasks and the diffusion of responsibility. Since risk management of complex technologies requires institutional operation and control, routinization and diffusion of control impact the performance of risk managers (Perrow 1984; Clarke 1989). For example, a technological risk situation, which includes organizational factors such as complacency of operators or inadequate control, may produce a much higher risk for the public than the risk measure calculated by technical risk assessment. As a result, the technological risk assessment may underestimate the "real" risk because routinization of tasks and diffusion of responsibility are both factors that are likely to increase the probability of operational errors or inadequate control (Freudenburg 1989).

Systems theory. Systems analysis regards risks as an element of a larger social or institutional unit. It focuses on structural factors and spans *real* and *constructed* realities. Risk issues evolve in an evolutionary process in which groups and institutions organize their knowledge about their natural and social environment and share this knowledge with other social systems through communication (Luhmann 1986, 1990; Stallings 1987). Various systems of knowledge compete in a society and are subject to a selection and adaptation process that is governed by structurally determined criteria. These criteria indicate and provide a basis to evaluate perceived advantages for the macrosystem in order to sustain its basic biological, social, and cultural functions. Advantages can be *real* in the sense that they promote evolutionary adaptation, or *constructed* in the sense that they promote self-confidence and reassurance within a given social system. This approach, after one of its derivations, functional-structural analysis, dominated the discipline of sociology in the 1950s and 1960s, is almost absent from U.S. literature on risk, but remains very prominent in the European sociological literature (Luhmann 1990).

Neo-Marxist and critical theory. These concepts share the objective component of the rational actor approach but rely on structural analysis for determining institutional interests and social group behavior (Habermas 1984–87; Forester 1985; Dombrowski 1987). The focus is on the normative aspect of emancipation rather than explanation of risk experience or policies for risk reduction. Emancipation in this context involves the empowerment of

groups and communities to enable them to determine their own acceptable risk level. According to this perspective, present risk policies suffer a legitimation crisis because they are based on the imposition of risks by one social group on another (reproduction of class structure) and are often not in the interest of those who have to bear them (lack of social integration). The risk experiences by different social groups reflect the class structure of society and indicate the inequities in the distribution of power and social influence.

Social constructionist concepts. These concepts treat risks as social constructs that are determined by structural forces in society. Issues such as health threats, inequities, fairness, control, and others cannot be determined by *objective* scientific analysis but only reconstructed from the beliefs and rationalities of the various actors in society (Johnson and Covello 1987; Bradbury, 1989; Gamson and Modigliani 1989). The fabric and texture of these constructions reflect both the interests/values of each group or institution in the various risk arenas and the shared meaning of terms, cultural artifacts, and natural phenomena among groups (Wynne 1983; Rayner 1987b). Risk policies result from a constant struggle of all participating actors to place their meaning of risk on the public agenda and impose it on others. The need to compromise between self-interest, that is, constructing one's own group-specific reality, and the necessity to communicate, that is, constructing a socially meaningful reality, determines the range and limitations of possible constructs of reality. Technical risk analyses are not necessarily superior to any other construct of risk because they are also based on group conventions, specific interests of elites, and implicit value judgments (Appelbaum 1977; Dietz, Stern, and Rycroft 1989).

In addition to an emphasis on social processing of risk, all six approaches, though the organizational concept to a lesser extent, appear to have a common interest in explaining or predicting the experience of social injustice and unfairness in relation to distributional inequities (see column 6 in Figure 3.1). The individualistic concepts regard inequities as potential violations of group interests, whereas the structural concepts treat them either as a reflection of the "real" inequities in the distribution of power and social resources or as a dysfunctional result of inadequate balancing of social interests and values. In the social constructivist perspective, perceived violations of fairness constitute a powerful social construct that can be used in the respective risk arena to demand corrective actions, provided that the group's claim of unfair treatment can be made plausible to the other groups. In the objective perspective, inequities are reflections of class structure and domination. The power elites provide justifications for these "real" inequities by creating or referring to social constructions such as religions or ideologies.

From a normative point of view, the sociological perspectives illuminate

the need to base risk policies on the experience of inequities, unfairness, and—to a lesser degree—perceived social incompetence (see Figure 3.1). These three experiences are not the only social consequences that people may perceive as undesirable effects, but they are probably the most important in conjunction with perceived health impairments. Many of the perception variables, such as personal control and voluntariness, reflect the same concern. As a consequence, sociological studies can help to address the issues of fairness and competence and provide normative conclusions for legitimizing risk policies. However, these conclusions will vary considerably depending on which of the six perspectives is being employed. One example is the contrast between the neo-Marxist and the rational actor perspective. The neo-Marxist perspective implies that capitalist societies can only mask inequities by offering compensation or participation, because an equitable solution would necessitate a fundamental change in the basic power structure of society. The rational actor approach suggests that compensation of risks is the right tool to balance the interests of risk creators and risk bearers.

In terms of the three guiding questions noted above, the sociological perspectives include undesirable events that are socially defined and (in some cases) socially constructed. *Real* consequences are always mediated through social interpretation and linked with group values and interests. Possibilities for future events are not confined to the calculation of probabilities but encompass group-specific knowledge and vision. Furthermore, possibilities are shaped by human interventions, social organizations, and technological developments. Ignoring the connections between social organizations and technological performance may seriously underestimate the likelihood of failures. Lastly, reality is seen as a system of both physical occurrences (independent of human observations) and constructed meanings (with respect to these events and to abstract notions, such as fairness, vulnerability, and justice).

The broad scope of sociological perspectives and the inclusion of social experience of risk close the gap that is left open by the other perspectives on risk. This accomplishment, however, has its price. The necessity to reduce the complexity of the social world and to model the major influential factors opens the door for subjective selection and ideological reasoning. The outcome of a sociological analysis is at least partially predetermined by the theoretical concept on which the analysis is based. Furthermore, the complex reality offers empirical proof for almost any perspective (it may, however, falsify theories within a perspective). As a result, social actors in society often select the perspective that best serves their interests (legitimation function) and ignore those perspectives that are antagonistic to their interests.

THE CULTURAL PERSPECTIVE ON RISK

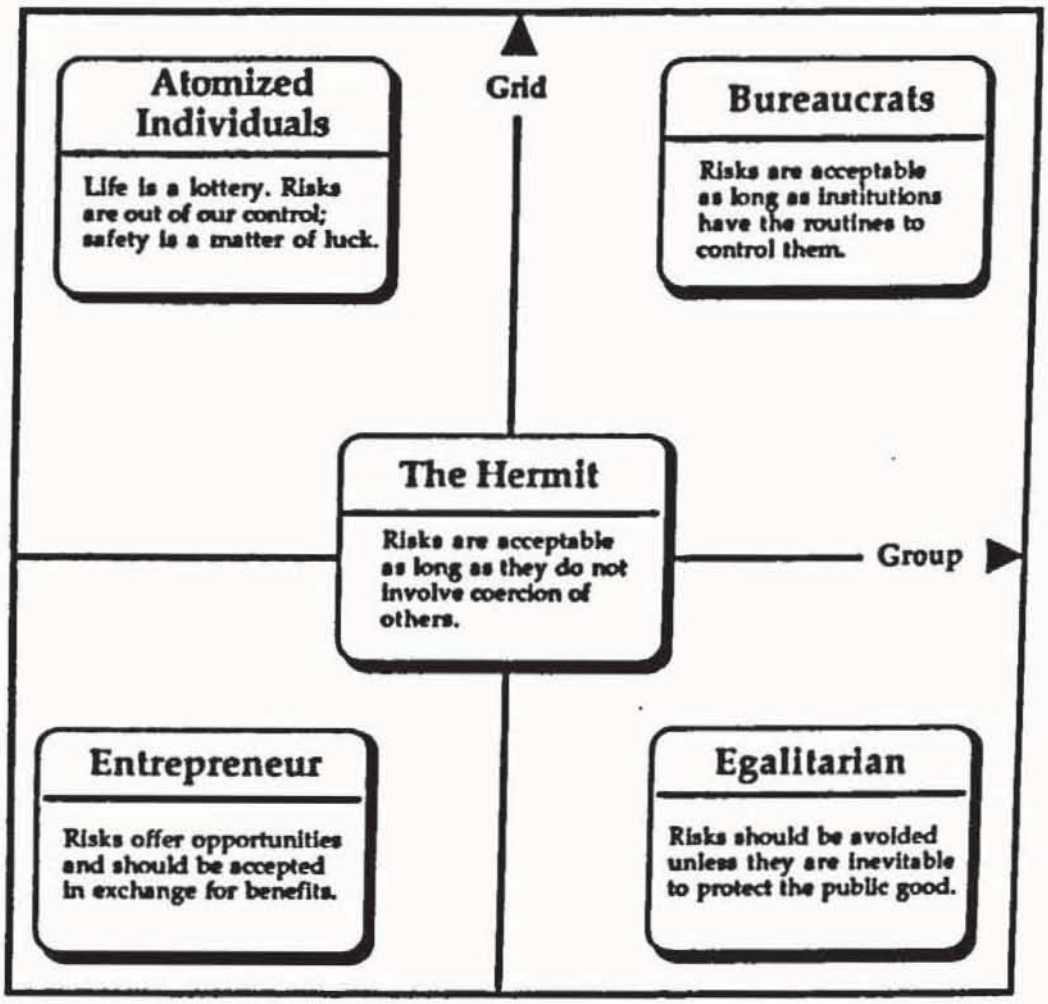
In recent years, anthropologists and cultural sociologists have suggested that social responses to risks are determined by prototypes of cultural belief

patterns, that is, clusters of related convictions and perceptions of reality (see column 7 in Figure 3.1). Based on studies of early organizational principles in tribal communities, one school of anthropologists identified several generic patterns of value clusters that distinguish different cultural groups from each other (Douglas 1966; Thompson 1980a; Douglas and Wildavsky 1982b; Rayner, 1987b; Schwarz and Thompson 1990). These different groups form specific positions on risk topics and develop corresponding attitudes and strategies. This approach is both structural and constructivist (Figure 3.2). Most proponents of this theory agree that it does not apply to individual attitudes or convictions but to larger social aggregates such as organized groups or institutions (Rayner 1984; opposite view in Wildavsky and Dake 1990). However, cultural prototypes can be used to predict individual responses, particularly responses of individuals in their social roles as representatives of agencies, industries, or private organizations. In addition, the cultural approach perceives environment and risk as social constructs (Wildavsky 1979).

Whereas the sociological analysis of risk links social judgments about risks to individual or social interests and values, the cultural perspective assumes that cultural patterns structure the mind-set of individuals and social organizations to adopt certain values and reject others. These selected values determine the perception of risks and benefits (see column 7 in Figure 3.1). The number and types of such cultural patterns are not always consistent in the literature. Douglas and Wildavsky distinguish between center and periphery (1982b); Rayner uses four prototypes (Rayner 1987b; Rayner and Cantor 1987) and Thompson five (Thompson 1980a). I shall address the latter classification, which is more inclusive. (See Chapter 4 for a longer discussion of the origins and development of cultural theory.) Figure 3.3 illustrates the five prototypes. The types differ in the degree of *group* cohesiveness (the extent to which individuals take on a group mind-set and find identity 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).

Organizations or social groups belonging to the *entrepreneurial* prototype perceive risk taking as an opportunity to succeed in a competitive market and to pursue their personal goals (Rayner 1987b). They are less concerned about equity issues and would like the government to refrain from extensive regulation or risk management efforts. This group contrasts most with organizations or groups belonging to the *egalitarian* prototype, 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 prototype, the *bureaucrat*, 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

Figure 3.3
Risk Taking in the Context of Cultural Prototypes



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 prototype, the group of *atomized* or *stratified individuals*, principally believes in hierarchy, but its members 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 (Thompson 1980a). The last group is the group of *autonomous individuals* in the center of the group-grid coordinates. Thompson describes autonomous individuals as self-centered hermits and short-term risk evaluators. I like to refer to them as potential mediators in risk conflicts, since they build multiple alliances to the four other groups and believe in hierarchy only if they can relate the authority to superior performance or knowledge (Renn 1992).

In terms of the three guiding questions, cultural analysis implies that the

definition of undesirable events, the generation and estimation of possibilities, as well as the constructions of reality depend on the cultural affiliation of the respective social group. If this were true, cultural theory would qualify as an exclusive and comprehensive theory of risk since all risk experience is seen as a reflection of cultural affiliations.

The premise that cultural theory can serve as an umbrella for all other risk perspectives is doubtful at best, if not unsubstantiated. First, most authors within the cultural theory emphasize that cultural prototypes do not characterize individuals but social aggregates. The reason for this is obvious. Anecdotal evidence tells us that individuals may belong to different organizations and groups having different cultural profiles. An owner of a business (entrepreneurial prototype) may belong to a fundamentalist church (egalitarian prototype) and serve as treasurer in a volunteer charity organization (bureaucratic prototype). But role differentiation and segmentation of individuals are mirrored in the functional differentiation of social aggregates (see B. B. Johnson 1987). Environmentalists and industrialists may be easy to classify, but what about the League of Women Voters, the American Association of Retired People, the American Automobile Association, and others? If groups are mixtures of prototypes, the cultural perspective loses much of its explanatory power.

Second, the relationship between cultural prototype and organizational interest is unclear and problematic. If cultural affiliation precedes interest, then what determines to which cultural prototype groups or organizations belong? Are we born as entrepreneurs or egalitarians? Are social institutions formed because cultural prototypes desire to express themselves? If cultural affiliations are social acquisitions learned through interaction with others, then they must be linked with personal or institutional tasks or interests. For example, an interest in preserving the environment may lead to the adoption of an egalitarian viewpoint, or vice versa.

Third, the selection of the five prototypes as the only relevant cultural patterns in modern society needs more evidence than the reference to tribal organizations. Many social groups seem to have agendas and worldviews that cannot be captured by the five prototypes. For example, many religious groups are very hierarchical in structure but egalitarian in doctrine. It is also unclear why only hierarchy and openness matter in cultural prototypes. Why not other characteristics such as spirituality or vulnerability? The inherently reductionist view of partitioning culture into four or five segments appears to be too simplistic (see Funtowicz and Ravetz 1985).

Lastly, the cultural perspective has not provided sufficient empirical evidence of its validity. This is partly due to the problem of measurement (see Rayner 1990). Organizational philosophies are often hidden and cannot be revealed by interviewing representatives of these organizations. Furthermore, if prototypes are mixed in organizations, then the perspective (similar to many sociological concepts) is not falsifiable. Any observed behavior is

compatible with some mix of prototypes. Some attempts have been made to collect or reinterpret empirical data about individual values and attitudes in the light of cultural theory (Buss, Craik, and Dake 1986; Wildavsky and Dake 1990). However, the empirical data suggest that beliefs representing various cultural prototypes are related to individual attitudes toward risks. This phenomenon can well be explained in terms of underlying individual values or worldviews.

Similar to the other perspectives, the cultural theory of risk has its shortcomings and its merits. My critical remarks about the perspective are meant to reject the claim that cultural theory is sufficient to explain the social processing of risk. It is the "cultural imperialism" (Kasperson, Chapter 6) or the "cultural determinism" (Nelkin 1982) to which I (and others) object. The reduction of cultural clusters to basically three important prototypes (entrepreneurial, egalitarian, and bureaucratic) may be a valid and intuitively plausible hypothesis in analyzing risk responses, but it should be treated as a hypothesis rather than the exclusive explanation. The emphasis on values and worldviews rather than interests and utilities (which in themselves are reflections of one worldview) is a major accomplishment of this theory. People are not motivated by payoffs only. Neither are organizations. To understand organizational behavior, interests, norms, values, and self-images have to be taken into account. Furthermore, what people and organizations perceive as undesirable events reflects their perception and evaluation of the cultural definition of the social context and its relevance for their worldview.

Based on the constructivist concept, the cultural theory of risk offers an interpretation of the social experience of risk without falling prey to the trap of arbitrariness that characterizes many of the sociological analyses inspired by the same philosophy (Rayner 1987b). It can offer additional evidence for the importance of cultural factors in risk perception and risk policies. It also provides better explanations for social actions that seem to be in conflict with either the technical risk analyses or the obvious interests of the initiating group.

CONCLUSION

What is the major lesson to be learned from the classification of risk perspectives? Figure 3.1 shows that all these perspectives have their specific niche in the analysis of risk. Technical analysis provides society with a narrow definition of undesirable effects and confines possibilities to numerical probabilities based on relative frequencies. However, this narrowness is a virtue as much as it is a shortcoming. Focused on "real" health effects or ecological damage, technical analyses are based on a societal consensus of undesirability and a (positivistic) methodology that assures equal treatment for all risks under consideration. The price we pay for this

methodological rigor is the simplicity of an abstraction we make from the culture and context of risk-taking behavior.

The other perspectives on risk broaden the scope of undesirable effects, include other ways to express possibilities and likelihood, and expand the understanding of reality to include the interpretations of undesirable events and "socially constructed" realities. The social experience of risk includes the perception of actual damage, but it is more focused on the evaluation of the risk context and the associations between the risk and social or cultural artifacts.

> Cultural reason does not deny the role of technical reason; it simply extends it. The former branches out, while the latter branches in. Cultural rationality does not separate the context from the content of risk analysis. Technical rationality operates as if it can act independently of popular culture in constructing the risk analysis, whereas cultural rationality seeks technical knowledge but incorporates it within a broader decision framework. [Plough and Krimsky 1987, 8–9]

Integrating all these perspectives in order to do justice to the phenomenon of risk in our society appears to be necessary for both the analysis of risk experience and the prescription of risk policies. While few would dispute that the observed risk behavior of individuals and groups is puzzling enough to get the social and cultural sciences involved, many feel that risk policies should be based solely on technical and economic considerations.

This would indeed be appropriate if society were only concerned about risk minimization. If all society cared about was reducing the amount of physical harm done to its members, technical analyses and economic balancing would suffice for effective risk management. Included could be the perspective of organizational sociology to make sure that technical safety measures are paralleled by institutional control and monitoring. The social sciences would only be needed to sell the risk management packages to the "misinformed" public via risk communication.

However, society is not only concerned about risk minimization. People are willing to suffer harm if they feel it is justified or if it serves other goals. At the same time, they may reject even the slightest chance of being hurt if they feel the risk is imposed on them or violates their other attitudes and values (Otway and von Winterfeldt 1982). Context matters. So does procedure of decision making independent of outcome. Responsive risk management needs to take these aspects into account. The social science perspectives on risk can help to enrich risk management. They can

- identify and explain public concerns associated with the risk source;
- explain the context of risk-taking situations;
- identify cultural meanings and associations linked with special risk arenas;
- help to articulate objectives of risk policies in addition to risk minimization, such

as enhancing fairness and institutional trust and reducing inequities and vulnerability;

- design procedures or policies to incorporate these cultural values into the decision-making process;
- design programs for participation and joint decision making; and
- design programs for evaluating risk management performance and organizational structures for identifying, monitoring, and controlling risks.

The above discussion, however, demonstrates that the inclusion of the social science perspectives for normative use in policy making faces two major drawbacks. First, the advice of social scientists will vary considerably depending on the worldview and disciplinary background of the individuals asked. Second, unlike the technical or economic perspective, the social science concepts offer no common denominator for measuring cultural or social acceptability (Douglas 1985). What constitutes a value violation for one group may be perfectly in line with the values of another group. Who is going to decide which social construction of reality has more validity than another competing construction?

Risk policies can cope with the first problem by employing different perspectives in analyzing the situation and by knowing the relative advantages and disadvantages of each perspective. The second problem creates more difficulties. It is obvious that a simple or even complex algorithm of multidimensional decision making would not resolve the potential conflicts between competing social constructions (although formal multi-attribute decision analysis may provide an excellent framework for structuring problems and decision options). There is also no impartial referee available to judge the appropriateness of cultural constructions. The only viable resolution of these conflicts in democratic societies is by initiating a discourse among the major parties involved in the decision-making process or affected by the decision outcomes (Habermas 1971). Such a dialogue can be organized in the form of advisory committees, citizen panels, formal hearings, and others (Fiorino 1989). Democratic values can provide the means by which to construct this dialogue, and the social science perspectives can help to make these forms of dialogue work, that is, to make sure that each group can bring their own interest and values to the process and yet reach a common understanding of the problem and the potential solutions (Renn, Webler, and Johnson 1991).

The need for social science perspectives in risk analysis and risk management is impeded by the fragmentation of the social sciences and the claim of exclusiveness or incompatibility with competing perspectives. This analysis has demonstrated that such a competition is neither theoretically compelling nor helpful. It has become evident that a novel and integrative framework is necessary to capture the full extent of the social experience of risk and to study the dynamic processing of risks by the various partic-

ipants in a pluralistic society. Such a novel approach cannot and should not replace the existing perspectives, but should instead offer a meta-perspective that assigns each perspective an appropriate place and function. The major objective of such a meta-perspective is to make the various perspectives compatible with each other and to provide a semantic framework that allows comparative analysis across the various perspectives. A potential candidate for such an integrated framework is the concept of social amplification, which is described in this volume (see Chapter 6). Whether the social amplification framework can meet this challenge remains to be seen.