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Risk as an Interdisciplinary Research Area

Jens O. Zinn and Peter Taylor-Gooby

Risk issues initially attracted attention as the growing complexity of technical processes and enterprises generated interest in practical problems of risk management. Two factors—the realization that accidents and errors were not simply technical issues, and the increased opposition of members of the public to innovations—directed attention to psychological and sociological approaches to risk. As theoretical and empirical work developed, researchers from different perspectives recognized the importance of the sociocultural embeddedness of risk perceptions. This chapter discusses the variety and complexity of risk issues and the value of the various approaches.

The chapter starts by examining the established procedures of statistical-probabilistic risk calculation in three main areas: insurance, of technical risks, and toxicological and epidemical risks in health and illness. Risks from this perspective are concerned with the extent to which objective hazards can be managed through insurance, prevention, and reduction, in relation, for example, to the reliability of technical processes, the deterioration of machines, the probability of industrial accidents, or the effectiveness of medicine or medical treatment. These strategies are likely to be successful so far as risks and impacts can be specified and a value-consensus on the acceptable level of risk exists.

However, risk decisions involve issues other than technical management. Uncontrollable malfunctions like the Three Mile Island nuclear power plant incident (near Harrisburg in 1979) or the catastrophic accidents in Bhopal (1984) or Chernobyl (1986) revealed the limitations of risk-management systems. In addition, evidence about the ways in which

people actually deal with risks indicated the weakness of common research assumptions. Initially, researchers treated responses to existing risks (e.g. traffic accidents, smoking, and drinking) as a benchmark for the acceptability of new risks. Similar assumptions were applied to the introduction of new technologies (Starr 1969). However, it became obvious that people treat established and novel risks in very different ways. A further point is that public concern about the risks attending technical innovation in a wide range of fields, from food safety to nuclear power, from new medicines to fuel additives, and from mobile phones to air pollution raised difficult issues about acceptable risk levels for policymakers.

As a result, researchers became more interested in peoples' perceptions of and decisions about risky issues. Whilst behavioural economists and cognitive psychologists sought to establish universal laws of human decision-making, risk research in the narrower sense examined the problem of public perception of risks through a psychometric paradigm. This approach aims to understand how risk perception is influenced by the characteristics of risks as well as by socio-structural factors. Optimistic expectations that this work would find more or less stable patterns in perceptions and responses, which would allow researchers to predict and to explain risk acceptance and which could be used for decision-making by politicians and business, were not fulfilled. Another stream of research in this area that has attracted more attention recently approaches risk responses by assuming that people interpret their world through 'mental models'.

Researchers inspired by psychological and social psychological perspectives have attempted to integrate different approaches, mainly those concerned with risk perception and risk communication, into an ambitious *Social Amplification of Risk Framework* (Pidgeon, Kasperson, and Slovic 2003). This enterprise built on the assumption that risk perception is mainly determined by risk communication through the media and other routes. Examination of the way these processes work can then explain the amplification or attenuation of risk concerns. However, the model has proved to have weak predictive ability.

Further research indicated that the public framework of risk perception is a complex and socioculturally diverse mixture of stable and unstable patterns. As a result, the more individualistic approaches have tried to integrate sociocultural accounts of risk perception into their models. Simultaneously, sociocultural and more general sociological approaches have attracted attention.

The prelude to the sociological contribution to the risk debate was the 'expert-layman' controversy. In controversies between local laypeople and experts on such issues as how to assess the impact of large-scale industrial accidents, the authorities often found the rejection of official expertise frustrating. Sociological and, increasingly, psychological approaches support the recognition that laypeople's knowledge systems also offer valid interpretations of risk.

One assumption has been that the ways in which people perceive and respond to risk are significantly determined by the social organization or group to which they are attached and their position in it. In later cultural approaches, risk perceptions are often understood as linked to the individual's social identity. Others assume that the current explosion of interest in risk in public discourse is a systematic problem associated with the stage of development of modern societies. The risk society, reflexive modernization approach argues that growing uncertainties have to be accepted, because they can only be managed and not eliminated. In another tradition, risk awareness is interpreted chiefly as the product of society itself. The dominance of a new style of government which shifts risks and responsibility to the subject is responsible for the preoccupation with risk issues.

Statistical-Probabilistic Concepts of Risk

The development of statistical methods to calculate probabilities supported the rapid spread of risk ideas across a wide range of areas. Initially applied in the concept of insurance, it spread into technical risk calculation in an industrializing society and into other domains, including, for example, the estimation of the effects of treatments and lifestyles on health and illness, or the assessment of pension benefits.

All these applications of the idea of risk rest on statistical-probabilistic calculation. A central requirement for the successful calculation of risk is that expected gains and losses can be transformed into an objective measure (most prominent in economics and technical approaches)—for example, money, life expectancy, or, in epidemic and toxicological approaches, death rates. In this way risk can be understood as an objective entity (risk is understood to equal the probability of an occurrence multiplied by the extent of damage) which can be calculated with the help of probability theory.

Insurance

Insurance initially developed at the close of the Middle Ages as a method for managing the risks of trade. Merchants sought to guard against insolvency in the event of losing a ship. The loss was calculated as the value of a cargo, and estimates of the probability of loss based on experience. The quality of risk estimation depends on experience of previous losses. As long as past experience can be applied to the future, insurance is a feasible solution.

In a changing world with an uncertain future, insurance companies need reserves for unexpected events. They are sensitive to shifts in probabilities, and are unable to manage risks where predictions of the future entail a high degree of uncertainty. Examples would be a rapid and unforeseen increase in flooding, or the problems involved in the nuclear industry, where technology is innovative, experience limited, and the possible costs enormous.

Technical Risk Analysis

The point of origin for technical risk research was concern with the controllability, safety, and reliability of technical systems and processes, and with the reasons and outcomes of failures in the context of the rapid expansion of technical innovation during industrialization. Technical risk analysis aims to make a process or technique more reliable and secure. From this perspective, researchers need to develop the necessary routines and techniques in order to identify vulnerabilities and eliminate them in order to reduce the final risk to an acceptable level. The approach is typically based on the principle of cost efficiency, so that the option with the best balance of risk and cost is chosen.

Comprehensive risk analysis and evaluation developed from the middle of the nineteenth century onwards, particularly in major industrial enterprises and the defence industry. Through 'Operations Research' and 'Systems Analysis', an independent stream of research to estimate risk (risk assessment) was established, drawing on a purely technical and economical approach. Typical methods are the analysis of hypothetical accidents, models and scenarios of possible accidents, cost-benefit analysis, probabilistic estimation of safety and credibility, and quantitative risk estimation. This strategy aims to control the uncertainties and insecurities which go along with the application of new techniques (Banse 1996: 31). The approach works well in many cases but also shows

systematic deficiencies which may trigger public concerns about new developments.

Epidemiological and Toxicological Risk Analysis

Risk estimations are also relevant to medical contexts. Epidemiological and toxicological research estimates how factors such as lifestyle or diet influence the probability of falling ill (e.g. the connection between smoking and cancer), or whether particular medical treatments significantly reduce the symptoms of an illness. Other aspects concern the probability and seriousness of side effects from a medicine and whether these are acceptable compared with the risk of illness.

The whole logic of modern orthodox medicine rests on the direction of treatment to tackle the identified causes of symptoms, to produce objectively measurable improvements. This approach was central to the development of scientific medicine, supplanting the former plurality of magical and philosophical belief systems. However, problems may arise. New illnesses with unclear symptoms and no certain treatment strategies, as well as acknowledgement that some illnesses cannot be cured at all, promoted patients' engagement with alternative approaches (Bury 2001). Their involvement is accompanied by the increasing influence of competing more holistic knowledge systems, such as acupuncture or homeopathy, and by new approaches which seek to define health in terms of positive well-being, rather than the absence of illness.

The Crisis of the Statistical-Probabilistic Approach to Risk

A rational and objective approach to risk calculation was successful as long as it was applied to risks where the outcomes could be ascribed, the expected harms, losses, or damages could be measured, and causes and results controlled and isolated. It was sometimes not fully understood that the probability and extent of losses can only be estimated over groups of events and do not strictly apply to individual cases. This approach encountered problems with innovative and large-scale technologies where risks have changed not only quantitatively but also qualitatively. In several other domains the risk logic also came under pressure.¹ The potential threats as well as the growing uncertainty regarding ignorance and knowledge of possible outcomes were prefigured in the Windscale reactor fire in 1957 and attracted growing public attention during the 1970s and 1980s. The accidents mentioned in the first section

(including Bhopal, where a gas release from the Union Carbide plant killed more than 2,000 people immediately and many more in the following years, and Chernobyl, with uncounted deaths, injuries, and illnesses caused by contamination) showed the limits of current approaches to risk. The Challenger Space Shuttle accident in 1986 brought home the uncertainties inherent in advanced technology. Perhaps more important than any technical shortcomings of the statistical approach is the fact that the public response to these disasters is a growing suspicion of technical innovations and developments.

These new risks have qualities and dimensions which violate many of the assumptions of risk calculation. They tend no longer to be geographically, regionally, or nationally restricted, but are global. They are complex and increasingly entangled with different areas. New technical risks share the characteristics of catastrophes. The potential material, and financial and personal damage can hardly be estimated and may extend to the elimination of all life on earth. They are mainly invisible and inaccessible by direct means. They produce long-lasting outcomes, and are difficult to determine, and the effects cannot easily be reversed. Not all of these factors are absolutely new. Some were shared by past risks, such as plague or crop failure. It is the extensive public awareness of the new risks that brings home these characteristics in a way that is qualitatively different in its cultural impact.

The disasters and accidents mentioned above graphically illustrate the shortcomings of scientific, technical, and formal strategies in controlling complex technical systems. These failures direct attention to the question of how complex organizations can be managed safely. A series of studies has shown how the rapid development of management systems intended to reduce the scope for disaster often in fact increases it, because complexity introduces greater uncertainty (Perrow 1984). Further work shows how risks which conflict with the range of outcomes expected within an organizational culture may not be effectively tackled (Turner 1978; Pidgeon and O'Leary 2000). Economic and political pressure can also influence an organization's safety culture (Vaughan 1996).

In some fields, the characteristics of new risks make adequate analysis through probability estimations virtually impossible. If we still use such approaches, the extent of subjective weightings and valuations has to be taken into account. Scientifically developed long distance planning and probability risk analyses pursue the successive adaptation of technical systems to situational necessities (e.g. more restrictive safety regulation as a response to accidents). Hypothetical assumptions substitute for practical

knowledge (models, ideals, and reductions of complexity), and empirical knowledge is replaced by probability assumptions. Tests of the assumptions cannot be applied, and experiments and observations cannot be repeated adequately. The potential damages and the probability of their occurrence cannot² be determined and reduced by the usual strategies of learning by trial and error (Banse 1996: 34). Even though risk calculation in some areas was eroded by uncertainty and estimates were open to interpretation by different scientists, the real crisis of the technical-rational paradigm resulted from a separate socio-political development. In many cases in which the potential damage is irreversible, growing numbers of the public will not in fact accept any probability of risk, however small (Luhmann 1993: 2). Examples are nuclear energy, vaccination resistance, and genetically modified food. Many experts were astonished at public resistance to comparatively small new risks, in contrast to the acceptability of much higher everyday risks (such as those associated with road transport or smoking) without even questioning the dangers. The understanding of the public as 'irrational' was widespread, and gave new impetus to further research on responses to significant political decisions.

The Problem of Predicting the Acceptability of Risk

Politicians and other decision-makers have to act on the basis of available knowledge, even though this knowledge may be limited. The central problem is the acceptability of decisions, rather than the resolution of technical questions. With the shift from technical problems to the questions of acceptability and the prediction of public response, social and psychological issues move to the fore in risk research. How urgent this question had become for technical risk research may be illustrated by the fact that the first attempt to deal with the problem was by a leading engineer turned academic.

Starr, former president of the Atomic Division of Rockwell International, analysed popular responses to risk in a way intended to be of use to decision-makers (Krohn and Krücken 1993: 26). In his lecture *What is our society willing to pay for safety?*, the findings are phrased in precise, statistical terms: the public 'is willing to accept "voluntary" risks roughly 1,000 times greater than "involuntary" risks'; tends to use risk of death as a "psychological yardstick"; and acceptability "appears to be crudely proportional to the third power" of expected benefits' (1969: 1237). He compares the risks of nuclear power with the level of risks associated with

the existing conventional power plants that most people apparently find acceptable. The lower risks for nuclear power (estimated at 1 in 200 as against 1 in 40), together with the expected gains, support his optimistic expectation of a high social acceptability of the new technology.

Critics of this approach commented on the equation of acceptable and accepted risks, the restriction to risk of death, the pecuniary calculation of costs and profits, and the focus on quantitative approaches to the exclusion of a qualitative dimension. They also pointed out that Starr derived people's preferences theoretically and not directly. This led to interest in the examination of people's actual risk perceptions, pursued through the psychometric paradigm of risk research.

How Do People Make Decisions and Perceive Risks?

The psychologists who criticized Starr (1969) referred to another stream of research which had already started to develop in decision-making research. This work was pursued mainly by cognitive psychologists, who originally experimented in laboratories with risk behaviour, examining gambling and risky choices. Referring to the economic model of rational action, behavioural economists and cognitive psychologists together examined how people deviate from theoretical assumptions. This interest resembles closely that of technicians and engineers who cannot understand why and how people deviate from what seems the best risk calculation for them, from a rational standpoint. Whilst risk management was, for technicians and engineers, principally a technical problem of calculation and public acceptance, from the perspective of behavioural economists and cognitive psychologists it was understood as a more general problem of decision-making. They were much more interested in the universal laws of decision-making than specific responses to technical innovations.

One stream of research sought to investigate the conceptual models of reality people construct, and how these models differ from those based on expert knowledge. Slovic and colleagues also worked from the assumption that laypeople's perceptions of risk were inadequate ('faulty perceptions of risk could be explained as a result of the cognitive limitations of human beings', Slovic, Fischhoff, and Lichtenstein 1977). They introduced, in response to Starr (1969), a new methodological approach to investigate risk perception, which became at the time the most influential approach in risk research, the 'psychometric paradigm'.

Behavioural Decision-Making

Since the assumptions of rationality seem to be inaccurate in many cases, economists had started to find out how people really decide or judge. Simon's early work on 'bounded rationality' (1957) and further examinations in behavioural economics led Tversky and Kahneman (1974) to the conclusion 'that the deviations of actual behaviour from the normative model are too widespread to be ignored, too systematic to be dismissed as random error, and too fundamental to be accommodated by relaxing the normative system. We conclude from these findings that the normative and descriptive analyses cannot be reconciled' (quoted in Renn et al. 2000: 43). The central finding of Tversky and Kahneman (1974: 35) showed that 'people rely on a limited number of heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgemental operations.' Even though these heuristics are in general useful, they sometimes lead to severe and systematic errors. The range of heuristics includes *representativeness*, *availability*, *anchoring*, and *adjustment*.

People tend to compare issues with others by superficial indicators assumed to indicate whether an issue belongs to a specific group with corresponding characteristics (representativeness) (Tversky and Kahneman 1974: 36). They often judge the frequency or probability of an event by the ease with which such issues can be brought to mind (availability). 'For example, one may assess the risk of heart attack among middle-aged people by recalling such occurrences among one's acquaintances' (Tversky and Kahneman 1974: 42f.). However, availability is also influenced by factors such as media coverage rather than the frequency of the event itself. This heuristic may produce systematic biases. Another important heuristic shows that judgements are anchored to an initial value, which is then adjusted according to present circumstances (Kahneman, Slovic, and Tversky 1982), so that relative judgements depend crucially on the respective starting points.

Another central result in the field of decision-making is the *framing effect*. Although the concept of rationality assumes that the same problem should always lead to the same result, even though the contexts differ, the formulation (framing) of a problem influences the judgement. How decision-makers frame a problem is partly influenced by the formulation of the problem and by the norms, habits, and personal characteristics of the decision-maker. For example, a problem can be presented as a gain (200 of 600 threatened people will be saved) or as a loss (400 of 600

threatened people will die). In the first case people tend to adopt a 'gain frame', generally leading to risk aversion, and in the latter people tend to adopt a 'loss frame', generally leading to risk-seeking behaviour (Tversky and Kahneman 1981).

A number of criticisms of this research have been made. The experiments were conducted in laboratories under artificial conditions. The subjects had limited information and were under strict time pressures. They may therefore deviate systematically from the real life situations where people already have relevant experiences or can ask others for help and advice. This approach shares with Starr the difficulty that little direct information about people's risk judgements in real life is employed.

At least two main strategies followed from this perspective. One tried to map out the ways in which people think and decide by qualitative experimental methods (*mental modelling*). The other approach, quite influential for risk research, is to simply ask people directly (*psychometric paradigm*).

The Psychometric Paradigm

Following Starr's work, the psychometric paradigm developed rapidly. It promised to give access to the understanding of public risk preferences which was urgently needed by politicians and other decision-makers. It also anticipated the identification of more or less stable factors in risk perception to which risk policy could refer. On this basis, it was hoped that policy could be adapted to fit public attitudes and be made acceptable to a wider audience (Krohn and Krücken 1993: 28). The psychometric paradigm to risk perception was principally developed by the 'Decision Research Group' at the University of Oregon (Fischhoff et al. 1978, 1983; Slovic, Fischhoff, and Lichtenstein 1982, 1984, 1985, cited in Rohrman and Renn, 2000, 17). Whilst Starr referred to *revealed preferences*, the psychometric paradigm aims at *expressed preferences* which can be approached by standardized questionnaires (Fischhoff et al. 1978; Slovic, Fischhoff, and Lichtenstein 1985). It assumes that 'risk is subjectively defined by individuals who may be influenced by a wide array of psychological, social, institutional and cultural factors ... many of these factors and their interrelationships can be quantified and modelled in order to illuminate the responses of individuals and their societies to the hazards that confront them' (Slovic 2001: xxiii). People were asked to rate the risks associated with various sets of hazardous activities, substances, and technologies, such as nuclear power, pesticides, bicycles, or sunbathing.

Also, judgements were recorded about other hazard characteristics which were hypothesized to account for risk perceptions. Several contextual factors were identified to affect the perceived seriousness of risks, for example, the expected number of fatalities (Renn 1983; Jungermann and Slovic 1993) and the catastrophic potential of a risk.

We follow the authoritative introduction to risk perception research of Rohrman and Renn (2000). The work showed that risks with a low probability but high consequences would be perceived as more threatening than more probable risks with low or medium consequences (von Winterfeldt, John, and Borchering 1981). Additionally, the perceived characteristics of the risk source or the risk situation, for example, the conviction of having personal control over a risk, familiarity with a risk, the perception of equitable sharing of both benefits and risks, and the opportunity to blame a person or institution responsible for the creation of a risky situation, influence evaluation (Slovic, Fischhoff, and Lichtenstein 1981). Finally, beliefs and attitudes about the nature, consequences, history, and justifiability of a risk are also important (Otway and Thomas 1982; Renn and Swaton 1984).

Multivariate analysis of the relations between these variables showed that many of these risk characteristics are related to two or three underlying factors, which explain most of the variance of the judgements. Most important is the factor which represents characteristics which were related to the severity or dreadfulness of the hazard, such as terror, lack of controllability, involuntariness, or concern for future generations (the dreadfulness of risks factor). A second factor comprises knowledge-related characteristics such as whether the risk is observable, known, or new (the degree of knowledge and familiarity with the hazard factor). In some studies the number of exposed people represents another factor, but its influence is weak. This two-dimensional structure appears in a number of articles by Slovic, Fischhoff, and Lichtenstein (1980, 1981, 1985, 1986) and Slovic (1987, 1992). Several studies reproduce similar structures, at least for factors of dreadfulness and degree of knowledge (compare Renn and Rohrman 2000: 29).

Further research demonstrates the complexity of attitude structures. National patterns of risk perception have been discovered, as well as regional and local differences (Fitchen, Heath, and Fessenden-Raden 1987; Fowlkes and Miller 1987). Social stratification (by gender, ethnicity, or social class) also influences the ways in which people perceive risks (Rohrman 1999). The central result is the identification of a mixture of stable and unstable patterns of risk perception which generally make

overall predictions of the acceptability of risks difficult (Fischhoff, Slovic, and Lichtenstein 1983; Slovic 1992: 127). However, the original hope of discovering the explicit risk estimations and preferences of the public and therefore the urgently needed knowledge for decision-making in politics and economy was disappointed. One of the reasons for this unsatisfying result might be that the study of risk perceptions within this paradigm condenses information which is based on average ratings. The influence of knowledge, values, and feelings, and of individual differences, receives little attention. Before findings could be generalized, the cultural context has to be explicated (Rohrman 1999: 135–7), and this context is often dynamic rather than stable. Another limitation is the unclear connection between the measured risk perception and the practical response in everyday life (Wilkinson 2001).

The important message of the psychometric approach for risk is that for most (lay)people, risk is not just a combination of the size and the probability of damage, as proposed by the technical-statistical approach, but also has a social and subjective dimension.

Mental Modelling

'Mental modelling' approaches draw on the conventional concept of rational decision-making and the insights of the findings of cognitive psychology about heuristics and cognitive biases in laypeople's decision-making. The core idea is that people develop conceptual structures that correspond to risks as they understand them. These structures may be more or less accurate and may be mapped through psychological investigation. The approach seeks to examine how people construct accounts of reality.

Such models are useful in understanding the world, but as Fischhoff et al. (e.g. 1997) point out, may lead to error if they contain misunderstandings. This approach lends itself to the view that distinguishes expertise and ignorance, and the concern with improving communication to rectify the latter by ensuring that lay models correspond more closely to those of experts. For example: 'whatever the goal of communication, its designers need to address the mental models that recipients bring to it, that is, the pattern of knowledge, overly general understandings, and outright misconceptions that can frustrate learning' (Atman et al. 1994).

Models may typically be elicited through qualitative interviews and then compared with expert understandings in order to identify discrepancies (Weyman and Kelly 1999: 26). Quantitative studies can then

be designed to explore the extent of these discrepancies and their relationship to knowledge and other factors. The approach draws on decision-making research on heuristics and biases, and on findings from psychometrics, but differs in the use of qualitative methods to elicit lay understandings of risk, including beliefs both corresponding to and differing from those of experts.

The potential of the approach was judged by the 1992 Royal Society report as 'highly promising' (Pidgeon et al. 1992: 121). A considerable amount of work has been carried out on lay models of specific risks (reviewed in Weyman and Kelly 1999: 12), much of it indicating that laypeople have simpler and more intuitive mental models than experts, often influenced by cognitive biases which appear to result from the use of simplifying heuristics. More recently, a number of writers have questioned the critique implicit in much of the work (and expressed in the Atman quotation above and by MacGregor and Fleming 1996) of the accuracy of lay mental models. One strand concerns the extent to which expert knowledge can be seen as unified and consistent and as having an objective status, in contrast to the presumed subjective nature of lay perceptions. Another raises the issue of the validity of lay knowledge of risk issues in the context in which most people encounter them. This approach effectively claims an equal status for lay understanding with that of experts whilst acknowledging differences in perspective. A third raises the issue of trust in expert accounts and how this contributes to acceptance of the authority of expertise (Weyman and Kelly 1999: 26).

Attempt to Integrate Different Approaches

Some psychologists, unsatisfied with the lack of a dynamic perspective in their models of risk perception and the under-examination of contextual factors, have developed the concept of social amplification. This approach combines risk perception and risk communication perspectives in such a way that other social psychological insights may be integrated in an overall theoretical framework. The social amplification approach (SARF) developed by the Clark University group (Kasperson et al. 1988; Renn et al. 1992) is an ambitious attempt 'to construct a framework which unifies understanding of risk-perception and -communication' (Pidgeon, Kasperson, and Slovic 2003: 2). The point of origin is the assumption that most of our knowledge comes at second hand, and is acquired by communication—mainly understood as information given by the mass

media. Risk messages are understood as signals emitted by social events and 'subject to predictable transformations as they filter through various social and individual amplification stations' (Pidgeon, Kasperson, and Slovic 2003: 15).

The first stage of the basic model identifies several social processes which influence risk perception. These include the operation of the channels through which information is disseminated (or not), the role of social institutions in modifying signals, individual factors (e.g. the use of the cognitive heuristics identified by Tversky and Kahneman), and social and institutional behaviour, such as protest actions, or political processes within parliament or public enquiries. In the second stage, 'risk messages' 'ripple out' through a widening range of social groupings from the individual to society as a whole. There is provision for feedback between the various first-stage processes, and it is in the operation of these processes and the interaction between them that amplification or attenuation of risk signals occurs. The established theories dealing with risk institutions, social systems, individual cognition, and so on provide understanding of the various individual processes. Thus, the approach links together existing work and provides a framework within which accounts of the processes which influence the way risk events are perceived and influence society, and in particular the way in which expert judgements fail to carry consistent conviction with the public, are located. Parallels can be drawn between SARF and work in other disciplines, for example, the sociological analysis of the diffusion of 'moral panics' as a process of 'deviance amplification' in the understanding of the 'mods and rockers' seaside riots (Cohen 2002; Murdock, Petts, and Horlick-Jones 2003).

The authors comment that existing research on risk signalling, communications and the mass media, organizational processes, imagery, and stigma contribute to the framework (Pidgeon, Kasperson, and Slovic 2003: 16–30). The approach is eclectic and interacts with other social sciences, especially sociology, in its interest in social institutions and processes, and increasingly with political science in the emerging awareness of how political factors facilitate or obstruct the impact of risk perceptions on policy (see Gowda 2003). However, the operation of ripple effects (which are of most importance in relation to public policy) is less well understood, and proponents argue that this is where more research is needed (Pidgeon, Kasperson, and Slovic 2003: 31–6).

The main criticisms of the framework concern its ontology and its account of social processes. It has also been criticized on the grounds that it is not a theory and does not generate testable hypotheses

(Wahlberg 2001). This may miss the point, since the approach claims to offer an overall framework, which combines a range of disciplinary backgrounds and middle-range theories (of human cognition and communication, attitude change, the influence of mass media, and so on), rather than a tightly defined theory. It implicitly adopts the realist conception of risk that underlies all work that makes a strong objective, subjective distinction and 'lies at the core of the SARF foundation' (Rosa 2003: 62). This is challenged by those who adopt a more cultural approach and see risks as socially constructed at all levels. The main criticisms of the account of social processes concern the role of feedback, particularly in relation to the media, and the implicit account of power in society. Murdock and colleagues, drawing on the work of Bourdieu, point out that media reporting is not simply a one-way process. The complex interactions between individuals and the media in relation to risk events cannot simply be captured in the account offered in stage one of social amplification, drawing on an electronic engineering metaphor of signals and feedbacks (Petts, Horlick-Jones, and Murdock 2001: ch. 6; see also Murdock, Petts, and Horlick-Jones 2003: 158).

Sociological Approaches to Risk

Sociological theories approach risk questions mainly from the opposite direction to psychologists and economists, moving from societal institutional structures to the level of the individual, rather than the other way about. The main problems tackled from this perspective are the interweaving of culture and individual perception and responses to risk, and the way in which these factors change or develop over time.

The influence of sociological approaches to risk originates with the debate on the lay-expert division of knowledge. Many economists, psychologists, and decision-theory researchers set the objective or rational ideal as the standard for individual decision-making. The assumption was that experts would tend to follow this model whereas laypeople (as the research showed) do not. An alternative tradition in science studies has criticized the claim that experts and science in general always take an objective standpoint as a myth (in the context of risk, Wynne 1982; more generally, Latour and Woolgar 1979). The dismantling of positivistic accounts of science and their intrinsic hierarchical political impact on risk problems strengthened the view that citizens' understanding of risk has an equivalent validity and rationality to that of the accredited experts. It also supported a new approach to public responses to the new

technologies, especially in the development of social movements opposed to new technologies, such as the nuclear industry, and the promotion of a more ecological lifestyle.

These public responses are explained from the sociological perspective in terms of sociocultural change. The new developments were initially examined, in the US context, through the *cultural approach* of Douglas and Wildavsky, as the result of sociocultural change affecting societal groups differently. In Germany, by contrast, Beck's approach through the concepts of *Risk Society* and *Reflexive Modernization* emphasizes the impact of a general shift within modernity caused by new risks as well as socio-structural changes. This perspective has gained ground rapidly and has also been developed in the UK, whilst the *systems theory* approach to risk, developed by Luhmann, is prominent only in Germany. In Britain, as in other Anglo-phone countries, another perspective has gained ground, explaining growing risk awareness in terms of a shift in how societies are governed or govern themselves. This *governmentality* approach (Foucault 1991) was imported from France and fitted very well the experience of free market liberalism from 1979 onwards.

Expert-Layman Controversy

Much early risk research assumed, either implicitly or explicitly, that scientific and professional knowledge is superior to that of laypeople or embodied in everyday life practices. The difference between lay and expert judgements about risks and uncertainties was explained in terms of limited knowledge and misunderstandings of reality. Despite the evidence that scientists are also influenced by heuristics and biases (e.g. Tversky and Kahneman 1974: 50), the assumption of an objective and superior scientific knowledge, which would lead to an optimum solution if only the confounding influence of policy, values, and ideologies could be discounted, was central to the early risk debate (Wynne 1982).

In accordance with the basic idea of a positivistic science, accidents such as those in nuclear power plants were regularly interpreted as caused by the imperfect behaviour of the staff responsible. This led to recommendations for improved staff selection and training. More recently, social studies of science have argued that objective positivistic knowledge can be illusory, and often serves to disguise social power enshrined as authority (Wynne 1982).

Consequently, the practical sociological contribution to the risk debate aims to acknowledge laypeople's knowledge, values, and cultural

positions on the one hand and to show how expert knowledge is involved in social processes of knowledge production on the other. It fills the gap between those psychological approaches which interpret public responses mainly as deviations from correct solutions generated by science and the claims to objective and expert knowledge which ignore the social embeddedness of knowledge.

A key finding in relation to such activities as public participation exercises or the implementation of nuclear technology is that laypeople are not necessarily irrational, but pursue a specific form of knowledge and experience based on value systems which are culturally different from rather than inferior to those of experts. The research of Wynne was highly influential, especially in the UK. He pointed out that the laboratory knowledge of the experts fails repeatedly in attempts to transfer it to real life situations (Wynne 1982, 1987, 1992, 1996). He uses detailed empirical studies to show that experts have their own beliefs, epistemologically similar to laypeople's knowledge, although constructed by following scientific rules rather than through life experience. He showed, for example, that expert framing of the safety problem regarding the production and usage of pesticides was naïve. It assumed, for example, that 'pesticide manufacturing process conditions never varied so as to produce dioxin and other toxic contaminants of the main product stream; drums of herbicide always arrived at the point of use with full instruction intact and intelligible; in spite of the inconvenience, farmers and other users would comply with the stated conditions, such as correct solvents, proper spray nozzles, pressure valves and other equipment, correct weather conditions, and full protective gear' (Wynne 1992).

Wynne also examined the responses of Cumbrian sheep farmers to the claims of government scientists about the impact of radiation from the Chernobyl disaster, and more generally in accounts of the risks from agricultural chemicals (1992, 1996). He points out that the farmers felt themselves 'completely controlled by the exercise of scientific interpretation' (1996: 63) but developed a thorough-going scepticism of scientists pronouncements, because they were aware that the scientists made obvious errors. Official science failed to predict the course of the outbreak of radiation in ways which was financially devastating for the farmers, and made elementary and obvious mistakes in experiments and analysis. This was because they simply did not have the farmers' understanding of sheep behaviour and of local environmental conditions (1996: 65–7).

Subjective and sociocultural beliefs or frames of reference differ. People respond differently to risk and often deviate systematically from the

simple assumptions of a generalized rationality which seeks to apply to all people in the same way. In this context, cultural aspects play an important role.

Sociocultural Approaches to Risk

The sociocultural perspective on risk was initially informed by the seminal anthropological work of Douglas (1963, 1966) and was further developed by Douglas (1985, 1992) and Douglas and Wildavsky (1982). A stream of work uses a quantitative perspective (Wildavsky and Dake 1990; Dake 1991; Dake and Wildavsky 1991) whilst another stream follows a qualitative approach (Rayner 1986; Bellaby 1990). In more recent qualitative work, the influence of the functionalistic perspective of Douglas and Wildavsky is supplanted by more descriptive approaches (Tulloch and Lupton 2003).

The core assumption of the cultural approach is that the individual's perception and response to risk can only be understood against the background of their embeddedness in a sociocultural background and identity as a member of a social group, rather than through individual cognition, as is proposed by mainstream economics and cognitive psychologists (Douglas and Wildavsky 1982: 6–7). Risk is interpreted as a socially constructed phenomenon although it has 'some roots in nature' (Thompson and Wildavsky 1982: 148). The different ways in which societies or specific social groups construct risks and dangers are understood as depending on their form of social organization (Douglas and Wildavsky 1982: 8). Douglas and Wildavsky explain the new awareness of risk and the rise of social movements opposing technical innovations in the 1980s through shifts in the organizational culture of society (which they call 'sectarian'), rather than by the occurrence of new risks. Complex historical changes have led to increased mobilization of citizen's organization opposing big government, big money, and market values (Douglas and Wildavsky 1982: 10–1).

Douglas and Wildavsky developed a framework for analysing social organization along the two dimensions of 'grid' and 'group'. Grid stands for the degree to which an individual's life is regulated or prescribed by the roles in a social group. It is high in hierarchical organizations and low in egalitarian organizations. The group dimension stands for the degree of identification with a particular group. It is strong when the individual is a member of a group and weak when the individual does not belong

(Douglas 1992: 192). The result is a four-category typology (Thompson, Ellis, and Wildavsky 1990: 62–6).

The cultural type of competition or individualism, typified by the market and entrepreneurial perspective on risk, interprets risk-taking as an opportunity to pursue personal goals in competition with others. Group cohesion is weak and the normative bonding into the group is low. In contrast, strong group incorporation and low hierarchy characterize the cultural type of egalitarianism or enclave (the earlier sectarian type). People belonging to this type emphasize cooperation and equality, and have a strong sense of solidarity. They tend to focus on the long-term effects of human activities and are more likely to abandon an activity than to take chances. A strong group cohesion and highly regulated social life are associated with hierarchy, or bureaucracy. Cultural types falling into this category rely heavily on rules and procedures as provided by social institutions to manage risks and uncertainties. The last type stands for isolation, fatalism, or atomized respectively stratified individuals which believe in hierarchies but do not identify with the hierarchy they belong to. They rely only on themselves and are very reluctant to accept risks imposed by others. Finally, some researchers have identified a fifth group, located between the others. Hermit or autonomous individuals do not belong to one of the specified types but can flexibly refer to each type, as long as it fits their personal aims and needs (see, for example, Rohrmann and Renn 2000: 34–5). The cultural approach has a major impact on risk research. A mainly quantitative perspective refers to risk perception approaches. Standardized measures for cultural values (worldviews) were developed (Dake 1991, 1992), assumed to correspond to group cultures. This concept of culture also influences the psychometric paradigm, which tries to integrate cultural aspects in their instrument (Slovic 2001).

The influence of cultural values on risk perception and responses is still controversial. Some studies suggest that other attitudes associated with risk sensitivity (specific fears in relation to the particular risk) explain by far the largest part of risk perception, whilst the heuristics and other variables stressed by psychometry (dread and customary risk) explain roughly half as much, and culture even less (Marris, Langford, and O’Riordan 1998; Sjöberg 2000). One problem is that such an approach interprets culture as an additional and independent, not as a general underlying factor. The evidence of dread, for example, is itself understood as strongly influenced by culture. Critics doubt whether cultural approaches can be successfully captured through structured

questionnaires as developed by Dake (1991, 1992) or in general (Rippl 2002; Tansey 2004).

Besides the standardized quantitative stream of cultural theory, there is also research in a qualitative tradition which uses the grid/group scheme as a heuristic or a means out of charting sociocultural reality (e.g. Douglas and Calvez 1990). Some researchers argue that the ideal types are too schematic to grasp the complexity of social life (Funtowicz and Ravetz 1985; Johnson 1987). They also claim that the grid/group scheme is little help in understanding how the shift of risk perception, from one type to another, might take place (Bellaby 1990). More recently, research has been influenced by cultural studies. These approaches use the categories of post-structuralism and postmodernism to analyse experience of social change. The work of Tulloch and Lupton is influential (see *Risk and Everyday Life*, 2003). Douglas drew attention to the fundamental distinction between Self and Other running across cultures and interpretations of social contexts, and used it to provide an understanding of the multidimensionality of socially available semantics and perception of risk. The main concerns here are the different ways in which risk is understood by different people, how people construct their identities and membership of social (sub-) cultures referring to risk, how the understanding of risk is engaged in ‘border crossings’ between Self and Otherness, and how people interpret risks as positive Lupton and Tulloch 2002; Tulloch and Lupton 2003)³ as well as sometimes negative. The concept of risk used in this tradition is a descriptive one (‘real definition’), focusing on people’s understanding of risk in the context of their everyday lives.

Risk Society and Reflexive Modernization

Beck’s work on the *Risk Society* (1992) originally published in German (1986: *Risikogesellschaft*) was influential for theorizing in this field. It was complemented by further publications (1995: *Ecological Enlightenment*, 1999: *World Risk Society*) which respond to earlier criticisms. Several publications critically discuss the initial assumptions (Lash, Szerszynski, and Wynne 1996; Adam, Beck, and Van Loon 2000). The main thesis and controversies about a changing modernity are published in *Reflexive Modernization* (Beck, Giddens, and Lash 1994; Beck, Bonss, and Lau 2003). The growing risk-awareness and societal as well as individual responses to risk are interpreted from the perspective of the risk society thesis in a general framework of social change within modernity. The modern worldview emerged through the interaction of many factors: the critical

and scientific spirit of the enlightenment, the technological advances of the European industrial revolution, and the social and political changes that followed the development of a working class, the continuing refinement of the division of labour, the expansion of an international system resting on sovereign nation states, and the political economy of national economic management in the interests of assured growth. Beck's thesis claims modernization undermines its own foundations. He identifies two central developments.

First, qualitatively new risks (or better: dangers, threats, and harms) produced as unforeseen and unintended side effects of industrialized modernity are emerging. A risk logic increasingly replaces the traditional logic of social class. Although some risks and risk-dimensions still follow class patterns (Beck 1992: 35), other and new risks concern people in a way that is relatively independent from their social status. New risks, for example, BSE, smog, radiation, climate change, genetically modified food, and ozone depletion, mainly follow logics of allocation other than those of social class. They are 'democratic' even though some might argue that money and status could partly help to deal with such risks or influence how they are perceived. Whilst these risks appear as unexpected side effects of industrialized modernity, they also cannot be solved easily on the basis of available knowledge. Their effects and causes are typically only partly understood, and science does not provide us with the necessary knowledge to manage them within the current policy framework. The typical strategy used to domesticate uncertainty in modernity, insurance, cannot be applied, it is claimed, since the necessary information on the probability and extent of damages is not available—the risks are too great and there is too little experience of them for prediction. Therefore, uncertainty becomes a fundamental experience of modernity where it was once successfully overcome by science and technique.

Second, understanding of social inequalities shifts from a collective social class to an individual level. Beck (Beck 1992: 91–2) starts out from the puzzle that 'the structure of social inequality in the developed countries displays an amazing stability' whilst 'the topic of inequality disappears almost completely from the agenda of daily life, of politics, and of scholarship'. 'During the past three decades, almost unnoticed by social stratification research, the social meaning of inequality has changed... Social groups lose their distinctive traits, both in terms of their self-understanding and in relation to other groups. They also lose their independent identities and the chance to become a formative political force' (Beck 1992: 100). 'Inequalities by no means disappear. They merely

become redefined in terms of an individualization of social risks. The result is that social problems are increasingly perceived in terms of psychological disposition: as personal inadequacies, guilt feelings, anxieties, conflicts, and neuroses. There emerges, paradoxically, a new immediacy of individual and society, a direct relation between crises and sickness. Social crises appear as individual crises, which are no longer... perceived in terms of their rootedness in the social realm' (1992: 100).

Since the allocation logic of risk does not follow the traditional class logic and the bonds to traditional social groups are weakened or dissolved, political mobilization tends to follow the logic of risk rather than of social class solidarity (1992: 35–6, 100).

The risk society approach claims that risks are real and also socially constructed. Referring to Latour (1993), Beck (1999: 146, 150) claims that risks or hazards are hybrids which are not accessible beyond their social construction but also affect the social. It is not possible to be only on the realist or constructivist side. Rather the distinction between realism and constructivism or nature and culture is seen as a modern idea of reality which never becomes real ('*We have never been modern*' as Latour puts it, 1993). This position can be understood as reconciliation between the strong opposition of realist and constructivist sides of risk, which is theoretically unsatisfying, even though still widely disseminated in risk discourse. Risk society themes have been taken up in the UK by Giddens. Adopting a different approach from that of Beck, who discusses individualization processes on the institutional level (Beck 1992: 128–9), Giddens (1991) pays greater attention to the operation of reflexive modernization at the individual level. This leads to a strong emphasis on the 'cultural turn' away from received authority and expertise and towards a citizenship of 'active trust', rather than taken-for-granted deference to accredited experts (1994). Giddens follows through the implications of a critical citizenry and a decline in the capacity of nation states to manage the political economy for the political order in the context of the 'Third Way' politics of New Labour in the UK (Giddens 1999).

In Giddens' view, the key cultural shift among the citizens of risk society is that individuals are more conscious of their social context and their own role as actors within it. Managing the risks of civilization becomes both a pressing issue and one that is brought home to individuals. At the same time however, confidence in experts and in accredited authorities tends to decline as people are more aware of the shortcomings of official decision-makers and of the range of alternative approaches to problems

available elsewhere on the planet. The tendency to breakdown of an established traditional order in the life course provided by work, marriage, family, and community leads to greater individualization and increased uncertainty and anxiety. In this context, the individualized citizens of world risk society are increasingly conscious of the responsibility to manage the risks they perceive in their own lives, and, in this sense, 'self-create their own biographies'.

The risk society approach has been criticized both theoretically (Lash 1994; Alexander and Smith 1996; Lupton 1999; Elliott 2002; Boyne 2003) and on the basis of empirical evidence (Tulloch and Lupton 2003: 132). Rose (1996: 321) points out that Beck's claim 'the prevalence of a language of risk is a consequence of changes in the contemporary existential condition of humans and their world (Beck 1992)' may be misleading. A number of studies (e.g. Ewald 1986; O'Malley 2004: 179) show that risk emerged as a social category and as a concern for government in relation to social insurance at least as early as the nineteenth century (see also Dingwall 1999).

Further comments address the predominance of an individualized notion of identity and agency. Since Beck mainly argues on the institutional level and interprets institutional individualization as a process which can succeed or fail at the individual level, he pays too little attention to differences between social groups. Focusing on the declining role of social class and the importance of personal and active choice, Beck tends to underestimate the continuing explanatory power of social class categories (Mythen 2005). The responsible, confident, self-creating individual may mainly be fulfilled within a particular social stratum (Rose 1999).

Lash (2000) and others stress the significance of culture and an emotional and aesthetic dimension to life, alongside choice in individual action. Beck emphasizes that the cultural construction of risk is not the whole truth. Risk and culture cannot be separated. 'Risk' and the '(public) definition of risk' are one and the same' (1999: 135). He moves from a notion of risks as dangers to risks as (social) expectations, which are necessarily socioculturally constructed. He explicitly opposes the separation of an realist and constructivist side of risk.

From the perspective of risk society and reflexive modernization, the fundamental social changes regarding risk and uncertainty are understood as the result of objective changes in the quality of risks as well as societal transformations. Governmentality studies, however, interpret this change in terms of a shift in strategies of power and domination.

From this perspective, risk is understood as a fundamental social construction referring to a specific social constitution, rather than a change in objective dangers.

Governmentality

Governmentality approaches draw on the path-breaking work of Foucault (1991). Following some early work (Burchell, Gordon, and Miller 1991) an increasing number of books and articles has been published, examining the phenomena of governance in a broad range of societal domains, such as the governance of childhood (Bell 1993; Brownlie 2001; Kelly 2001), crime (Garland 1997; Joyner 2001; O'Malley 2004), health and illness (Turner 1997; Joyce 2001; Brown and Michael 2002; Flynn 2002), and cyberspace (Loader 1997). For an overview, see Dean (1999). Foucault's work on societal governance contributes to the discourse on two levels: he provides an instrument to analyse power and domination in society and offers an historical analysis of how they were transformed during the development of the modern state. Central to Foucault's theorizing is the connection between governing ('*gouverner*') and mentality ('*mentalité*'), which is united in the term '*governmentality*'. It indicates his broad view regarding issues of power and domination, which are reduced neither to direct external impacts on the subject nor to the governmental practices of the state. It rather includes the construction of realities through practice *and* sense-making, encompassing the multitude of societal organizations and institutions producing social reality.

In his historical analysis of power and domination in societies from the mercantilist nation states in the seventeenth century to the modern capitalist state, Foucault identifies significant changes. Modern states developed new techniques for managing their populations and achieving national goals (Foucault 1977; see Dean 1999: 18–20). Instead of punishment and immediate external control directed at a specific ideal, the strategies refer ever more to populations and abstract categorization to assess national resources and assist planning. These were transformed into sophisticated systems of ordering, a whole rationality of government which saw its role as including the reviewing, planning, structuring, allocating, and regulating of its own population. Authorities developed the use of audit, judicial discipline, economic management and an apparatus of welfare, education, urban planning, and redistributive measures directed at enhanced security during the life course to achieve these ends.

The individual is no longer treated holistically but as a bearer of indicators which qualify his or her affiliation to one or another group (as 'at risk' or 'risky'). Specific 'safety strategies' were developed (most prominently, social insurance), which supplant the former class (or 'estate' in mercantile society) specific organizations. The friendly society, for example, represents the idea of a prudent and responsible working class. Class specific organizations were replaced with systems established by the state which refer to the family or individual rather than to class solidarity. Such historical transformations regarding societal self-constitution were first supported by the analyses of the circle of scholars around Foucault (e.g. Ewald 1986; Donzelot 1997).

Foucault also mentioned a far-reaching change within modern liberal states (Gordon 1991: 19f.). Neo-liberal power strategies change the relation between state and economy. Whilst in early liberalism the state was understood as controlling the liberty of the market, the market became the central regulatory principle of the state itself. Economics is no longer a domain with a specific rationality, laws, and instruments. Rather all human action became characterized by an economic rationality as far as the allocation of limited resources is concerned. The general principle of government is no longer the regulation of natural liberty, which has to be accepted. Instead it constitutes an artificial 'freedom' for economically rational individuals (Burchell 1993: 271; Rose 1996: 50–62; Lemke 2001).

This freedom is produced by linking 'power strategies' and 'technologies of the self' which indicates another important theoretical distinction introduced by Foucault. It allows systematic analysis of the link between the strategies which aim to determine individuals' behaviour directly (*power strategies*) and the ways in which individuals are empowered to manage their bodies, souls, and their way of life in order to attain such goals as perfection, happiness, purity, or exceptional power (*technologies of the self*). The dominant moral model of the liberal project is not the direct control of individuals, but rather the autonomous, self-responsible, prudent subject, weighing rationally the pros and cons of choices. In several societal domains, the governmentality approach shows how responsibility for societal risks such as illness, unemployment, and poverty is transferred to the collective and to individual subjects (individuals, families, clubs, and so on). It thereby becomes a problem of self-provision (see, for example, O'Malley 1996: 199–204; Rose 1996: 50–62; Dean 1999: 191–2).

Within this theoretical framework, risk and security are understood as central elements of power and domination and thus a strategy for

the government of societies. Risk does not result directly from objective facts, rather it represents a specific way in which aspects of reality can be conceptualized and rendered controllable. From this perspective the 'objective' decision-making approach of rational choice, mainly used in economics and psychology, is interpreted as a normative societal programme which is linked to the rise of neo-liberal styles of governmentality. The increasing amount of risk communication in society is therefore understood as the result of the growing influence of neo-liberal strategies of government.

One stream of research in the tradition of Foucault refers to François Ewald's work on the development of insurance as a core indicator of the transition to modernity. It stresses that insurance does more than distribute financial risks between insured parties. Insurance constitutes and spreads a moral idea of responsibility. The actor is released from responsibility for the insured event and the person affected entitled to compensation. Insurance also is part of a moral technology which defines correct behaviour. For example, compensation may be limited to motor accidents where the driver is sober.

Even though the theoretical instruments developed by Foucault open up a broad range of analysis, many governmentality studies focus narrowly on the level of national government. For example, Dean starts out from broad definitions ('the conduct of conduct'—1999: 10—embracing the 'government of the self', to include such personal activities as dieting and religious practice—17), but by the end of the book concentrates on 'historically delimited' authoritarian and neo-liberal forms of government (Chapters 7 and 8). In principle, however, the approach can include a cultural account of power at all levels.

Governmentality perspectives have also been criticized as over-reliant on a top-down functionalism that seeks to explain social developments in terms of the exigencies of government and other power-holding institutions, to see people as inherently open to manipulation and to contain an under-developed account of agency. The topic of agency emerges mainly through the notion of a generalized subject constructed by societal discourses. Individual possibilities for resistance are often underestimated (Lupton 1999). One direction for development links together the accounts of shifts at the level of political economy with detailed and nuanced analyses of individual behaviours and responses. Kemshall's work (2002) on young people and perceptions of risks in the context of a more flexible labour market or Hartley Dean (1999) on the changing responses to social security regulation are examples of this approach.

Some Lessons and Perspectives from Interdisciplinary Work on Risk and Uncertainty

All the approaches reviewed in this chapter contribute to the overall understanding of perceptions and responses to risk. The technical and rational calculation of risk is still applied successfully in domains where knowledge of the relevant risk and shared values about its status, priority, and management are available. Psychological approaches show how risk perception deviates from technical scientific rationality, and that it is subjectively constructed but is also influenced by factors such as gender, national culture, age, class, and ethnic group. This corresponds to the sociological insight that people perceive and respond to risks in the context of their sociocultural embeddedness, which is also constituted by other group affiliations, lifestyles, values, and identity constructions in general. Furthermore, people often apply diverse strategies as heuristics in order to simplify choice or to manage the decision-making load of everyday life. This is not best understood as a deviation from a superior, objective scientific rationality. Laypeople have specific knowledge and a perspective which draws on their experience of scientific expertise, but is also linked to local and everyday knowledge and their specific position in society. Our current concerns regarding risk and uncertainty are as much an effect of the evident limits of control by science and technology as they are an outcome of a cultural perspective which tends to interpret uncertainties as in principle controllable by rationality.

Overall, approaches which attempt to explain risk perception and responses only at the level of one of the social science disciplines contributing to work on risk seem inadequate. Nevertheless, the attempt to combine a range of theoretical approaches within the social amplification of risk framework encounters the problem of its limited predictive power. We have available a range of different instruments and methods. The absence of a homogenous approach may be seen as an advantage, enabling us to do justice to the multidimensional reality of risk and uncertainty in current society.

Some of those issues emerged in the very recent past and they still attract research engagement and feed into continuing controversies. The 'precautionary principle' (the idea that if the consequences of an action are unknown, but may have major or irreversible negative consequences, then it is better to avoid it) is promoted in order to manage irresolvable uncertainties and provide a way of deciding which risks we are willing to take. The controversy about the irrationality of public responses to risk

as against the development of scientific knowledge continues. In several research domains, there have been real improvements in knowledge in recent years. The link between the media and the public is seen as interactive and complex, rather than just top-down.

People do not generally and automatically place their trust in established institutions. Instead of following an overall objective rationality, people's perceptions and responses to risk are bound up with their cultural and social context. The factors influencing risk responses and their interaction and dynamic development are difficult to predict. In the process of decision-making, rationality as well as trust, emotion, competing perspectives, and the accumulation of risks are interwoven, and further research is needed in all these areas. Finally, discourse is often narrowed to the negative side of risk. The fact that people are willing to take risks in areas such as extreme sports and sexual activities also requires further considerations. In the next chapter we consider how these issues are being tackled in current research.

Notes

1. We explore the growing risk awareness and the erosion of traditional risks through the example of technical risks because of their significance for the development of risk research in general. The objective concept of risk was also questioned in relation to health and illness, crime, environmental issues, and several other domains mentioned in the thematic chapters of the book.
2. They are sometimes not allowed for ethical reasons, for example.
3. Compare the work on edgework and voluntary risk-taking (Lyng 2005).

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