2 Background to Risk Perception

This chapter gives a theoretical and empirical account of risk perception research. Definitions of risk and an introduction to the concept of risk perception are presented in chapter 2.1, followed by an overview of the underlying cognitive and affective processes that affect human perception and decision making (2.2). The subsequent section 2.3 presents the theoretical approaches that have been developed in order to understand differences in risk perception between individuals and groups of individuals, and chapter 2.4 gives a detailed overview of the empirical evidence related to the factors that determine individual differences in the perception of risks.

2.1 The Concept of Risk and Risk Perception

Starting off with a brief introduction to the different conceptualizations of risk (2.1.1), the concept of risk perception and how it has evolved during the last few decades is presented in chapter 2.1.2.

2.1.1 The Concept of Risk

‘Risk’ is conceptualized in many different ways across research disciplines. However, most risk concepts are based on the distinction between ‘reality’ and ‘possibility’. ‘Reality’ is related to adverse effects and its consequences and ‘possibility’ refers to the probability of adverse effects (Kogan and Wallach, 1964; Rayner and Cantor, 1987).

This probabilistic viewpoint dates back to Frank Knight (1921), who proposed a distinction between risk and uncertainty. Knight (1921) conceptualized
risk as a measurable probability and uncertainty as a situation with lack of probabilistic information (LeRoy and Singell, 1987). According to Cunningham (1967), consumer decisions are in general decisions under uncertainty as they lack information about exact probabilities. Probabilistic thinking only gained importance when it was introduced in the debates around nuclear reactor safety in the sixties by Farmer (1967) and Starr (1969). Before, risk was mostly described in terms of (a) kind and (b) magnitude of damage following a deterministic approach to risk (Banse and Bechmann, 1998). Approaches solely based on this two-dimensional risk conceptualization are called formal-normative risk concepts that dominated early risk research and were introduced by the seminal work of Chauncey Starr (1969). Starr (1969) widened the approach to include technological risks.

The introduction of ‘probability’ led to a differentiation between ‘risk’ and ‘hazards’. ‘Hazard’ is mostly described in terms of the source of an adverse effect and ‘risk’ refers to the possibility and probability of an adverse effect (Kaplan and Garrick, 1981). Whereas hazard is supposed to have an external cause, risk is internally produced by the acts and omissions of individuals (Ulbig, Hertel and Böl, 2010). In a similar way, the sociologist Niklas Luhmann differentiated between ‘danger’ and ‘risk’. Whereas ‘danger’ is attributed to an external cause, ‘risk’ is produced inherently in the system itself (Luhmann, 1993). However, for Luhmann ‘risk’ is not necessarily related to the behavior of an individual, but the concept of risk entails a distinction between ‘decision makers’ (those who take risks) and those who are affected by the decisions of others (Japp and Kusche, 2008). Furthermore, the concept of ‘probability’ entails aspects of insecurity and uncertainty that are strongly linked to risk (Schütz et al., 2003). Taking ‘uncertainty’ into account, Rosa (2003: 56) defines risk as “a situation or event where something of human value (including humans themselves) is at stake and where the outcome is uncertain.”

In addition to probabilistic approaches to risk, other conceptualizations of risk follow a contextualist approach (Thompson and Dean, 1996). The contextualist viewpoint treats probabilities as only one attribute among many others and focuses on the meaning of hazards for individuals and groups. For Mary Douglas (1990) risk, is, in addition to probability, determined by the meaning and value that is given to the outcome and consequences that depend on political, aesthetic and moral viewpoints. Accordingly, risk is associated with several risk characteristics such as familiarity or personal danger. Hence, the probability of occurrence is only one, albeit important, risk attribute among several others (Jackson, Allum and Gaskell, 2006; Thompson and Dean, 1996).

In addition to the probabilistic versus contextualist conceptualization of risk, a further helpful classification is built by Zinn (2008a). He classifies risk
definitions and the related theoretical approaches on a continuum from whether risk is regarded as having an objective existence to being socially mediated/constructed independent of its objective existence. Approaches that presuppose the objective existence of risks regard risk as real dangers. These objective dangers either exist independently of social factors or are subjectively perceived by individuals. Other approaches assume that real dangers are socially transformed into risks for the organization of society or that the subjective experience of a real danger is mediated by social factors. In addition, approaches that follow a constructivist view deny the existence of any objective risk and conceptualize it as a result of social processes.

Beck (1986; 1992) distinguishes three different kinds of risks according to time era: in pre-industrial societies, risks were conceptualized as hazards and regarded as coming from external forces such as gods or demons. In classical industrial society, the notion of hazards changed to the notion of risks that are taken voluntarily such as smoking and that can be calculated. Today, in what Beck (1986; 1992) calls ‘risk society’, risks are “man-made side effects of modernization”. He characterizes these new risks as techno-scientifically produced risks that, compared to earlier risks, cannot be managed with the established scientific control strategies. New risks cannot be limited in time or place, questions of causality and liability are in general unanswerable, and thus compensation and insurance against these new risks is not possible (Banse and Bechmann, 1998; Beck, 1986; 1992; Zinn, 2008b). Thus, today’s decisions are to an increasing extent decisions that have a probable but uncertain impact in the future (Banse and Bechmann, 1998). Linked to that, many decisions in our modern times are decisions under uncertainty as already claimed in the definition by Rosa (2003).

2.1.2 The Concept of Risk Perception

Research into risk perception in the 1960s draws on the discussion around the evaluation and acceptance of man-made technical risks that are automatically linked to decision making processes (see above: Luhmann, 1993). Thus, cognitive processes that determine perception and evaluation of risks are central aspects of ‘modern’ risk research (Banse and Bechmann, 1998). Research into risk perception is used synonymously for assessment and evaluation. It does not refer to selection processes that play a role when human beings process information that they receive from the environment.
perception was inspired by the observation that experts and lay people often differ in their judgment about how risky hazards are. While experts were assumed to base their risk assessment on the analysis of probabilities, it has been found that lay people judge risks using manifold attributes. Findings in cognitive psychology by Tversky and Kahneman (1974) were critical for research into risk perception. They showed that people face cognitive limitations in dealing with probabilities and therefore deviate from the assumed rational behavior. They further found that people use a “limited number of heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations” (Tversky and Kahneman, 1974: 35).

Out of the assumed differences in risk assessment between experts and lay people arose the distinction between objective risks and subjective risks, with the idea that experts are the representatives of objectivity and lay people have to be supported for example with information to judge risks more realistically. Objective risk perception is the result of e.g. calculating probability distributions such as the probability of being killed in a plane crash, while subjective risk refers to the experiences and perceptions of individuals and thus the meaning of that risk for the individual person (Oltedal et al., 2004).

Whereas the distinction between subjective and objective risks is still made by researchers following a positivist philosophical belief, researchers following a relativist view deny the existence of any objective risks, arguing that risk is always a subjective and thus relative concept (Mitchell, 1999). For most sociologists, risk perception is a social and cultural construction process that reflects and is determined by values, symbols and ideology (Bøholm, 1998; Sjöberg, 2000b; Sjöberg, Moen and Rundmo, 2004). Independently of this philosophical orientation, research into risk perception is interested in people’s subjective judgments and is trying to find out why people differ in their risk assessments (Slovic, 1987).

2.2 Cognitive and Affective Processes in Risk Perception

As the decision-making process itself is not observable, models of consumer behavior generally talk of a so-called Black Box where affect and cognition interact in influencing human behavior. Cognitions and affect also influence people’s assessments of risks. Affects and cognitions are produced by the affective and cognitive system where each of them can react independently to stimuli of the environment, but the two systems are strongly interconnected and influence each other most of the time (Bänsch, 2002; Kroeber-Riel, Weinberg and
Gröppel-Klein, 2009). Organization and working of the cognitive and affective system is first introduced in 2.2.1, before the importance of cognitive and affective processes for consumers’ perception of risk is outlined in 2.2.2.

2.2.1 Cognitions and Affect Influencing Decision Making

Dual-process theories of thinking distinguish two different modes by which information is processed (Chaiken, 1980; Chaiken and Trope, 1999; Epstein, 1994; Petty and Cacioppo, 1984; Sloman, 1996): a ‘deliberative’ and an ‘experiential’ style of reasoning. The ‘deliberative’, also called ‘rule-based’ processing (Sloman, 1996), is an analytical, formal and verbal style of thinking (see e.g. Epstein, 1994). It is a relatively controlled form of information processing and refers to the conscious, cognitive processing of information. The ‘experiential’ style of processing, also known as ‘associative’ processing (Sloman, 1996), is characterized as intuitive, automatic, natural, and nonverbal. In contrast to the ‘deliberative’ system of thinking that is based on conscious logic, the ‘experiential’ system is supposed to operate according to the principle of similarity and context and is thus quicker and more efficient (Sloman, 1996). According to the principle of similarity, the strength of activation from one concept to another depends on the similarity or strength of association between the concepts. Thus, the stronger the association between two concepts, the more activation is supposed to flow between the concepts. This activation is further dependent on situational context factors (Loewenstein et al., 2001). The ‘experiential’ system further encodes reality in the form of images, narratives and metaphors to which affect is attached. The ‘deliberative’ system results rather in cognitive processing, whereas the ‘experiential’ system results in an affective processing of information.

2.2.1.1 Cognitive Processes and Cognitive Structures

Peter and Olson (2010) define cognition as the thoughts and beliefs produced by the cognitive system (cognitive structures) and all mental processes (cognitive processes) performed by the cognitive system including understanding (interpretation of meanings of stimuli), evaluating (judging a stimuli as positive or negative), planning (developing solutions in order to reach a goal or solve problems),
deciding (choice of the best solutions among alternatives) and thinking (cognitive activity necessary for the four processes).

According to approaches in cognitive psychology, human behavior is the result of an interaction between cognitive structures and cognitive processes (Grunert and Grunert, 1995; Peter and Olson, 2010). Consumers are exposed to information in their environment that is then processed by their cognitive system – the interacting cognitive structures and processes – and in turn influence consumers’ decisions and behavior (Kroeber-Riel, Weinberg and Gröppel-Klein 2009; Peter and Olson, 2010). Cognitive structures or so-called knowledge structures define the already memorized knowledge that is the result of past experiences and past information. They are a representation of consumers’ beliefs, values but also feelings (Grunert and Grunert, 1995, Kroeber-Riel, Weinberg and Gröppel-Klein, 2009; Olson and Reynolds, 1983). These knowledge structures are stored in long-term memory (LTM) and are called schemata. Schemata organize knowledge and canalize the perception and processing of information. They are linked with verbal and visual concepts in memory and can be applied to persons (schemata regarding another person or self-schemata), issues and events (Kroeber-Riel, Weinberg and Gröppel-Klein, 2009; Trommsdorff and Teichert, 2011). Cognitive structures strongly influence how people process new information (Olson and Reynolds, 1983). This processing of new information comprises processes through which information is perceived, processed and stored (Kuß and Tomczak, 2007). Cognitive processes change existing cognitive structures as a consequence of new information from the environment. Furthermore, cognitive processes retrieve information from cognitive structures in order to perceive and process new information (Grunert and Grunert, 1995). Thus, consumer decision-making behavior is the result of current, external information and of stored, internal information (memory) (Kuß and Tomczak, 2007).

Figure 1 details the functioning of cognitive processes and the role that cognitive structures play. It is based on the model of human memory by Atkinson and Shiffrin (1968) and describes the interaction between the key components of human’s cognitive system and the processes within (Trommsdorff and Teichert, 2011): the ultra-short-term memory (USTM), the short-term memory (STM) and the long-term memory (LTM). The USTM receives external stimuli, e.g. visual and acoustic stimuli, and stores them for a very short time. By means of selection processes, also called perception, only a part of this information is transferred to the STM. This selection is part of the automatic cognitive processes that are unconscious and is influenced by the cognitive structures of the LTM (Kroeber-Riel, Weinberg and Gröppel-Klein, 2009; Trommsdorff and Teichert, 2011). The STM is the most active part of the cognitive system and works as its processor: it temporarily stores and processes current information (Keller, 1993).
The processes of the STM are part of the strategic cognitive processes and are conscious for humans. These processes refer to mental activities necessary for problem-solving tasks such as the interpretation of stimuli or combination of information in new ways in order to make evaluations and take decisions (Grunert and Grunert, 1995; Schneider and Shiffrin, 1977). By means of cognitive and behavioral processes, part of the processed information is transferred to the LTM, which is defined to be a subcomponent of human memory with an unlimited storage capacity (Dacin and Mitchell, 1986). The LTM is an active network that presents the knowledge structures (cognitive structures) (Kroeber-Riel, Weinberg and Gröppel-Klein, 2009) formed due to past experiences and past information.

*Figure 1: Model of Consumer Information Processing*

Source: Adapted from Trommsdorff and Teichert (2011)^3^.

^3^ The model of consumer information processing is based on the human memory system by Atkinson and Shiffrin (1968).
Information from the LTM is retrieved (recall) and used to process new information (Marks and Olson, 1981) as it provides rules and heuristics that guide people’s information processing in the STM and USTM (Grebitus, 2008; Wilkie and Farris, 1976). Also cognitive processes such as risk perception/evaluation are influenced by knowledge that is stored in the LTM (Slovic, 1987).

According to Kuß and Tomczak (2007), knowledge is defined as the information that is stored in memory and that can be retrieved. Two types of knowledge are usually distinguished: procedural and declarative knowledge (Squire, 1987; Trommsdorff and Teichert, 2011). Procedural knowledge contains scripts and skills, the knowledge how to do things, such as riding a bicycle or skiing (Anderson, 2007). This knowledge is unconscious and cannot be verbalized (Trommsdorff and Teichert, 2011). Declarative knowledge is formed by all kinds of stored information about the environment – facts, situations, objects, and causalities etc. It is thus factual and conscious knowledge and can be verbalized (Anderson, 2007). It comprises categories, concepts and associative networks (Brunsø, Scholderer and Grunert, 2004). Declarative knowledge is further subdivided into episodic and semantic knowledge. Episodic knowledge refers to a person’s experiences and is mainly stored in the form of pictures. Semantic knowledge on the other hand is mainly stored in the form of words and refers to factual knowledge, meanings of words, rules of interpretation and analytical rules for solving problems (Kuß and Tomczak, 2007; Trommsdorff and Teichert, 2011). Semantic knowledge plays an important role in the formation of cognitive structures; due to its structured organization, it can be retrieved relatively fast (Anderson, 2007). Knowledge is assumed to be encoded and stored in LTM in the form of organized structures (knowledge structures) or semantic networks (Grebitus, 2008; Kroeber-Riel, Weinberg and Gröppel-Klein, 2009).

2.2.1.2 Affective Processes

Recent research into human decision making is increasingly interested in the impact of affect (Clore, Schwarz and Conway, 1994; Loewenstein et al., 2001; Zajonc, 1980). According to several authors, affect can be defined as a state of feeling that human beings experience such as ‘sadness’ or ‘happiness’ and is often also related to feelings of ‘goodness’ or ‘badness’ with regard to an external stimulus (Finucane et al., 2000a; Peters, Burraston and Mertz, 2004; Peter and Olson, 2010; Slovic and Peters, 2006). Affective responses are often linked to bodily reactions, e.g. increased heart rate or tears, and vary in terms of intensity. Peter and Olson (2010) distinguish four different types of affect that differ in
terms of strength and physical reaction: emotions such as joy, fear or love are linked to intense bodily reactions and are very strong affective responses. Specific feelings such as disgust and sadness are linked to somewhat weaker physical reactions and are somewhat less intensive than emotions. Besides, moods such as boredom are rather diffuse affective responses that are not directed to a specific object or issue. Finally, evaluations such as liking and goodness are linked to the lowest level of bodily response and felt intensity (Kroeber-Riel, 1979; Peter and Olson, 2010). Moreover, in the empirical literature, the term affect is often used as a bipolar item contrasting positive and negative evaluation of an object or situation (Sjöberg, 2007).

Research into the influence of affective responses on judgment and decision making can be distinguished according to whether one is focusing on ‘anticipatory’ or ‘anticipated’ emotions (Loewenstein et al., 2001). Decision making research is interested in the effect of ‘anticipated’ or expected emotions. ‘Anticipated’ emotions are not experienced in the immediate situation, but it is assumed that during the process of decision-making, people anticipate how they would feel in different outcome situations, which constitutes an additional factor influencing decisions. With ‘anticipated’ emotions, the process of decision-making is still viewed as a mainly cognitive one (Loewenstein et al., 2001; Zinn, 2006a). Neuroscience and social psychology have mainly focused on the role of ‘anticipatory’ emotions by examining how immediate emotions (immediate visceral reaction in the decision-making situation) influence human decision-making. Lerner and Keltner (2000) further make a distinction between ‘integral’ and ‘incidental’ affect. Studies focusing on ‘integral’ affect analyze the impact of emotions that are related and relevant to the object of decision-making. ‘Incidental’ affect refers to emotions that are experienced during decision-making and that sometimes have an impact on judgment and choice even though these emotions are not linked to the object on which decisions are taken.

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4 Damasio (1994) proposes a different classification. He distinguishes between (1) basic universal emotions such as happiness and anger, (2) subtle universal emotions such as jealousy and embarrassment and (3) background emotions such as wellbeing and fatigue. For Damasio (1994) ‘feeling’ is the experience of emotion.
There exist several hypotheses about the interplay between cognitions and emotions, and their order and influence on judgment and choice. Those will be discussed in the following.

Stimulus $\rightarrow$ cognitions $\rightarrow$ affective responses $\rightarrow$ decision-making

Some researchers assume that people first cognitively evaluate a stimulus. This cognitive evaluation results in affective responses that directly influence human judgment and decision making. In other words, it is assumed that the effect of cognitions on decision making is mediated by affective reactions (Cottle and Klineberg, 1974; Damasio, 1994; Loewenstein et al., 2001). According to the ‘somatic marker’ hypothesis by Damasio (1994), emotions are the result of images related to the expected consequences or decision making outcomes. Due to past experiences these images are ‘marked’ by positive or negative feelings that are further linked to somatic states. Positive ‘somatic markers’ are likely to result in a positive evaluation of the outcome consequences, whereas negative ‘somatic markers’ are likely to lead to negative evaluations. These ‘anticipatory’ emotions linked to images of outcomes and consequences were found to guide people’s judgment in an accurate and efficient way (Damasio, 1994) as they present a kind of summary of the likely consequences (Loewenstein et al., 2001). Studies supporting the ‘affect-as-information’ hypothesis found that affect can have a direct influence on decision-making outcome. When feelings during a decision-making process are perceived as relevant to the decision-making task by the person (referred to above as ‘integral affect’ according to Lerner and Keltner, 2000), then these feelings have an impact on the person’s choice (Clore, Schwarz and Conway, 1994; Loewenstein et al., 2001).

Stimulus $\rightarrow$ affective responses $\rightarrow$ decision-making

In addition to the ‘stimulus $\rightarrow$ cognitive $\rightarrow$ affective’ path, affective reactions can also be a direct answer to a stimulus. Zajonc (1980) argues that people can emotionally react to a stimulus without being aware of the stimulus. For Zajonc affective responses are the first and automatic reactions to a stimulus that further
An Investigation of Women's and Men's Perceptions and Meanings Associated with Food Risks
Bieberstein, A.
2014, XVI, 317 p. 15 illus., Softcover
ISBN: 978-3-658-03274-6