To be or not to be at risk:  
Reactions to blood pressure and cholesterol feedback  
in a South Korean sample  
by  
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Abstract

The present dissertation aims at exploring the reception of individual health risk feedback in a South Korean sample. It is based on data from two community-based blood pressure and cholesterol screenings conducted within the project Risk Appraisal Consequences in Korea (RACK). Elevated blood pressure and cholesterol levels are risk factors for cardiovascular disease, which is the leading cause of death globally (WHO, 2004) and an issue of concern in both Eastern and Western societies.

The reception of individual health risk feedback, such as information about one’s blood pressure and cholesterol levels, has mostly been studied from a researcher-oriented approach. Often, single cognitive reactions pre-selected by the researcher were examined, with perceived test accuracy being a particularly popular example. In the present thesis (Studies 1 and 2), this view is contrasted with a more recipient-oriented approach, in which recipients of health risk feedback are free to express any type of reaction they wish. This approach can provide more information on the full array of spontaneous reactions, on the relevance of various reactions to feedback recipients, and on the interplay of reactions (cf. Chapter 1.2.1). After identifying which reactions seem relevant to feedback recipients, a more detailed examination of one of them is provided from a more traditional researcher-oriented approach, namely of hindsight on pre-feedback expectations (Study 3).

The aim of Study 1 was to explore array and base rates of spontaneous reactions towards individual health risk feedback, analyzing thoughts listed immediately after feedback reception \((n = 629)\). A system was developed to code thoughts on eight reaction dimensions: emotions, risk feedback valence, feedback expectedness, future lifestyle, attributions, implications for health, need for information, and acceptance. The coding system proved to be reliable and comprehensive. The first four reaction dimensions were generated most frequently, both across different threat levels (low, borderline high, high risk) and across different types of risk feedback (cholesterol, blood pressure). Importantly, three out of the four most often generated types of reactions (emotions, expectedness, and future lifestyle) are comparably underrepresented in previous research. Moreover, consideration of feedback valence, expectedness, and future lifestyle point towards the adaptivity of reactions towards self-relevant health risk feedback.
Study 2 is based on thought-listing data from a second screening \((n = 423)\) and aimed at exploring array, base rates, and co-occurrences of spontaneous reactions on a more specific level, applying a network perspective. Network nodes represent reaction types (e.g., emotions), node segments sub-types (e.g., positive vs. negative emotions), and node sizes reaction type frequencies. Network paths depict joint mentions of pairs of reaction types. Results show that emotions, risk feedback valence, feedback expectedness, and future lifestyle form large and well-connected nodes in a network of reactions towards individual health risk feedback. Study 2 also aimed at using the network for identifying reaction patterns of varying adaptivity. Results indicate that reaction patterns in accordance with the valence of the feedback were predominant after both positive and negative feedback. Thus, reaction patterns appear largely adaptive. The network is a potentially useful tool for research and practice, highlighting previously neglected relevant reactions, and providing a group-level background against which individual reactions can be evaluated.

Study 3 explored hindsight bias following self-relevant feedback in an Asian sample for the first time. Participants \((n = 811)\) provided foresight estimates before receiving positive or negative feedback about their actual cholesterol level. Afterwards, hindsight estimates and resultant surprise were assessed via questionnaire items. Overall, hindsight bias was found, with higher levels of bias and marginally lower levels of resultant surprise after unexpected positive compared with unexpected negative feedback. Those who displayed the bias reported lower levels of resultant surprise than those whose hindsight estimates were accurate. Thus, hindsight bias can occur in Eastern samples after self-relevant outcomes, and feedback valence and surprise appear to play similar roles as in Western samples. Implications regarding the presence of motivational processes and the potential generalizability of models of hindsight bias developed in the West towards Eastern samples are discussed.

Overall, the present thesis demonstrates benefits of complementing a traditional researcher-oriented with a more recipient-oriented approach (cf. Chapter 5.2.1). It also provides some evidence for the adaptivity of reactions towards individual health risk feedback, thus contributing to the debate about distortion and adaptivity in this field (cf. Chapter 5.2.2). Moreover, tentative conclusions regarding the applicability of models of hindsight bias developed in the West in Eastern samples are drawn (cf. Chapter 5.2.3).
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1 Introduction

1.1 On the relevance of researching reactions to blood pressure and cholesterol risk feedback

1.1.1 Cardiovascular disease

Cardiovascular disease (CVD) is the leading cause of death globally (World Health Organization [WHO], 2004). In the near future, the number of deaths from CVD is expected to keep rising, from 17.1 million deaths in 2004 to 23.4 million in 2030 (WHO, 2008). CVD is not a single disease, but an umbrella term for a variety of diseases related to the heart and circulation of the blood, such as coronary heart disease or stroke (WHO, 2004). A large number of factors have been found to contribute to the onset of CVD (WHO, 2002, 2004). The presence of any of these risk factors does not mean that the affected individual will necessarily contract CVD, but it does indicate an increased probability of getting CVD in the future (WHO, 2002).

Two important risk factors for CVD are elevated blood pressure and cholesterol levels (WHO, 2004). Blood pressure is „a measure of the force that the circulating blood exerts on the walls of the main arteries“ (WHO, 2002, p. 57). A blood pressure reading consists of two measurements: A higher, systolic one is taken as the heart contracts, and a lower, diastolic one is taken as the heart fills (WHO, 2002). High blood pressure (hypertension) is defined as a systolic blood pressure above 140 mmHg, or a diastolic blood pressure above 90 mmHg (WHO, 2004). Cholesterol is a lipid which is transported within the body in low-density lipoprotein (LDL) and high-density lipoprotein (HDL, WHO, 2004). While cholesterol serves important functions (WHO, 2002, 2004), high total cholesterol and high LDL levels can increase a person’s risk for cardiovascular disease by contributing to the formation of plaques on the artery walls which in turn contribute to atherosclerosis (WHO,
Cholesterol levels are measured in the blood, and total cholesterol levels of less than 200 mg/dl are deemed optimal by the American Heart Association (2002), while levels of 200 to 239 mg/dl are considered borderline high, and levels of 240 mg/dl or more are deemed high.

Both elevated blood pressure and cholesterol levels have been established as risk factors for CVD by a large body of research. The Framingham Study, for example, examined the development of CVD in more than 5000 North American participants over the course of 50 years, starting in 1948, and adding new cohorts over the years. Participants had not suffered from symptoms related to CVD at the onset of the study. Elevated blood pressure (e.g., Kannel, 2000; Kannel, Vasan, & Levy, 2003; Vasan et al., 2001) and cholesterol levels (e.g., Lloyd-Jones et al., 2003) were found to contribute to a person’s risk of various diseases related to the heart and circulation of the blood in the course of the study. Both elevated blood pressure and cholesterol levels are intermediary risk factors for CVD, meaning that they are, in turn, influenced by other – frequently modifiable – risk factors such as tobacco use, physical inactivity, alcohol consumption, or obesity (WHO, 2004).

Cardiovascular disease is not only a problem of Western societies, but an issue of interest for many countries around the world (WHO, 2004, 2008). In South Korea, there has been an increase in noncommunicable diseases and in deaths from these diseases since the beginning of the 1980s (WHO, 2007). A rise in heart diseases in particular has made them the third leading cause of death in South Korea in 2005, accounting for 8% of deaths (WHO, 2007). Both hypertension and elevated cholesterol levels have been established as risk factors for CVD in Asia Pacific countries (Asia Pacific Cohort Studies Collaboration [APCSC], 2002, 2003, 2005, 2007a). The likelihood of getting CVD therefore seems to increase with similar risk factors in Asia Pacific countries as in Western societies, so that these factors contribute to the prediction of cardiovascular risk similarly in East and West (APCSC, 2007b).
Korea, the mean population blood pressure is 120/78 mmHg, and the mean cholesterol level is 187 mg/dl (Kang et al., 2006). Despite the fact that these mean values lie within the optimal range, hypertension had an incidence rate of 28% in 2005, and it ranked among the top 10 causes of death at the same time (WHO, 2007). While no similarly official data on the incidence of elevated cholesterol levels in the overall population are reported, large-scale studies found cholesterol levels exceeding 200 mg/dl in 35% to 45% of their adult South Korean samples (Choi, Song, & Sung, 2007; Kim, Suh, & Choi, 2004; Suh et al., 2001). Elevated blood pressure and cholesterol levels are therefore a concern for public health in South Korea.

1.1.2 Learning about individual health risks

Information on individual risk for CVD via cholesterol and blood pressure feedback can be viewed as just one example of learning about individual health risks, making the results from studying this topic potentially interesting for researchers in the larger field of health risk feedback reception. Persons were rarely confronted with individual health risk feedback before World War II, after which extensive screening programs were introduced in various countries, contributing to a rise of surveillance medicine (Armstrong, 1995). Treating the sick was no longer the sole interest, as attention was drawn to monitoring the healthy. Medicine started to focus on health risks, exploring factors contributing to later illness, many of them related to lifestyle (Armstrong, 1995). With advancing technologies, two types of health screenings became available: Screenings „to detect early asymptomatic signs of disease in order to treat“, and risk factor screenings (Morrison & Bennett, 2006, p. 100). In the course of the latter, individuals were no longer confronted with explicit medical diagnoses, but gained access to information about their personal health risks. While surveillance medicine has a history of more than 50 years, three more recent developments imply that the question how individuals react to health risk information has not lost its importance, but may in fact be gaining relevance.
Firstly, it is possible, and sometimes easy, to learn about one's health risks in the absence of medical professionals. The United States Food and Drug Administration's in vitro over-the-counter database, for example, lists more than 500 tests that are available for purchase without prescription in the United States, such as cholesterol tests and fecal occult blood tests whose results can point to an elevated risk of colon cancer (U.S. FDA, 2008). To obtain these tests, it is not even always necessary to visit a pharmacy, as many of them can be purchased online at shops such as drugstore.com. Thus, the recipients of the results of these tests may initially be alone with the results and with any emotions or thoughts they may experience in response to learning about their risks.

Secondly, it is not always necessary to take physiological measurements to learn about one's health risks. It is possible to obtain individual health risk feedback by simply filling in a questionnaire on the Internet. These may vary greatly in quality: On one end of the spectrum, there are short quizzes on popular health-focused websites that might simply ask a few questions about the presence of risk factors such as family history of a disease, while not claiming to give medically sound advice. On the other end there are, however, scientifically backed health risk appraisal instruments such as those at http://www.yourdiseaserisk.wustl.edu, a site where one can test for risk for 12 types of cancer, diabetes, heart disease, stroke, and osteoporosis. Some tests require the participant to enter measures such as height, weight, body mass index, blood pressure, or cholesterol levels. It is up to the participant to obtain reliable and valid measurements of these. Others provide the participant with a risk estimate in the absence of physiological data. Again, the recipient is left alone with the results of these tests, and with any uncertainties she or he might experience.

Thirdly, the range of tests and conditions for which they test is expanding. For example, tests for the early detection of lung cancer (cf. Boffey, 2008) and self-tests for prostate cancer (cf. Kolata, 2008) have recently been discussed. Additionally, genetic
tests have become available, such as tests for carrying Huntington’s disease, the risks of “catastrophically high cholesterol”, breast, colon, and thyroid cancer (National Cancer Institute, 2006). The range of genetic tests is expanding (cf. Pear, 2008), and the addition of genetic tests is posing new problems and questions for research and practice (cf. Patenaude & Collins, 2004).

Given the abundant possibilities for obtaining individual health risk feedback in a variety of settings, the question of how individuals react to such feedback is of great importance. Feedback is usually provided with the rationale that it can function as an early warning: It is intended to provide the basis for recipients to take action (cf. Morrison & Bennett, 2006), e.g. by changing their health behavior or by monitoring their condition more closely than usual, which in turn can help reduce risks and may ultimately prevent disease. Whether the provision of health risk feedback can succeed in this goal depends, however, greatly on the processing of the feedback by its recipients. There is thus a need for empirical studies of the processing of health risk feedback. In fact, a number of studies have explored this topic, using a variety of operationalizations for feedback reception, and approaching this topic from different theoretical perspectives. The perspectives most relevant to the present thesis are outlined in the following chapter.

1.2 Perspectives on the reception of individual health risk feedback

1.2.1 Towards a recipient-oriented approach regarding the reception of individual health risk feedback

The reception of individual health risk feedback has so far typically been studied from a researcher-oriented approach. Following this approach, the researcher decides which reactions should be included in a given study. So far, this has led to a focus on
cognitive reactions, in particular acceptance-related ones such as perceived test accuracy (assessed e.g. by Croyle & Sande, 1988; Croyle, Sun, & Louie, 1993; De Hoog, Stroebe, & De Wit, 2005; Ditto, Jemmott, & Darley, 1988; Ditto & Lopez, 1992; Ditto, Munro, Apanovitch, Scepanisky, & Lockhart, 2003; Ditto, Scepanisky, Munro, Apanovitch, & Lockhart, 1998; Hadjistravopoulos, Craig, & Hadjistravopoulos, 1998; Lipkus, McBride, Pollak, Lyna, & Bepler, 2004; Michie et al., 2002; Renner, 2004a) or implications such as threat to future health (e.g., Croyle et al., 1993; De Hoog et al., 2005; Ditto & Jemmott, 1989; Ditto et al., 1988; Ditto & Lopez, 1992; Renner, 2004a). Furthermore, the selected reactions were usually assessed by closed questionnaire items. Each item typically assessed the intensity of one pre-selected reaction (e.g., “How confident are you that this test result is an accurate indication of your actual [...] status?”, Ditto et al., 1998, p. 63) on a Likert-type rating scale. Analysis of the results from these studies was usually conducted reaction by reaction, i.e. each reaction – often, each item even – was analyzed separately from other reactions. While research conducted in the tradition of this approach has greatly improved our understanding of the reception of individual health risk feedback, the approach has some limitations (cf. Weiner, 1985, for a similar debate in attribution research). It does not yield much information on the full array of spontaneous reactions, nor on the types of reactions that are relevant to the feedback recipients themselves. It also focuses on one reaction at a time, yielding little information on the interplay of multiple reactions.

Recently, some research on screenings, risk, or illness perceptions began to depart to a degree from a strict researcher-oriented approach by employing open instead of closed questions within semi-structured interviews (e.g., Boeije & Janssens, 2004; Gooding et al., 2006; Kahn et al., 2007; Senior, Smith, Michie, & Marteau, 2002; Smith, Michie, Stephensson, & Quarrell, 2002) or focus groups (e.g., Goldman et al., 2006; Schapira, Nattinger, & McHorney, 2001). While the use of an open response format allows for a greater variety of responses, the questions typically still addressed
specific researcher-selected topics, as for example severity or anticipated shame in the context of HPV and Pap tests (Kahn et al., 2007), and sample sizes were typically small. Compared with open, but thematically specific questions, thought listing tasks (Cacioppo & Petty, 1981) allow for capturing an even broader array of responses. They are also more economical in use, and therefore permit the use of larger samples. Thought listing tasks have recently been used to study responses to risk communication (e.g., Das, De Wit, & Stroebe, 2003; De Hooge et al., 2005), but analysis of the thoughts listed was focused on the number of thoughts and their valence (e.g., positive vs. negative thoughts), whereas thought content has, to the best of my knowledge, not been closely examined.

In the present thesis, a stricter recipient-oriented approach is put forward, based on thought listing tasks. Following this approach, the recipients of individual health risk feedback are free to express any kind of reaction without being limited by a pre-selection through the researcher. Thus, it is possible to determine which reactions are important to recipients of health risk feedback, and to examine whether they are the same ones as usually studied. Compared with the researcher-oriented approach, analysis of the responses will yield less information about the intensity of any given reaction, but can provide more information about the quality of reactions, i.e., for example the type of reactions expressed and their array. Following a recipient-oriented approach, analysis need moreover not be reaction by reaction; instead, multiple reactions can be analyzed simultaneously in order to get a fuller picture of patterns of reactions to individual health risk feedback. Studies 1 (Panzer & Renner, 2008) and 2 (Panzer & Renner, 2009) of the present thesis followed this recipient-oriented approach with the overarching aim of exploring spontaneous reactions to individual health risk feedback. By pursuing a recipient-oriented approach, these two studies should allow for (1) classifying spontaneous reactions to individual health risk feedback, (2) identifying reactions which appear particularly relevant to feedback
recipients themselves, and (3) developing a network of reactions towards individual health risk feedback which depicts various reaction characteristics (for a more detailed description of study aims, please see Section 1.3 and Chapters 2 and 3).

1.2.2 Reactions towards individual health risk feedback: A debate about distortion and adaptivity

Results from the researcher-oriented studies on the reception of individual health risk feedback have been frequently interpreted in light of motivated reasoning (MR). One of the core assumptions of MR (e.g., Kunda, 1990; cf. Croyle et al., 2006 for a recent study, cf. Croyle, Sun, & Hart, 1997 for an overview of earlier health-risk-related studies) is a motivation to achieve and maintain a positive self-view to the degree of an illusion (Kunda, 1990). It is further assumed that such a view may foster mental (Taylor & Brown, 1988, 1994; Taylor, Lerner, Sherman, Sage, & McDowell, 2003; but see also Colvin & Block, 1994) and possibly even physical health (Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000; Taylor et al., 2003). Negative feedback about one's health risks can be seen as a threat to a person's positive self-view. It is therefore assumed to be distorted and devalued to some degree (Taylor, 1991), for example by downplaying or minimizing its validity or the severity of its consequences. Recipients of negative health risk information have in fact been found to rate the related disease as less serious and threatening and the test indicating the presence of a risk as less accurate than recipients of positive health risk information (e.g., Ditto et al., 1988; Jemmott, Ditto, & Croyle, 1986). A large array of research has been conducted in the tradition of MR (e.g, Ditto et al., 1988; cf. also Croyle et al., 2006; Eisenstadt & Leippe, 1994; Wiebe & Korbel, 2003). Overall, this approach suggests that feedback valence is a crucial determinant of health risk feedback reception, and its focus lies on the distortion of self-threatening feedback.

Despite its popularity, the MR approach has some limitations (cf. Ditto & Lopez, 1992; Ditto et al., 1998; Ditto et al., 2003; Renner, 2004a, 2004b). A first critical
issue is the lack of an objective criterion for determining the limits of distortion. Negative feedback is supposed to be distorted only to a degree – to which the distorted perception is still justifiable to others (Kunda, 1990), or to which an illusion of objectivity can still be held up (Pyszczynski & Greenberg, 1987). Distortion is supposed to lie within the limits of an optimal margin of illusion (Baumeister, 1989). These limits of distortion are, however, difficult to operationalize, so that findings which might seem to challenge MR can be interpreted as merely indicative of a distortion within reasonable limits, rendering the whole approach relatively immune (cf. Ditto & Lopez, 1992; Ditto et al., 2003). Secondly, a differential acceptance of positive and negative feedback is typically interpreted as evidence for the distortion of the negative feedback, while the positive feedback is supposed to be perceived adequately (e.g., Croyle et al., 1993). However, in the absence of a clear criterion for adequacy of specific reactions, it is equally possible to argue in favor of a distortion of the positive feedback, implying an inappropriately positive perception of it, while negative feedback may in fact be perceived adequately (Renner, 2004b). A third issue is the potential maladaptiveness of devaluating and distorting negative self-relevant information (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Reed & Aspinwall, 1998). After all, negative self-relevant consequences implied by such information can sometimes be alleviated by taking actions, such as preventive measures in the case of health risks. While it is sometimes acknowledged that extreme forms of distortion may not be adaptive in the long run within MR (e.g., Taylor & Brown, 1988, 1994; Taylor & Gollwitzer, 1995), the approach makes it harder to explain findings pointing towards the adaptivity of reactions.

In an attempt to overcome some of the limitations of MR, the cue adaptive reasoning account (CARA, Renner, 2004a) was put forward. Following CARA, feedback valence is supplemented by feedback expectedness as a core determinant of the reception of health risk feedback. Both negativity and unexpectedness of health risk
feedback are proposed to function as cues for the relatively deep processing of the feedback (compared with a relatively shallow processing of feedback which is both positive and expected). These differences in processing depth are believed to be adaptive: A closer scrutiny of negative compared with positive feedback seems adaptive (cf. Baumeister et al., 2001; Ditto & Lopez, 1992; Ditto et al., 1998; Ditto et al., 2003) because negative feedback has a greater potential to have negative consequences for the self – and it often implies that some action be taken in order to alleviate these consequences. A closer scrutiny of unexpected compared with expected feedback seems similarly adaptive (cf. Renner, 2004a; cf. also Stangor & McMillan, 1992): After all, it makes sense to quickly incorporate information that fits one's existing knowledge, while examining new information more carefully. In line with this reasoning, Renner (2004a) has shown that, in the course of deeper processing, the quality of negative or unexpected feedback is examined more closely, as indicated by differences in the reactions to high-quality compared with low-quality feedback. High-quality cholesterol feedback was perceived as more accurate than low-quality feedback, but only among recipients of unexpectedly positive, unexpectedly negative, or expectedly negative cholesterol test results. Recipients of expectedly positive cholesterol feedback perceived the test as equally accurate regardless of feedback quality. Overall, CARA suggests that feedback valence is not the only important determinant of feedback reception, but that feedback expectedness also plays an important role. Moreover, it posits that reactions to individual health risk feedback are ultimately adaptive, which suggests a shift in focus from defensiveness to adaptivity. Although the present thesis does not aim at a direct comparison of MR and CARA, it is possible to relate at least some of its results to the debate about distortion and adaptivity of reactions towards health risk feedback, for example by looking at the role of feedback valence and feedback expectedness and by discussing the potential adaptivity of the
spontaneous (cf. Studies 1 and 2) and prompted (cf. Study 3) reactions under study (cf. Chapter 5.2.2).

### 1.2.3 Hindsight bias as one example of a specific reaction towards individual health risk feedback

Hindsight on pre-feedback expectations is an example of one specific reaction towards individual health risk feedback and it was singled out for a more thorough examination in Study 3 of the present thesis (cf. Chapter 4), thus complementing the relatively broad, recipient-oriented examination of spontaneous reactions in the first two studies (cf. Chapters 2 and 3) with a more traditional approach. Of all available reactions, hindsight was chosen for a more thorough analysis partly because it appears relevant to many feedback recipients (cf. Chapters 2 and 3). When people look back at their expectations regarding an outcome in hindsight, hindsight bias can occur, which is the tendency to remember one’s predictions regarding the outcome of an event as more consistent with the outcome than they really were after the outcome becomes known (Fischhoff, 1975; but see Blank, Nestler, von Collani, & Fischer, 2008). The reception of individual health risk feedback therefore appears to be a situation in which hindsight bias might not only occur when prompted, but probably also spontaneously. Hindsight was also chosen for Study 3 because, although hindsight bias has been demonstrated following a wide range of outcomes (cf. Christensen-Szalansky & Willham, 1991; Guilbault, Bryant, Brockway, & Posavac, 2004; Hawkins & Hastie, 1990) and within various cultures (Choi & Nisbett, 2000; Heine & Lehman, 1996; Pohl, Bender, & Lachmann, 2002), studies on the hindsight bias in Eastern societies have to my knowledge so far exclusively used non-self-relevant outcomes. Research conducted in Western samples, however, has demonstrated that the self-relevance of an outcome sometimes reduces the bias (Mark & Mellor, 1991; Mark, Boburka, Eyssell, Cohen, & Mellor, 2003), and outcome valence has been found to play a role in the emergence of hindsight bias following self-relevant outcomes (e.g.,
Louie, Curren, & Harich, 2000; cf. also Louie, 1999; Renner, 2003). The influence of different motivational processes on the bias following self-relevant outcomes has been discussed controversially (Haslam & Jayasinghe, 1995; Louie 1999; Louie et al., 2000; Mark et al., 2003; Mark & Mellor, 1991; Pezzo & Pezzo, 2007; Renner, 2003, please see Chapter 4 for a more thorough overview), making hindsight following self-relevant feedback in the East an interesting research topic.

1.3 Outline and aims of the thesis

The overarching topic of the present thesis is the reception of individual health risk feedback, various aspects of which were researched in the course of three studies. While their specific aims vary, each study is based in part on the results of the former one(s). Studies 1 and 2 depart from the prevailing approach towards researching the reception of individual health risk feedback in that they follow a recipient-oriented approach which allows for the examination of spontaneous reactions (cf. 1.3.2 and 1.3.3). Study 3 examines one of the – according to results from Studies 1 and 2 – most relevant spontaneous reactions in more depth, namely hindsight on pre-feedback expectations (cf. 1.3.4). All three studies are based on data from the research project “Risk Appraisal Consequences in Korea” (RACK, cf. 1.3.1).

1.3.1 Introduction to the RACK project

RACK is a DFG-funded project (Re 583/2-1) at the center of which is a large screening study focusing on risk for cardiovascular disease. In the course of RACK, two community-based blood pressure and cholesterol screenings were conducted in Seoul and Kyungki-Do, South Korea, with a time lag of six months between them. Participants were recruited via information leaflets and flyers in multiple institutions (e.g., universities, parishes). At each screening, they first filled in a pre-screening questionnaire, assessing (among other variables) their expectations regarding the screening
results. Afterwards, their height and weight were measured. Trained laboratory assistants measured participants’ blood pressure, followed by total cholesterol level measurement. Trained medical staff provided each participant with a standardized oral feedback. Participants additionally received an individual feedback sheet containing the exact measured values (cholesterol level in mg/dl, systolic and diastolic blood pressure in mmHg) and a classification of each value as optimal, borderline high, or high in accordance with international standards (American Heart Association, 2002; WHO, 2004). Recipients of borderline high or high readings were informed about the implications of these results for their risk of cardiovascular disease. Immediately after the screening, participants were asked to please list, within one minute, any thoughts or ideas they had after reception of their results. This thought listing task was given separately for blood pressure and cholesterol feedback. It was followed by a second questionnaire assessing immediate reactions to the screening. After a debriefing and the receipt of information material on cardiovascular disease, participants were provided with a third questionnaire to be filled in at home and mailed back to the researchers. The third questionnaire focused on later reactions to the screening, and on behavior associated with risk for cardiovascular disease (nutrition, smoking, alcohol consumption, and physical activity). An overview of the study procedure is included in Appendix A. The documentation of all questions used in RACK can be found at http://www.gesundheitsrisiko.de, and the items used for the present studies are re-printed in Appendix B. Each study conducted for the present thesis uses data from RACK, and additional results from RACK are published by Renner et al. (2008), Renner, Spivak, Kwon, and Schwarzer (2007), and Spivak (2007).

1.3.2 Study 1: Classifying spontaneous reactions to individual health risk feedback

The first study reported in this thesis is based on data from the first wave of RACK (n = 629). Its main aim was a first exploration of the thoughts listed by participants in
response to their blood pressure and cholesterol feedback. To achieve this aim, three more specific objectives were pursued. The first objective was to use a combined deductive-inductive approach to develop a comprehensive and reliable coding system which would make it possible to analyze the content of the thoughts listed with regard to reaction types. A second objective was to explore which topics are brought up most frequently by recipients of individual health risk feedback, implying their relevance, and to compare these with the attention they received in previous research. A third objective was to explore whether the order of reaction dimensions ranked by their relevance differed between recipients of optimal, borderline high, or high readings. This would allow to see whether some reactions are more important in the reception of feedback of a specific valence, or whether the classification of reactions and their rank order can be generalized to the reception of feedback of different valences. Aims, procedure, and results of Study 1 are described in detail in Chapter 2.

1.3.3 Study 2: A network perspective on reactions toward individual health risk feedback

The second study reported in this thesis is based on data from the second wave of RACK (n = 423). Its overarching aim was to deepen analysis following the recipient-oriented approach. Analysis of broad reaction dimensions was extended to allow for comparisons of results from the first screening with those of the second as an additional reaction type. On this basis, a first objective was to test for the replicability of results from Study 1. A second objective was to deepen the level of analysis beyond the level of broad reaction dimensions to include array and frequency of specific reaction subcategories (e.g., positive vs. negative emotions) in order to acquire a more detailed picture of what is important to recipients of individual health risk feedback. Deepening the level of analysis also meant exploring co-occurrences of reactions, allowing for the identification of reaction patterns. A third objective was to combine the wealth of information retained by analyzing the array of both broad and specific
reactions, their frequency of occurrence, and their co-occurrence in a clear and useful way. Thus, a network of reactions to spontaneous health risk feedback was constructed and graphically displayed. A fourth objective was to exemplify the usefulness of the risk reaction network. Therefore, reactions and reaction patterns were distinguished by how well they matched the valence of the preceding feedback (positive vs. negative). A more detailed description of aims, procedure, and results of the second study, as well as a depiction of the risk reaction network is included in Chapter 3.

1.3.4 Study 3: Hindsight bias following unexpected health risk feedback

A look back at pre-feedback expectations in hindsight was examined more closely in Study 3 as one example of a relevant spontaneous reaction towards health risk feedback. Study 3 aimed at providing a first exploration of hindsight bias following self-relevant feedback in an Eastern sample. A first objective was to examine whether hindsight bias would at all occur. A second objective was to explore whether there would be differences in hindsight bias depending on feedback valence, pointing towards possible motivational influences. A third objective was to examine the role of resultant surprise, which had been related to hindsight bias in Western samples (e.g., Ofir & Mazursky, 1997; Pezzo, 2003, cf. Chapter 4). A more detailed description of aims and procedure can be found in Chapter 4, where the results of Study 3 are additionally discussed with regard to the role of motivational processes and the generalizability of Western models of hindsight bias in an Eastern sample.

1.4 References

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2 Study 1. To be or not to be at risk:

Spontaneous reactions to risk information

This is a preprint of the article “To be or not to be at risk: Spontaneous reactions to risk information” by Martina Panzer and Britta Renn er, whose final and definitive form has been published in Psychology & Health 2008 (volume 23, pp. 617-627), © Taylor & Francis. Psychology & Health is available online at http://www.informaworld.com, with the published article accessible at http://www.informaworld.com/openurl?genre=article&issn=0887-0446&volume=23&issue=5&spage=617.

2.1 Introduction

Imagine your general practitioner routinely runs a cardiovascular check and tells you that your cholesterol level is too high. What would be your first thoughts and reactions?

Understanding how people react to health risk information is of increasing importance because the range and number of health screening tests is rapidly increasing. The medical community is progressively focusing more on risk rather than on disease. As a consequence, national health organizations as well as commercial companies are steadily extending their health risk screening programs. Although health risk screenings gain prominence within as well as outside the traditional medical setting, the question how people react toward receiving threatening risk information has been rather neglected. Most national health organizations focus on effectiveness, monitoring, and management of screenings. Even more important, access to risk screening tests outside the traditional medical setting is ever made easier by the growing number of over-the-counter screening tests in pharmacies and shops, or via Internet purchases. Google yields, for example, more than one million hits for cholesterol test kits. Thus, an increasing number of people may have to deal with health risk
information without professional support and counseling. Given these developments, there is a need to ensure a better understanding of the psychological effects of health risk information.

One important source for understanding the psychological effects of health risk information is to determine the spontaneous thoughts and reactions upon receiving health risk feedback. Surprisingly, despite numerous experimental and field studies on psychological effects of risk feedback information (e.g., Ditto, Munro, Apanovitch, Scepansky, & Lockhart, 2003; Marteau et al., 2004; for a review see Croyle, Sun, & Hart, 1997; Lerman, Croyle, Tercyak, & Hamann, 2002) this aspect has not yet been systematically addressed. Most often, participants in health risk feedback studies were asked a set of predetermined questions designed to shed light on theoretically compelling issues. This research considers risk feedback valence (e.g., good or bad cholesterol test result) as primary determinant in the reception of risk information (e.g., Croyle et al., 2006; Ditto et al., 2003; Taylor, 1991). Reactions revolving around perceived accuracy and acceptance of the feedback information are the best-studied response type to risk information (e.g., De Hoog, Stroebe, & De Wit; 2005; Ditto et al., 2003). A further well-studied aspect of risk feedback reception concerns reactions related to threat to health and perceived implications (Ditto, Scepansky, Munro, Apanovitch, & Lockhart, 1998; Radcliffe & Klein, 2002). Supporting the notion of self-defensive biases, various studies showed that people receiving bad news (e.g., high cholesterol reading) rated the test result as less accurate and less serious than people receiving good news (cf. Croyle et al., 1997; Liberman & Chaiken, 1992). Comparably few studies assessed more behavior-proximal variables such as intentions and behavior change. This type of response, however, is of particular relevance for understanding the translation of risk feedback into action (Renner & Schwarzer, 2003). Interestingly, these studies suggest a more adaptive response pattern: People who received bad news were more inclined to change behaviors than people who
received good news (e.g., Bowen, Fries, & Hopp, 1994; Kreuter & Strecher, 1996; Renner, 2004).

While these studies greatly facilitated the understanding of risk feedback reception, there are also limitations when asking a predefined set of questions (Sudman, Bradburn, & Schwarz, 1996; Weiner, 1985). Most important, the method is reactive and participants may answer questions regarding aspects of risk feedback which are not part of their spontaneous reaction repertoire. Furthermore, the reverse case is also possible in that important aspects of feedback reception are not assessed. The assessment of spontaneous responses to risk feedback offers the possibility to explore the whole array of spontaneous reactions in real-life settings which is informative with regard to current theories of risk feedback reception.

The present study examined what kinds of reactions are reported spontaneously when participants receive personally relevant health risk feedback in a real-life setting. Building upon previous research, we examined whether responses vary as a function of the threat level of the given risk feedback. Furthermore, reactions toward two different types of risk feedback were assessed, i.e. blood pressure and total cholesterol level feedback. Thus, reliability of reaction patterns across different types of risk feedback was additionally examined.

### 2.2 Method

#### 2.2.1 Procedure

A call for a community-based blood pressure and cholesterol screening was made via information leaflets and flyers in multiple public institutions (e.g., universities, parishes) located in Seoul, South Korea. During the screening, trained laboratory assistants measured participants’ blood pressure, followed by total cholesterol level measurement. After each measure, participants were provided with their exact actual
reading, and they received a standardized feedback on their risk category according to international guidelines (cf. WHO, 2004). Oral feedback was given by trained medical staff, and supplemented by a feedback sheet displaying the individual test results. Thus, participants with a blood pressure of \( \leq 140/90 \) mmHg or a cholesterol level of \( \leq 200 \) mg/dl were told that their reading was normal and did not pose a risk for cardiovascular diseases. Individuals with either a borderline high reading (systole between 140-160 mmHg or diastole between 90-95 mmHg; cholesterol between 201-239 mg/dl) or a high reading (systole > 160 mmHg or diastole > 95 mmHg; cholesterol > 239 mg/dl) were informed about the potential risks of borderline high and high readings for cardiovascular diseases. Upon receiving the cholesterol risk feedback, participants were asked to write down any thoughts or ideas they had after receiving cholesterol and blood pressure feedback (Cacioppo & Petty, 1981; Orbell & Hagger, 2006).

### 2.2.2 Participants

Nine hundred and fifty-one South Koreans aged 16 to 90 years (\( M = 33, SD = 18; 57\% \) women) participated in the health screening. Of these, only participants reporting at least one spontaneous reaction were included in the main analyses, resulting in a final sample of 629 participants with a mean age of 31 years (\( SD = 16 \)) and 55\% women. The average cholesterol level of the responders was 167 mg/dl (\( SD = 30 \)), which is below the mean South Korean population cholesterol level of 187 mg/dl. The mean blood pressure of 124/81 mmHg was comparable to the population level with 120/78 mmHg (Kang et al., 2006).

Of the 322 participants who did not report any relevant spontaneous reaction, 61\% were female. They were on average 38 years old (\( SD = 19 \)), with an average cholesterol level of 172 mg/dl (\( SD = 26 \)) and an average blood pressure of 129/84 mmHg. Analyses showed that non-responders were on average seven years older than responders, \( t(570.09) = -6.31, p < .001, d = 0.40 \), and that they exhibited a significantly
higher mean cholesterol reading, $t(927) = -2.71, p < .05, d = 0.16$, and significantly higher systolic and diastolic blood pressure readings, $t_s(569.89) > -4.26, ps < .001, ds < 0.3$, than responders. Both groups did not differ significantly with regard to sex.

One reason for non-response might be a lower level of articulateness and education. The education pattern for non-responders (16% no completion of high school, 44% high school degree, 37% college or university degree) differed significantly from the pattern for responders (7% no completion of high school, 44% high school degree, 49% college or university degree, $\chi_M^2(6) = 19.3, p = .004$). The formal education pattern of non-responders was less similar to the South Korean education stratification (OECD, 2005) than the pattern for responders. Thus, compared with responders and the general South Korean population, non-responders were less educated and probably less articulate, which might partly explain why they were more likely to abstain from giving a written response.

### 2.2.3 Coding system

Responses were translated from Korean to English by a bilingual Korean native speaker who was unaware of the purpose of the study. A comprehensive coding system was developed based on previous research and on 10% of all thoughts listed. The system was tested and revised on the basis of two test codings. All responses used for the development or testing of the coding system were excluded from further analyses. The final coding was conducted by two independent coders who were given a 45-minute training session in which the coding system was presented. Each relevant response was rated once on each of the following nine dimensions: (1) *Emotions* (e.g., “I feel depressed”; “I am very happy”), (2) *risk feedback valence* (e.g., “I have a bad result”; “I received a normal reading”), (3) *expectedness* (e.g., “The result was unexpectedly high”; “I thought that I might end up with a high cholesterol level, but I am assured that it is not”), (4) *future lifestyle change* (e.g., “I’ll exercise more”; “I need
to control my diet”), (5) causal attribution (e.g., “I lead a healthy life, so this could be expected”; “The results reflect my obsession with dried squids”), (6) implications for future health (e.g., “It is an indication of poor health”; “I am in good health”), (7) need for information (e.g., “I want more precise results”; “I didn’t understand what they were saying”), (8) acceptance (“I will have a reexamination”), and (9) residual. Inter-rater agreement was moderate to high (99.7%-99.4%). Any disagreements were resolved by discussion between the coders before further data analysis.

2.3 Results

2.3.1 Frequency of generated reactions towards risk feedback

Participants who generated at least one reaction (N = 629) generated a comparable amount of reactions after cholesterol feedback (M = 1.67, SD = 0.85, range 1-5) and blood pressure feedback (M = 1.62, SD = 0.81, range 1-5, t(1) = 3.58, ns). A single reaction was generated by 55% of the participants; multiple reactions were generated by 45%. For both risks, cholesterol and blood pressure, post hoc tests revealed that the number of reactions generated did not differ significantly between the three risk categories optimal, borderline high, and high (ps > .06).

2.3.2 Type of generated reactions

Analyses showed that emotional reactions toward blood pressure feedback clearly constituted the predominant type of spontaneous reactions generated by 47% of the participants (cf. Figure 1). A description of the risk feedback valence was the second most frequently generated category of reactions (44%). A substantial amount of responses (24%) encompassed the expectedness of the feedback, and the fourth most often generated response was related to future lifestyle change, with 20%. As Figure 1

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1 The coding system used for Study 1 is highly similar to the coding system used for Study 2, which is printed in detail in Appendix C. For differences between the systems, please see Chapter 3.2.3.
shows, the remaining types of reactions were comparatively seldom generated. The categories implications for future health, need for information, and acceptance were generated by less than 10% of the participants.

Reactions toward cholesterol feedback yielded a highly comparable pattern (cf. Figure 1). The rank-order of response types mirrors the pattern found for blood pressure feedback perfectly, with emotional reactions, risk feedback valence, expectedness, and lifestyle change as the most frequent response types. Comparing the absolute frequencies of responses of cholesterol with blood pressure feedback showed small, albeit significant differences for risk feedback valence, expectedness, future lifestyle change and causal attribution, ($F$s(1) < 17.41, $p$s < .01, $\eta^2_p$ < .03).

Figure 1. Percentages of reactions by type of risk feedback. 
Note: Multiple responses were possible.
Additional control analyses showed that this pattern of results was highly consistent across sex and age groups. Sex differences were tested by 2 (women vs. men) x 2 (reaction present vs. non-present) chi-square tests for cholesterol and blood pressure, respectively. For the in total 18 different reactions tested, only one analysis yielded a significant effect: Men were less likely to generate emotions than women as reaction toward cholesterol feedback, $\chi^2(1) = 13.44$, $p < .001$. In addition, younger adults (below 35 years) and older adults (35+ years) generated highly comparable reaction patterns. Out of 18 comparisons, only two were significant: Adults older than 35 years were less likely to generate risk feedback valence or implications for health than younger adults after receiving feedback about their cholesterol reading ($\chi^2$s(1) > 13, $p < .001$). In general, the rank order of frequently generated reactions (emotions, risk feedback valence, expectedness, and future lifestyle change) and rarely generated reactions (implications, need for information, and acceptance) was very similar across sex and age groups. Moreover, the rank order was also highly consistent across participants who gave a single-reaction response versus those who gave a multiple-reaction response.

2.3.3 Level of health threat and generated reactions

2.3.3.1 Blood pressure risk feedback

Comparing reactions generated by participants who received a blood pressure reading within the desirable range with those receiving a borderline-high or high reading yielded for most response categories a highly similar pattern (cf. Table 1). Within all three risk groups, emotions, risk feedback valence, expectedness, and future lifestyle change represented the four most frequently generated types of reaction. Emotional responses were the most frequently generated response type, with 46%, 48%, and 42% for the desirable, the borderline-high, and the high blood pressure feedback group, respectively, $X^2 (2, n = 614) = 0.31$, ns. Table 1 shows that the only statistically signi-
significant difference between the three risk groups emerged for the category future lifestyle change, $X^2 (2, n = 614) = 23.96, p < .001$. The high-risk group and borderline-high risk group generated thoughts related to future lifestyle change more often (38% and 31%, respectively) than the desirable blood pressure group (13%).

The number of responses falling into the remaining five categories was comparably low, cf. Table 1.

**2.3.3.2 Cholesterol risk feedback**

A similar pattern of responses was observed across the risk levels for cholesterol feedback. Most reactions generated by the three different risk groups were related to the categories emotions, risk feedback valence, expectedness, and future lifestyle change, cf. Table 1. Again, the borderline-high and high cholesterol level groups generated more responses related to future lifestyle change (49% and 39%, respectively) than those with desirable cholesterol levels (21%), $X^2 (2, n = 612) = 22.02, p < .001$. In addition, the number of emotional responses differed significantly between the three risk groups, $X^2 (2, n = 612) = 10.33, p < .01$. Participants with a desirable cholesterol level generated emotional responses more often (50%) than participants with a borderline-high (28%) or high (33%) cholesterol test result. In a similar vein, participants receiving good news generated thoughts about risk feedback valence significantly more often than the two other groups, $X^2 (2, n = 612) = 8.6, p < .05$. For the category expectedness, no significant differences with regard to risk group were found, $X^2 (2, n = 612) = 2.7, ns$.

The remaining five categories were mentioned comparably less often, cf. Table 1.
Table 1. Percentages and frequencies of reaction categories by type of risk feedback and levels of health threat.

<table>
<thead>
<tr>
<th></th>
<th>Blood pressure</th>
<th></th>
<th>Cholesterol</th>
<th></th>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Optimal</strong> $(n = 522)$</td>
<td><strong>Borderline</strong> $(n = 44)$</td>
<td><strong>High</strong> $(n = 48)$</td>
<td><strong>Optimal</strong> $(n = 535)$</td>
<td><strong>Borderline</strong> $(n = 56)$</td>
<td><strong>High</strong> $(n = 21)$</td>
<td></td>
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<tr>
<td></td>
<td>% f</td>
<td>% f</td>
<td>% f</td>
<td>% f</td>
<td>$X^2(2, n = 614)$</td>
<td>% f</td>
<td>% f</td>
</tr>
<tr>
<td><strong>Emotions</strong></td>
<td>46.2 241</td>
<td>47.6 21</td>
<td>42.4 20</td>
<td>0.31</td>
<td>49.5 265</td>
<td>27.5 15</td>
<td>33.3 7</td>
</tr>
<tr>
<td><strong>Risk feedback valence</strong></td>
<td>39.3 205</td>
<td>45.5 20</td>
<td>33.3 16</td>
<td>2.6</td>
<td>34.0 182</td>
<td>23.5 13</td>
<td>11.1 2</td>
</tr>
<tr>
<td><strong>Expectedness</strong></td>
<td>27.6 144</td>
<td>16.7 7</td>
<td>24.4 12</td>
<td>2.46</td>
<td>19.7 105</td>
<td>29.4 16</td>
<td>22.2 4</td>
</tr>
<tr>
<td><strong>Future lifestyle change</strong></td>
<td>13.3 69</td>
<td>31.0 14</td>
<td>37.8 18</td>
<td>23.96***</td>
<td>20.9 112</td>
<td>49.0 27</td>
<td>38.9 8</td>
</tr>
<tr>
<td><strong>Causal attribution</strong></td>
<td>11.8 62</td>
<td>11.9 5</td>
<td>2.2 1</td>
<td>3.85</td>
<td>17.3 92</td>
<td>3.9 2</td>
<td>5.6 1</td>
</tr>
<tr>
<td><strong>Implications for health</strong></td>
<td>7.5 39</td>
<td>0 0</td>
<td>0 0</td>
<td>6.93*</td>
<td>11.4 61</td>
<td>2.0 1</td>
<td>0 0</td>
</tr>
<tr>
<td><strong>Need for information</strong></td>
<td>2.0 10</td>
<td>4.8 2</td>
<td>2.2 1</td>
<td>1.29</td>
<td>4.0 20</td>
<td>3.9 2</td>
<td>0 0</td>
</tr>
<tr>
<td><strong>Acceptance</strong></td>
<td>1.8 9</td>
<td>2.4 1</td>
<td>2.2 1</td>
<td>n. a.</td>
<td>1.7 9</td>
<td>0 0</td>
<td>5.6 1</td>
</tr>
<tr>
<td><strong>Residual</strong></td>
<td>7.2 38</td>
<td>2.4 1</td>
<td>6.7 3</td>
<td>n. a.</td>
<td>6.8 36</td>
<td>5.9 3</td>
<td>16.7 3</td>
</tr>
</tbody>
</table>

Multiple responses were possible. *p < 0.05, **p < 0.01, *** p < 0.001, n. a. = not applicable due to expected frequencies < 5 in more than 20% of the cells.
2.4 Discussion

To our knowledge, this is the first study examining spontaneous reactions toward blood pressure and cholesterol test result feedback in a standardized screening context using the cardiovascular risk categories recommended by WHO medical guidelines. We found that most spontaneous reactions were related to four types of reactions: Emotions, risk feedback valence, expectedness, and future lifestyle change. Interestingly, similar types of spontaneous reactions were generated by individuals receiving low, borderline high, or high risk feedback and upon receiving blood pressure and cholesterol risk feedback.

How do the findings relate to previous findings in the field of psychological effects of risk feedback? They provide support for the notion that feedback valence is of central importance for the reception of feedback (e.g., Croyle et al., 2006; Ditto et al., 2003; Renner, 2004). Responses related to feedback valence represented the second frequently generated response category. In contrast, the other three most often generated reaction categories (emotions, expectedness, and future lifestyle change) are comparably underrepresented in previous research on psychological effects of risk feedback.

Emotional reactions were the most frequent response to risk feedback. However, most studies assessing the psychological impact of individualized risk feedback focused on cognitive reactions. The few studies assessing emotional reactions focused mainly on emotional distress, i.e. worry and fear (De Hoog et al., 2005; French, Maisie, & Marteau, 2006). A new and interesting finding is that emotional reactions emerged not only when receiving borderline or high risk information, but with similar frequency when receiving good news. Possibly, not only the intensity of negative, but also of positive emotions indicates how people cope with and adapt to personally relevant health information. Specifically, a lack of positive emotions after receiving
good news might be an indicator for difficulties in adjustment and coping, and may be predictive of extensive retesting behavior.

Whether the risk feedback was expected or not by the participants constituted a further salient response category. Thus, expectancies modulated risk feedback reception. This converges with findings suggesting that medical test results which are objectively the same elicit different psychological responses depending on prior expectations (Renner, 2004; Sheppard & McNulty, 2002). Moreover, these results provide support for the conception of the cue adaptive reasoning account, which proposes that not only risk feedback valence, but also feedback expectedness represents a core determinant of the reception of health-related feedback. For example, unexpected positive cholesterol feedback induced a more elaborate processing of the information given. By contrast, expected positive feedback was processed rather superficially (Renner, 2004).

Lifestyle-related reactions, the fourth frequent category of spontaneous risk responses, showed expected differences as a function of the threat level posed by the given risk feedback (low, borderline-high, high). People with an elevated reading were more than twice as likely as those with a desirable reading to generate thoughts about future lifestyle change. This pattern of results concurs with findings showing that negative risk feedback increases perceived pressure to change (Renner, 2004), intentions for behavior change (Croyle et al., 1993), and actual behavior changes (Bowen et al., 1994; Kreuter & Strecher, 1996).

The response categories acceptance or implications for future health were comparably seldom generated, suggesting that these facets of risk feedback reception may not be spontaneously generated by individuals receiving cardiovascular risk feedback. This observation is interesting given that acceptance or implications for future health represent the most frequently applied response types in experimental risk
research to demonstrate self-defensive biases in the reception of consequential health feedback.

Experimental research has typically analyzed specific reactions to health risk feedback in an isolated manner (e.g., Ditto & Lopez, 1992). By contrast, the pattern of spontaneous reactions found in the present study could build the basis for analyzing multiple reactions jointly. The combined pattern of reactions, i.e. the network of reactions, could be used to explore the adaptivity of reactions toward risk feedback in a more ecologically valid and comprehensive way.

The present study represents a first step into examining spontaneous responses toward health risk feedback. Considering that control analyses yielded a highly consistent pattern across sex and age groups as well as across single versus multiple responders, one might speculate that the reaction pattern found represents a more general pattern. However, limitations of the internal and external validity of the present study must be acknowledged. People who choose to be tested are by definition self-selected and the degree to which the findings generalize to people who refrained from testing is limited. Moreover, future research is needed to determine whether the pattern extends to other health risk information and to different socio-cultural contexts. Also, the degree of spontaneity of reactions might have been limited due to the written response format.

Overall, the present results imply that spontaneous psychological reactions to consequential health feedback are rather adaptive. Recipients consider the match between the feedback and their prior expectations and elaborate on ways of behavioral adaptation when the result signals a potential health threat (cf. Renner, 2004). The study of spontaneous risk reactions extends the array of reactions assessed in current research. Findings suggest considering not only the valence of the given test result, but also prior expectancies, and assessing emotional as well as behavior-related responses (cf. also Marteau & Weinman, 2006).
2.5 References


3 Study 2. Spontaneous reactions to health risk feedback: A network perspective


3.1 Introduction

Cardiovascular disease (CVD) is the major cause of death worldwide (World Health Organization [WHO], 2004) with elevated blood pressure and cholesterol levels being main risk factors for CVD in Western and in Asia-Pacific countries (Asia Pacific Cohort Studies Collaboration [APCSC], 2002, 2005; WHO, 2002). As a consequence, national health organizations as well as commercial companies are steadily extending their health risk screening programs. However, most national health organizations focus on effectiveness, monitoring, and management of screenings whereas the question how people react toward receiving threatening risk information appears ever more urgent. Since the range and number of health screening tests is rapidly increasing (e.g., through the rise of genetic testing, cf. Pear, 2008) it appears utterly important to better understand lay people's behavioral and psychological reactions toward health risk information.

3.1.1 Reactions towards health risk screenings

Most field studies and laboratory experiments addressing reactions to individual health risk feedback have studied predominantly cognitive reactions, particularly perceived test result accuracy and the degree of message acceptance (e.g., Ditto & Lopez, 1992; Ditto et al., 1998). Commonly, these cognitive reactions have been assessed by
asking respondents a pre-defined set of closed questions (e.g., “How confident are you that this test result is an accurate indication of your actual […] status?”, Ditto et al., 1998, p. 63). Supporting the notion of self-defensively biased reactions, various studies showed that people receiving bad news rated their test result as less accurate than people receiving good news (Ditto et al. 2003; Taylor, 1991). A recent study examining reactions of individuals who took part in a cholesterol screening replicated this finding of self-defensive reactions toward risk feedback (Croyle et al., 2006). Participants were asked to recall their cholesterol measure six months after the screening. Results showed that participants who received the most undesirable test results were most likely to remember their cholesterol scores as lower (i.e., healthier) than the scores they actually received. These findings were interpreted by the authors as evidence that reactions toward self-relevant health information are susceptible to self-defensive biases.

While these studies greatly facilitated the understanding of risk feedback reception, there are also limitations when asking a predefined set of questions (Sudman, Bradburn, & Schwarz, 1996; Weiner, 1985). Most importantly, the method is reactive and participants may answer questions regarding aspects of risk feedback which are not part of their spontaneous reaction repertoire. Furthermore, it is also possible that important aspects of feedback reception which might be central for coping and behavioral processes are not assessed. Supporting this notion, a recent study assessing spontaneous responses to cholesterol and blood pressure risk feedback showed that cognitive reactions such as acceptance of feedback, which were typically assessed in previous research, represent only a small portion of the total array of spontaneous reactions (Panzer & Renner, 2008). More specifically, if reactions are not pre-selected by the researcher, but generated freely by the recipients, the predominant type of reaction appears to be emotions, followed by reactions referring to the valence or expectedness of the given feedback, or to lifestyle changes. These findings indicate
which types of spontaneous reactions prevail after receiving risk feedback. However, they are silent in respect to how these different types of reactions are related.

3.1.2 Interrelations between reactions toward risk feedback

In previous research the focus has been on specific, single reactions. However, focusing on the interrelations between reactions might yield a dramatically different picture. In an experimental study on reactions toward (fictitious) cholesterol test results, respondents who had received an elevated cholesterol test result rated the test as less accurate and cholesterol as less serious than respondents who had received a normal cholesterol test result. Croyle, Sun, and Louie (1993) interpreted this pattern of results as clear evidence for self-defensive reactions toward unfavorable information. However, the same recipients of an unfavorable test result were also more inclined to change their behavior. Accordingly, participants receiving bad news appeared to be more skeptical toward the quality of the information but were simultaneously more motivated to change their behavior, indicating an adaptive reaction pattern rather than a self-defensive one driven by a desire to derogate unpleasant information. A similar pattern of results has been observed in a public cholesterol screening (Renner, 2004). Specifically, participants receiving a test result indicating an elevated cholesterol level were more skeptical concerning the reliability of the test result than those with an optimal cholesterol test result. Nevertheless, 42% of the former reported that they had changed their behavior at a six month follow-up after the cholesterol screening. These results suggest that a joint analysis of different types of reactions is required for distinguishing maladaptive, self-defensive from adaptive reactions toward risk feedback.
3.1.3 A new approach for analyzing reactions toward risk information: A network perspective

In order to analyze the different aspects of reactions toward risk information conjointly, such as the observed types of reactions and the relationships between them, we suggest a new approach, i.e. a network perspective. We use the term network to refer to a simultaneous analysis of a set of variables (namely reaction types) and their interrelations which are then graphically represented as nodes and paths (cf. Colman, 2006; Heckerman, 2001). The network visualizes four different types of information about the observed reactions toward risk information. Firstly, the network includes information about the various dimensions or types of reactions generated by the respondents (e.g., emotions, cognitions about lifestyle changes) represented by different nodes. Secondly, for tailoring practical interventions such as doctor-patient counseling, it is important to assure that prevalent reactions receive a greater weight in analysis and intervention than reactions which occur comparably seldom. Accordingly, the prevalence indicating the practical significance of each type of reaction is represented in the network by the proportional size of the respective network node. Thirdly, the specific content of the observed reaction type is represented in the network as proportional segment of the respective network node. For example, the emotion dimension might entail positive and negative emotions, thus its node might have two different segments. The more frequently generated one would be represented by a proportionally larger segment. Finally, the co-occurrences between different reaction types are represented through connections between network nodes, reflecting their frequency relative to other interrelations between the nodes.

3.1.4 The present study

The overarching aim of the present study was threefold: (1) to gain information about spontaneous reactions to individual health risk feedback in a real-life setting, (2) to
explore their pattern of interrelations by developing a network of reactions to health risk information including the type, prevalence, and segmentation of reactions as well as the co-occurrence of different reaction types, and (3) to explore the network of reactions in order to identify reaction patterns which appear more or less adaptive in relation to the risk feedback received. Furthermore, reactions toward two different types of risk feedback were assessed, i.e. blood pressure and total cholesterol level feedback. Thus, reliability of reaction patterns across different types of risk feedback was additionally examined.

3.2 Method

3.2.1 Procedure

The present study is part of the larger research project Risk Appraisal Consequences in Korea (RACK), during which two community-based blood pressure and cholesterol screenings were conducted with a time lag of six months in between. Participants were recruited via information leaflets and flyers in multiple institutions (e.g., universities, parishes) located in Seoul, South Korea. At both screenings, trained laboratory assistants measured participants’ blood pressure and total cholesterol levels. The assistants provided each participant with a standardized oral feedback in Korean, along with an individual feedback sheet which contained the exact measured values in numbers (cholesterol level in mg/dl, systolic and diastolic blood pressure in mmHg) and an additional graphical classification of each value as optimal, borderline high, or high in accordance with international standards (WHO, 2004)². Blood pressure readings of ≤ 140/90 mmHg and cholesterol readings of ≤ 200 mg/dl were classified as normal and described as posing no elevated risk for cardiovascular disease. Systolic blood pressure readings of 141 to 160 mmHg, diastolic blood pressure

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² The cut-off for high blood pressure was chosen in consultation with faculty from the College of Medicine at Hanyang University in Korea.
readings of 91 to 95 mmHg, and total cholesterol levels of 201 to 240 mg/dl were classified as borderline high. Systolic blood pressure > 160 mmHg or diastolic blood pressure > 95 mmHg, and cholesterol levels of > 240 mg/dl were classified as high. Recipients of borderline high or high readings were informed about the potential risks of these readings for cardiovascular disease. Directly after receiving cholesterol and blood pressure feedback, participants were asked to list any thoughts or ideas they had immediately after receiving their test results (Cacioppo & Petty, 1981). This task was given separately for thoughts regarding the cholesterol and the blood pressure test result.

In the present study, only data from the second screening are analyzed and reported. Details and results for the first screening are described by Panzer and Renner (2008) and by Renner, Spivak, Kwon, and Schwarzer (2007).

3.2.2 Participants

Five hundred and ninety-seven volunteers took part in the second screening, out of 951 who took part in the first screening half a year earlier (cf. Panzer & Renner, 2008). Only participants reporting at least one spontaneous reaction were included in the main analyses. The final sample thus consists of 423 responders (51% women) with a mean age of 31 years ($SD = 18$). Responders had an average cholesterol level of 160 mg/dl ($SD = 22$), which is below the mean South Korean population cholesterol level of 187 mg/dl (cf. Kang et al., 2006). Among the 8% of responders with non-optimal cholesterol levels, the mean level was 227 mg/dl ($SD = 22 mg/dl$). The responders’ mean blood pressure level was 122/81 mmHg which is comparable to the mean population level of 120/78 mmHg (cf. Kang et al., 2006). Among the 14% of responders with non-optimal blood pressure, the mean was 148/94 mmHg ($SD = 15/15 mmHg$).

One hundred and seventy-four participants took part in the second screening but did not report any spontaneous reaction. These non-responders were on average
34 years old $\left( SD = 18 \right)$ with 62% women; they had an average cholesterol level of 166 mg/dl $\left( SD = 26 \right)$ and an average blood pressure of 125/81 mmHg. Analyses comparing responders with non-responders showed that responders had a lower mean cholesterol level, $t\left(281.50\right) = 2.67$, $p < .01$, $d = 0.3$ and were more likely to be male, $X^2\left(1\right) = 6$, $p < .05$. However, the two groups did not differ significantly with regard to blood pressure or age ($ts\left(595\right) > 1.9$, $ns$).

Differences in educational attainment may provide one explanation for non-response. Non-responders had a lower formal education (17% no completion of high school, 46% high school degree, 38% college or university degree) than responders (11% no completion of high school, 40% high school degree, 49% college or university degree), $X^2\left(2\right) = 6.44$, $p < .05$. The pattern found for responders is, however, more similar to South Korean high school enrollment and advancement rates of 97% and 85%, respectively (Organization for Economic Co-Operation and Development, 2005), than the pattern found for non-responders.

### 3.2.3 Coding system

Responses were translated from Korean to English by a bilingual Korean native speaker who was unaware of the purpose of the study. The coding system used in the present study is an extension of the risk feedback reaction coding system (RFR-system) developed by Panzer and Renner (2008) for coding responses to the first wave of the RACK screening. One coding unit comprised all words one participant wrote (e.g., “I was surprised with my high blood pressure reading”) in response to the respective thought listing task (cholesterol, blood pressure). In a first step, each coding unit was examined as to whether it contained at least one reference to the screening result or topic. Each relevant unit (387 for cholesterol, 369 for blood pressure feedback) was rated on each dimension of the RFR-system, with each dimension representing one reaction type: (1) Emotions (e.g., “I feel depressed”; “I am very
happy”), (2) risk feedback valence (e.g., “I have a bad result”; “I received a normal reading”), (3) expectedness (e.g., “The result was unexpectedly high”; “I thought that I might end up with a high cholesterol level, but I am assured that it is not”), (4) future lifestyle (e.g., “I’ll exercise more”; “I need to control my diet”), (5) causal attribution (e.g., “I lead a healthy life, so this could be expected”; “The results reflect my obsession with dried squids”), (6) implications for health (e.g., “It is an indication of poor health”; “I am in good health”), (7) need for information (e.g., “I want more precise results”; “I didn’t understand what they were saying”), and (8) acceptance (“I will have a reexamination”). The present RFR-system was extended to include the additional dimension (9) comparison with previous results (e.g., “It’s higher than in the past”; “It’s the same as before”). These nine dimensions captured 91% of the total of relevant reactions generated. Additionally, a (10) residual category was available for coding units without reference to any of the nine dimensions, including 9% of the total of relevant reactions generated (e.g., “It was a good idea to be examined”).

Extending previous results (Panzer & Renner, 2008), mutually exclusive subcategories were coded for each of the nine reaction dimensions representing the segments of each network node. These subcategories had been developed on the basis of models of reactions toward individual health risk feedback (e.g., Ditto, Jemmott, & Darley, 1988; Leventhal, Brissette, & Leventhal, 2003), and on reactions included in previous studies (e.g., Croyle et al., 1993; Ditto et al., 2003; Renner, 2003; Renner, 2004) supplemented by a review of 10% of thoughts listed (these responses were excluded from further analysis). For example, the dimension emotions entailed the subcategories (a) positive emotions (e.g., “I am happy”), (b) negative emotions (e.g., “I feel depressed”), (c) mixed emotions (e.g., “I feel mostly good, but still a little worried”), and (d) unclear emotions (e.g., “I’m not bothered too much”).

3 The coding system as used for Study 2 can be found in Appendix C.
Interrater agreement was substantial or almost perfect for all nine dimensions, with Fleiss’ kappa from .62 to 1, and with percentage agreements ranging from 90% to 100% (Fleiss, 1971; see Landis & Koch, 1977, for a classification of interrater agreement) except for the rarely used dimension acceptance in relation to blood pressure feedback (with $\kappa = .52$ and 99% agreement). Agreement for the residual category was fair to moderate with $\kappa = .23$ (90%) and $\kappa = .52$ (94%) for reactions to blood pressure and cholesterol feedback, respectively. Disagreements were resolved by discussion among the raters before further analyses.

### 3.3 Results

#### 3.3.1 Frequency of spontaneous reactions

In total, participants generated one to four reactions after receiving risk feedback. The average number of reactions to blood pressure feedback was $M = 1.35$ ($SD = 0.57$), and a comparable amount of reactions was reported after cholesterol feedback ($M = 1.38$, $SD = 0.63$, $F(1) = 2.36$, $ns$). A single reaction (e.g., “I am happy”; “It is good”) was generated by 68% and 70% of the participants after cholesterol and blood pressure feedback, respectively. Multiple reactions (e.g., “The result was lower than I expected”, “I think that I am benefiting from controlling my dietary habits and exercising”) were generated by 32% (cholesterol) and 30% (blood pressure) of the participants. For both risks, the number of reactions generated did not differ significantly between participants receiving a normal test result and those who had an elevated test result ($ps > .55$). The mean number of reactions generated is highly comparable to results reported for Western samples (e.g., $M = 1.33$ thoughts reported by Orbell & Hagger, 2006; $M = 1.26$ thoughts reported by Orbell, Perugini & Rakow, 2004).
3.3.2 Types of reactions: Network nodes

In a first step towards gaining information about the types of spontaneous reactions and to develop a network of reactions to health risk feedback in a real-life setting, each reaction dimension coded in the RFR (e.g., emotions) was translated into a network node (cf. Figures 2 and 3). Thus, each network node represents one of the nine broad types of reactions to individual health risk feedback. In addition, each network node was scaled in accordance to the observed prevalence of the represented reaction type in order to illustrate its practical relevance.

3.3.2.1 Blood pressure

As Figure 2 shows, emotions clearly constituted the most prevalent type of spontaneous reactions, generated by 39% of the participants. Reactions related to risk feedback valence were generated second most frequently, i.e. by 33%. The third most frequent reaction type encompassed reactions pertaining to future lifestyle, generated by 20% of participants in response to the blood pressure feedback. The reaction types expectedness and implications for health were generated spontaneously by 10% of the participants. Each other reaction type was generated spontaneously by less than 10% of participants. Accordingly, the reaction types causal attributions and comparisons with previous results form comparatively small nodes in the reaction network for blood pressure feedback. Even smaller nodes emerged for need for information and acceptance, as these reactions were generated by less than 5% of participants.
Figure 2. Network of spontaneous reactions to blood pressure feedback.

Note: Multiple responses were possible. Circles (and circle segments) are sized according to the relative frequency with which each reaction category (and subcategory) was generated. Numbers indicate the absolute and relative frequencies of reaction pairs. Percentages were calculated relative to the total of persons who generated either one or both reactions within the respective pair.
3.3.2.2 Cholesterol

Reactions toward cholesterol feedback (cf. Figure 3) mirrored the pattern found for blood pressure feedback, with emotional reactions (31%), feedback valence (26%), future lifestyle (15%), and expectedness (15%) as the most frequent reaction types. Other reaction types such as causal attributions, implications for health, and comparisons with previous results again formed comparatively small nodes in the network (5% to 8%). Even smaller nodes emerged for the types need for information and acceptance, as these reactions were generated by less than 5% of participants after receiving cholesterol feedback. Comparing the absolute frequencies of reactions toward cholesterol and blood pressure feedback showed small, albeit significant differences for risk feedback valence, emotions, and expectedness ($F_{(1)} < 8.8$, $p < .04$, $\eta^2 < .02$).

3.3.2.3 Control analyses

After both blood pressure and cholesterol feedback, the various reaction types were generated similarly frequently by those who received optimal feedback and those who did not ($X^2_{(1)} < 2.7$, $p > .07$). The only exception are reactions pertaining to future lifestyle, which were generated more frequently by those who received non-optimal feedback compared with those who received favorable feedback ($X^2_{(1)} > 9.1$, $p < .01$).

Additional control analyses showed that the types of reactions generated were highly similar among those participants who had converging risk feedback across both waves of the study (i.e., optimal feedback at both first and second screening, or repeated non-optimal feedback) and those who had received diverging risk feedback (i.e., optimal feedback at wave 1, but non-optimal feedback at wave 2, or vice versa).
Figure 3. Network of spontaneous reactions to cholesterol feedback.
Note. Multiple responses were possible. Circles (and circle segments) are sized according to the relative frequency with which each reaction category (and subcategory) was generated. Numbers indicate the absolute and relative frequencies of reaction pairs. Percentages were calculated relative to the total of persons who generated either one or both reactions within the respective pair.
The only exception were again reactions concerning future lifestyle, which were generated more frequently by recipients of divergent feedback for both blood pressure and cholesterol feedback ($X^2$(1) > 4.34, ps < .04).

In accordance with Panzer and Renner (2008), younger adults (below 35 years) and older adults (35+ years) generated largely similar reaction types: Reactions constituting large nodes (emotions, risk feedback valence, expectedness, and future lifestyle) and small nodes (implications, need for information, and acceptance) were highly similar across the two age groups. Only the following comparisons were significant: Adults older than 35 years were less likely to generate risk feedback valence or implications for health than younger adults and more likely to generate thoughts about future lifestyle in response to cholesterol or blood pressure feedback ($X^2$(1) > 4.64, ps < .03).

3.3.3 Specific content of reaction types: Node segmentation

In a next step, each network node was further segmented according to the specific form of reaction demonstrated. The segments were sized in proportion to the frequency with which the respective reaction occurred (cf. Figures 2 and 3).

3.3.3.1 Blood pressure

As Figure 2 shows, the emotion node consists of four different segments: positive emotions (69% of the total node), negative emotions (16%), mixed emotions (2%), and unclear references to emotions (13%). The feedback valence node entails a large segment for reactions referring to a positive valence (84% of the node) and a small segment with reactions referring to a negative valence (16%). Reactions pertaining to the expectedness of the received test result were allotted to seven different subcategories. Three of these seven reaction subcategories referred to expected results (high or low as expected, as expected without reference to the specific value). They jointly account for 65% of the node. Sixteen percent of the node encompasses reactions
referring to unexpected results (higher or lower than expected, different than expected without reference to the direction). The remaining 19% of the node represent reactions with an ambiguous reference to the expectedness of the result. The node for future lifestyle consists of a prominent group of segments for lifestyle change (80% of the node), a smaller segment for lifestyle continuation (12%), and an even smaller segment for reactions with an ambiguous reference to future lifestyle (8%). The group of segments for lifestyle change entails responses for the following subcategories: Proposed changes in nutrition (7% of the total node) or exercise (20%), other specific lifestyle changes such as check-ups (14%), change of multiple specific lifestyle aspects (7%, e.g., “I need to drink less and exercise more”), and unspecific lifestyle changes (32%, e.g., “Let’s be more careful”). The node for reactions related to implications for future health consists of a large segment for favorable implications (87%), and a smaller one for unfavorable implications (3%). A third residual segment encompasses reactions related to future health without mentioning valence (10%). The reaction node for comparisons of current and previous test results includes a large segment representing reactions which point to a perceived difference between current and previous results (68%, with 42% stating that the current result is more negative, 19% for more positive current results, and 7% for different results without clear indication of their valence). A smaller segment consists of comparisons indicating similarity between former and current results (26%), and an additional segment contains responses unclearly related to previous test results (6%). Within the causal attribution node, two main segments were created, one for external attributions (67% of the node), and one consisting of several smaller segments for attributions to lifestyle aspects (33%, with 5% for nutrition, 9% for exercise, and 19% for attributions to a single other lifestyle aspect).
3.3.3.2 Cholesterol

As Figure 3 shows, highly similar results were found for cholesterol feedback. The largest segment of the emotion node consists of positive emotions (75% of the node). Negative emotions (13%), mixed emotions (1%) and unclear references to emotions (11%) were again seldom mentioned. For the feedback valence node reactions pertaining to a positive valence outnumbered those referring to a negative valence, with ratios of 95% to 5%. The node for the expectedness of the test result includes (1) expected results (58% of the total node, with 28% high as expected and 30% without reference to valence), (2) unexpected results (34% of the node, with 20% lower than expected and 14% without reference to valence), and (3) reactions related to expectedness without clear indication of whether the result was expected or not (8% of the node). The node for implications for future health includes a very large segment for positive implications (92% of the node) whereas no negative implications were mentioned. Mixed implications (5%), and implications whose valence remained unclear (3%) were mentioned only rarely. The node for reactions related to future lifestyle shows that most reactions (75%) referred to lifestyle change (with 22% nutrition change, 14% exercise change, 1% changes in smoking, 1% changes in alcohol consumption, 10% changes of more than one specific lifestyle aspect, and 27% unspecific lifestyle change). Comparably few reactions entailed a lifestyle continuation (11%) or remained unclear in respect to whether change or maintenance was proposed (14%).

The node for comparisons of current with previous test results again consists of a large segment indicating a difference between current and previous results (68% of the node, with 9% for more negative current results, 56% for more positive current results, and 3% for different current results without reference to their valence). A second segment of 6% pertains to similarity between previous and current results, and a third segment of 19% contains responses referring to previous results without indicating whether they are similar or different to current results. Within the causal attribution node a larger segment consists of external attributions, which account for
59% of the total node. A smaller segment includes attributions to lifestyle accounting for 41% (with 14% for nutrition, 9% for exercise, 5% for a single lifestyle aspect for which no specific subcategory was available, 9% for multiple lifestyle aspects, and 4% for unspecific lifestyle attributions).

### 3.3.4 Interrelations between reaction types: Network paths

In a third step, the interrelations between pairs of reaction types were assessed by examining how often two broad reaction types were mentioned jointly within one response to the thought listing task. In Figures 2 and 3, these interrelations are displayed as network paths. In general, two reactions were more likely to be generated jointly if their base rates were high. Therefore, in addition to reporting the absolute number of recipients who jointly generated the two reactions, prevalences adjusted for reaction base rates are reported. Each network path is thus not only superscribed with the base rate of jointly generated reactions, but also with the percentage of joint generations relative to the total of persons who generated at least one of the two reactions connected by the specific path (cf. Figures 2 and 3). Reactions generated jointly by more than 10% of those who mentioned at least one of the two reactions within each pair are connected by a path drawn as a thick line. Paths with joint generations of less than 10% but more than 5% are drawn as a thin line, and paths with joint generations of less than 5% are omitted for greater clarity.

The results show that emotions and feedback valence were quite often generated conjointly. Among those who generated either emotions or thoughts about feedback valence, almost one fifth generated both reactions. Secondly, of those who generated thoughts pertaining to risk feedback valence or to the expectedness of the received test result, 13% generated both reactions conjointly. Thirdly, among recipients who generated emotions or causal attributions, 10% generated both.

Two additional paths were found either only for blood pressure feedback or for cholesterol feedback, but not for both types of risk feedback. For blood pressure
feedback, 10% of those who generated cognitions about need for information or acceptance of the given feedback generated both types of reactions conjointly. For cholesterol feedback, 10% of those who reported emotions or compared the current and previous cholesterol test results generated both reactions jointly (cf. Figures 2 and 3).

All other reaction pairs were generated by less than 10% of those who mentioned at least one reaction per pair.

### 3.3.5 Patterns of reactions toward positive and negative risk feedback

In the last step, the match between reactions and the given feedback (positive vs. negative) was analyzed in order to identify adaptive and maladaptive reaction patterns in relation to the valence of the received feedback. In order to do so, responses containing at least one specific reaction related to emotions, risk feedback valence, implications, and future lifestyle change were analyzed. From a normative point of view, recipients receiving an elevated reading should be more likely to generate negative reactions towards the received feedback including reactions such as negative emotions, and thoughts that negatively evaluate the negative feedback or its implications for their health. Most importantly, recipients of negative feedback should also be inclined to change their lifestyle in the future rather than to continue it. Conversely, recipients of positive feedback should be more likely to express positively toned emotions and they should evaluate the feedback valence and its implications in a positive way. As a consequence, they should be more inclined to continue with their lifestyle.

The remaining responses such as reactions related to expectedness, causal attribution, need for information, and acceptance cannot be categorized as being more or less adaptive in relation to the feedback valence from a normative point of view. For example, both positive and negative feedback could be equally expected or unexpected. Hence, the following analyses are focused on reactions containing at least
one clear normative reference point to feedback valence such as emotions, risk feedback valence, implications, and future lifestyle change. In total, 105 responses to blood pressure feedback and 84 responses after cholesterol feedback were thus classifiable as either adaptive or maladaptive.

Participants receiving a normal test result demonstrated in 96% (blood pressure) and 91% (cholesterol) of the observed cases an adaptive response pattern: They reported positive emotions or implications for health, or described their feedback as desirable, without generating negative emotions, negative implications, negative risk feedback valence, or intentions to change their lifestyle. A comparably small proportion of 4% (blood pressure) to 9% (cholesterol) of those who received a normal test result showed a maladaptive reaction pattern: Despite having received a favorable test result, they generated neither positive emotions, positive implications, nor positive risk feedback valence, but at least one of the specific negative reactions (negative emotions, implications, or risk feedback valence, or future lifestyle change). Thus, participants receiving a normal reading rarely showed a reaction which could be classified as being maladaptive from a normative perspective.

However, a different picture emerged for participants receiving an elevated test result: In particular, reactions were coded as adaptive if they included negative emotions, negative implications, negative feedback valence, or future lifestyle change without containing positive emotions, positive risk feedback valence, or positive implications. In total, 73% (blood pressure) and 50% (cholesterol) demonstrated such an adaptive reaction pattern. A maladaptive response pattern, that is a response pattern which includes at least one positive reaction but no negative one nor plans for future lifestyle change, was reported by 27% (blood pressure) and 50% (cholesterol) of the participants after receiving negative feedback.
3.4 Discussion

The aim of the present study was to examine spontaneous reactions to individual health risk feedback in a real-life setting from a network perspective. For both cholesterol and blood pressure feedback a highly similar reaction pattern emerged, indicating a high reliability of the findings.

3.4.1 Reaction types: How do people react after receiving risk feedback?

Turning to the question of what types of reactions people demonstrate after receiving self-relevant health feedback, the present results show that emotions, thoughts about the valence and expectedness of the given feedback, and about one’s future lifestyle constitute the most prevalent reaction types. Causal attributions, implications for health, comparisons with previous results, need for information, and acceptance were comparably seldom generated. Since the pattern of reaction types was not only similar across the two risk feedback types but also similar to the results reported by Panzer and Renner (2008), one might speculate that the four reaction types emotions, feedback valence, expectedness, and future lifestyle change might represent the “big four” of spontaneous reactions toward risk feedback. Interestingly, this pattern of results contradicts the attention these reaction types have received so far in research. Previous experimental studies have largely focused on the degree to which recipients accept risk feedback and on the implications they perceive for their future health (cf. Ditto & Croyle, 1995; Ditto & Lopez, 1992; Ditto et al., 1998). Emotional responses have only recently received attention – mainly in the form of negatively valenced reactions such as worry (e.g., De Hoog, Stroebe, & De Wit, 2005; French, Maissi, & Marteau, 2006; Lipkus, McBride, Pollak, Lyna, & Bepler, 2004) – while positive emotional responses and the expectedness of the given feedback have largely been neglected.
3.4.2 Specific content of reaction types: Node segmentation and interrelations

Findings regarding the interrelations between spontaneous reactions showed that emotions, risk feedback valence, and expectedness form large and well-connected network nodes. Interestingly, reactions pertaining to lifestyle change formed an also large, but less well connected node. Thus, contrary to previous research assuming that certain cognitive reactions such as acceptance of feedback are the pathway to awareness and behavior change, participants seem to chose a more direct, intuitive pathway to behavior change. In current risk research frameworks, intuitive or experiential modes of reactions are discussed (cf. Damasio, 2004; Loewenstein et al., 2001; Slovic et al., 2004; Weber & Hsee, 1999). Accordingly, people might rely not only on analytic deliberation for decisions but also on affective experiences when assessing the need for behavior change.

At large, the present network can be seen as a first step towards a cognitive-affective domain map of reactions to health risk feedback as proposed by the cognitive-affective system theory of personality (CAPS, Mischel & Shoda, 1995; Shoda & Mischel, 2006). Cognitive-affective domain maps allow for tracing “personal signatures” of individuals, describing situation transient reactions. Thus, an individual network analysis could extend the typical group-level data analysis. A comparison of an individual network with a group-based “social normative” network could be used by researchers, practitioners, and recipients in order to detect potentially critical reaction patterns, such as those indicating maladaptive reactions. For example, recipients with maladaptive patterns after negative feedback might be less likely to adopt behavior change than those with adaptive patterns. Similarly, maladaptive reactions after positive feedback might be precursory to retesting behavior.
3.4.3 Adaptive reaction patterns

After positive feedback, adaptive patterns were more prevalent than after negative feedback. Thus, recipients of negative feedback tend to express feedback-inconsistent thoughts such as mismatching (i.e. positive) emotions more often than recipients of positive feedback, indicating a maladaptive pattern with reactions which are non-normative from a medical point of view. This difference in reactions toward positive and negative feedback is explained from a Motivated Reasoning perspective (Kunda, 1990) as indicating self-defensive reactions which help to maintain a positive view of one's own health. However, even after negative feedback, adaptive reaction patterns were far more prevalent than maladaptive ones. This suggests that despite a possible self-defensive pattern on the group level, most recipients of negative feedback do properly acknowledge the valence of their result, as for example reflected by their spontaneous report of negative emotions. Generally, reactions to health risk feedback seem to be predominantly adaptive, supporting previous research (e.g., Renner, 2004).

The patterns found in the present study are, however, drawn from initial reactions towards health risk feedback, and their adaptivity was only assessed in relation to the valence of the received feedback. However, in order to assess the long-term adaptivity of the found reaction patterns, long-term outcomes including actual health behavior need to be assessed (cf. Renner, Schüz, & Sniehotta, 2008; Sweeny & Shepperd, 2007).

3.4.4 Limitations and suggestions for future research

The present study was limited to the exploration of spontaneous reactions to feedback about two risk factors for cardiovascular disease. Results were highly similar for both risk factors indicating a satisfactory reliability of our findings. However, future research is needed to examine whether the pattern of results can be generalized to other health risks. The present network is based on open-ended verbal responses, thereby providing a measure for initial spontaneous reactions that are consciously
accessible to the participants. However, the array of reactions towards feedback certainly also includes implicit reactions which are by definition not accessible to self-reports. A promising avenue for future research might be to combine different methods such as self-report and physiological measures in order to capture explicit and implicit reaction patterns. The network was derived from reactions to a second wave health risk feedback. While the generated reaction types were largely similar to those after the first feedback (cf. Panzer & Renner, 2008), we cannot rule out that the adaptivity of reactions is impacted by the familiarity with the feedback. Thus, future research is needed to explore the potential unfolding of reactions across repeated risk feedback.

There are cultural differences between our South Korean sample and previously researched Western samples (e.g., Croyle et al., 2006; Ditto et al., 2003, cf. also Ditto & Croyle, 1995), which might have partly contributed to a low degree of self-defensiveness in our sample (cf. Heine & Hamamura, 2007; but see also Sedikides, Gaertner, & Vevea, 2007). While there is some evidence that Westerners might also process self-relevant health risk feedback in an adaptive way (Renner, 2004; cf. also De Hoog, Stroebe, & De Wit, 2005; Liberman & Chaiken, 2003), empirical studies indicate that Eastern samples may be in general less prone to self-biased information processing. Thus, the present South Korean sample might not be representative in terms of the amount of adaptive reactions of European or North American samples. However, multiple group comparisons of reactions to health risk feedback between representative samples from different cultures need to be conducted in order to draw more exhaustive conclusions on the adaptivity of reactions across cultures.

The present results were moreover obtained within a relatively healthy sample. In a less healthy sample, we would probably have found different base rates on the level of specific reactions, e.g. more negative emotions and less positive ones. We would, however, expect similar results with regard to the broad reaction types
generated, their base rates (cf. Panzer & Renner, 2008), and their interrelations. Due to the relatively small number of recipients of non-optimal feedback, our findings regarding the proportion of adaptive reaction patterns within this group need to be interpreted cautiously.

The present study used a network approach to explore spontaneous reactions to health risk feedback for the first time. While we believe that this approach has yielded interesting results from a real-life setting, one of the most promising future directions could be the application of a network approach in an experimental setting, e.g. using the TAA paradigm (Croyle & Ditto, 1990). This would allow for a more rigorous design, randomization of positive and negative feedback, and overall increased internal validity, thereby providing valuable information about the health risk reaction network.

### 3.4.5 Implications

The network of reactions to health risk information could be an effective tool in guiding both research and practice. From a research-oriented perspective, the network could facilitate the selection of core reactions for future studies at the individual and group levels. It can also be used for examining inter-individual differences in the reception of health risk feedback. From a practice-oriented perspective, it could support practitioners in pinpointing reactions which are relevant to their clients. The network could also be used to identify clients with maladaptive reaction patterns, who could then be offered different interventions than those with adaptive reaction patterns might receive. Thus, the network could facilitate the choice of interventions appropriate for the individual patient's needs.
3.5 References


4 Study 3. Looking back at expectations: Hindsight bias after self-relevant feedback in a Korean sample

4.1 Introduction

Hindsight bias is the tendency to remember one's predictions regarding the outcome of an event as more consistent with the outcome than they really were after the outcome becomes known (Fischhoff, 1975; but see Blank, Nestler, von Collani, & Fischer, 2008). The phenomenon of hindsight bias has been demonstrated across a wide range of outcomes (cf. Christensen-Szalanksy & Willham, 1991, and Guilbault, Bryant, Brockway, & Posavac, 2004, for meta-analyses; see Hawkins & Hastie, 1990, for a review) and cultures (Pohl, Bender, & Lachmann, 2002). In particular, hindsight bias has not only been found in Western societies, but also in Eastern ones such as Japan (Heine & Lehman, 1996) or South Korea (Choi & Nisbett, 2000). Despite the apparent ubiquitousness of hindsight bias, however, lack of hindsight bias or even reversed hindsight bias have also been reported (e.g., Pezzo, 2003; Renner, 2003; Schkade & Kilbourne, 1991).

Research on hindsight bias in Eastern societies has typically used outcomes that had little, if any, relevance for the personal life of the study participants: Heine and Lehman (1996), e.g., used almanac-type statements such as “The liver is the largest organ in the human body” (p. 319) which had to be rated as true or false; Pohl et al. (2002) used numerical almanac questions such as “How many bones does a human have?” (p. 274); Choi and Nisbett (2000) used various fictitious vignettes. While such research has confirmed the existence of hindsight bias in Eastern societies, our knowledge of hindsight bias in the East is so far limited to non-self-relevant outcomes. Research conducted in Western societies shows, however, that the self-rel-
The self-relevance of an outcome thus appears to contribute to a reduction of hindsight bias.

In the context of self-relevant outcomes, motivational influences on the hindsight bias have been discussed, based on findings regarding the impact of outcome valence on the hindsight bias, as studied in Western samples. Differential hindsight reactions after favorable and unfavorable self-relevant outcomes have been interpreted as indicator for the influence of motivational processes on hindsight bias. The role of valence and motivational processes in hindsight bias has, to the best of my knowledge, not yet been researched in Eastern countries. In the literature based on Western studies, however, two somewhat contrasting views on the specific motivational processes involved can be found.

On the one hand, some researchers have found a hindsight bias “selectively for favorable outcomes” (compared with unfavorable ones; Louie, Curren, & Harich, 2000, p. 265; cf. also Louie, 1999; Mark et al., 2003). These findings have been interpreted in terms of self-serving mechanisms. In particular, it has been argued that the presence of a hindsight bias after self-relevant positive outcomes could be a sign of taking credit for a positive outcome (Louie, 1999; Louie et al., 2000). In line with this reasoning, Louie (1999) demonstrated that constraints on the ability to take credit for a favorable outcome went along with lower levels of hindsight bias. The effects of various degrees of self-relevance on hindsight bias after negative outcomes have been interpreted similarly: If highly self-relevant negative outcomes are easily foreseeable, an individual should be able to avoid these outcomes (at least if the outcomes are somewhat controllable). Thus, relatively low levels of hindsight bias after such out-
comes could indicate that study participants to some degree avoid blaming themselves for a negative self-relevant outcome (cf. Mark et al., 2003; Mark & Mellor, 1991).

On the other hand, some studies have found a different pattern of results. Renner (2003), for example, found significant levels of hindsight bias immediately after negative unexpected cholesterol feedback in a German sample, while recipients of positive unexpected feedback did not display such a bias. This pattern of results has been interpreted as indicative of fear-control processes: Since reducing the threat posed by high cholesterol levels requires long-term behavioral change, a hindsight bias immediately after the feedback might be a way of coping by restoring a sense of control and self-efficacy for which recipients of positive feedback have little need (cf. also Haslam & Jayasinghe, 1995). In order to interpret the results in terms of fear control, it seems prudent to make sure that negative feedback does indeed elicit a threat, as for example measured by items assessing perceived threat, worry, or pressure to change in response to the feedback (cf. Renner, 2003). The interpretation of differences in hindsight bias in terms of fear control represents an alternative account of motivational influences on the hindsight bias following self-relevant feedback. It is supported by findings from Renner (2003) that several weeks later, recipients of unexpected negative feedback did not display a hindsight bias anymore, and had even shifted towards displaying a reversed hindsight bias, which might represent a change towards danger control. The reactions of recipients of positive feedback, however, did not change over time. Further support for this notion comes from a study by Haslam and Jayasinghe (1995; cf. also Sedlmeier & Jaeger, 2007) who found higher degrees of hindsight bias among students who had predicted their mid-term grades as better than they actually were compared with those who had predicted their grades as worse than they actually were (the latter displayed a reversed hindsight bias). It has been argued that results in line with this account primarily stem from studies with out-
comes that are largely controllable, as opposed to the outcomes researched by Mark and Mellor (1991) or in stock-market game studies (e.g., Louie, 1999; Louie et al., 2000; Mark et al., 2003), which could be viewed as less controllable (cf. Renner, 2003). However, to my knowledge there are no empirical data on the interplay of valence, self-relevance, and controllability of an outcome in the context of hindsight bias.

Besides its valence, the surprise of an outcome has been found to play a role in hindsight bias in the West (Müller & Stahlberg, 2007; Pezzo, 2003; Pezzo & Pezzo, 2007). The sense-making model of hindsight bias (Pezzo, 2003) distinguishes between the level of surprise experienced when first learning about an outcome (initial surprise) and the level of surprise that is left after processing the outcome information (resultant surprise). Both the original model (Pezzo, 2003) and two later variations, the motivated sense-making model (Pezzo & Pezzo, 2007) and the model of surprise as metacognitive information (Müller & Stahlberg, 2007), posit that lower levels of resultant surprise go along with higher levels of hindsight bias. In these models, relatively low levels of resultant surprise are assumed to occur when an outcome has been processed with the result of making sense to an individual. Low levels of resultant surprise are then assumed to bias the recalled expectations towards the actual outcome. Conversely, high levels of resultant surprise are assumed to occur when, after processing, an outcome does not fully make sense to an individual, contributing to comparatively low levels of hindsight bias or even a reversed hindsight bias. For the special case of self-relevant outcomes, motivational processes are taken into account besides the more cognitive processes described in the motivated sense-making model (Pezzo & Pezzo, 2007). This model posits that unexpected self-relevant negative events trigger a sense-making process that is biased towards finding possible external causes for the outcome. If external causes are easy to generate, a hindsight bias will be displayed. A hindsight bias is also predicted to occur if external causes are not easily generated, but if undeniable internal causes come to mind. In both cases, the sense-
making process would be successful, so that resultant surprise would be low. If, on the other hand, external causes are not easily available but it is possible to deny internal causes, the sense-making process would not be successful and the hindsight bias should be reduced (Pezzo & Pezzo, 2007). The sense-making model and its modifications have proven successful in explaining and integrating various findings regarding the role of surprise in hindsight bias in Western countries (Müller & Stahlberg, 2007; Pezzo, 2003; Pezzo & Pezzo, 2007), although I am not aware of any rigorous empirical tests of the motivated sense-making model (cf. also Pezzo & Pezzo, 2007). Again, this research has been conducted with Western samples, whereas there is little research on the role of surprise in hindsight bias in Eastern samples.

Summing up, hindsight bias has, to my knowledge, so far not been studied in the context of self-relevant outcomes in an Eastern sample. Relatedly, in the East the role of motivational processes in hindsight has not yet been explored, nor has the role of outcome valence and resultant surprise been explored. The present study thus aims at exploring hindsight bias after self-relevant feedback in a South Korean sample, with the goals of (1) examining whether hindsight bias would emerge after self-relevant feedback, (2) finding out whether feedback valence would play a role in the emergence of hindsight bias, pointing towards possible motivational influences on the hindsight bias in the East, and (3) exploring the role of resultant surprise. To this end, hindsight bias was studied in a real-life setting, using feedback about a risk factor for cardiovascular disease, namely cholesterol.

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4 Choi and Nisbett (2000) have assessed both surprise and hindsight bias in American and Korean participants, but they focused more on comparing the two samples and on pre-post comparisons of surprise than on relating surprise to hindsight bias. Their results were also obtained with non-self-relevant feedback.
4.2 Method

4.2.1 Participants

A call for a community-based cholesterol screening was made via information leaflets and flyers in multiple public institutions (e.g., universities, parishes) located in Seoul, South Korea. Nine hundred and fifty-one South Koreans participated in the health screening. Of these, 22 participants (2.3%) had to be excluded from the present analyses because they did not complete the foresight measure or because the physiological measures were missing. Another 118 participants (12.4%) failed to complete the hindsight measure. Accordingly, the final sample for the present analyses consists of 811 individuals (85.3%) who provided complete data sets including both foresight and hindsight measures. The mean age of these participants was 32 years ($SD = 17$ years) and 55% were female. Their mean cholesterol level was 167 mg/dl ($SD = 28$ mg/dl), which is below the mean South Korean population cholesterol level of 187 mg/dl (Kang et al., 2006). Within the study sample, 71% of participants expected to obtain optimal cholesterol readings.

The data from the 140 individuals who were excluded from the present analyses were considered in control analyses. Of these 140, 68% were female, and their mean age was 42 years ($SD = 20$ years). Their mean cholesterol level was 179 mg/dl ($SD = 30$ mg/dl). Within the control sample, 69% expected optimal cholesterol levels. Analyses showed that the final sample was on average 10 years younger ($t(173) = -5.49, p < .001$) and comprised a higher proportion of male participants ($X^2(1) = 8.61, p = .003$) than the control sample. Consistent with the younger age of the study

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5 Participants took also part in a blood pressure screening in the course of the same study. The present analyses are, however, based on a subset of participants who received unexpected feedback (cf. 4.3.1 and 4.3.2). For blood pressure feedback, that subset was substantially (i.e. 30%) smaller than for cholesterol, resulting in a considerably reduced power for some of the reported analyses. The present paper is therefore solely based on results from the cholesterol screening part of the study.
sample, cholesterol levels were lower in the study sample (t(164.58) = -4.29, p < .001). Both samples did not differ with regard to the proportion of participants expecting optimal cholesterol levels (X²(1) = 0.09, p = .82).

4.2.2 Measures

A memory design was used to assess hindsight bias, which means that expectations regarding the outcome were assessed both before and after feedback. Foresight estimations were assessed in a questionnaire administered immediately before the screening. Participants were asked: “Immediately after completing this questionnaire, your cholesterol level will be measured. What cholesterol level do you expect?” Answers were given on rating scales from 1 very low through 4 normal to 7 very high. Responses from 1 very low to 4 normal were classified as expectations of optimal feedback whereas responses from 5 somewhat high to 7 very high were classified as expectations of non-optimal feedback.

Immediately after the feedback, participants filled in a second questionnaire. The hindsight estimation was included in this questionnaire, with the item “What cholesterol reading did you expect?” Answers were given on the same rating scale used for the foresight estimation. Resultant surprise was measured via the question “How surprised were you by the results of your cholesterol test?” Answers were given on a scale from 1 very surprised to 7 not at all surprised. Additionally, three items aiming at feelings of threat were included: Participants were asked to rate their concern about their test result (1 not at all concerned through 7 extremely concerned) and how serious a threat to health their result is (1 not serious, can be ignored through 7 very serious, life threatening). Participants also rated their agreement with the statement “It is necessary for me to take action in order to lower my cholesterol level” (1 exactly true to 4 not at all true).
4.2.3 Procedure

At the screening site, participants were asked to answer a first questionnaire containing the foresight estimations. During the following screening, trained laboratory assistants measured participants’ total cholesterol levels. After each measure, participants were provided with their exact actual reading, and they received a standardized feedback on their risk category according to international guidelines (cf. WHO, 2004). Oral feedback was given by trained medical staff, and supplemented by a feedback sheet displaying the individual test results. Thus, participants with a cholesterol level of ≤ 200 mg/dl were told that their reading was normal and did not pose a risk for cardiovascular diseases. Individuals with either a borderline high reading (between 201–239 mg/dl) or a high reading (> 239 mg/dl) were informed about the potential risks of borderline high and high readings for cardiovascular diseases. After the screening, participants received a second questionnaire containing the items related to hindsight, surprise, and feelings of threat. This questionnaire was to be completed immediately at the screening site.

4.3 Results

4.3.1 Foresight accuracy and cholesterol test results

Participants with normal readings were included in the optimal feedback valence group, whereas individuals with borderline high or high readings were included in the non-optimal feedback valence group. Screening results were optimal for 707 (87%) participants, whereas non-optimal screening results were received by 104 (13%) participants.

Participants were classified as having received expected feedback if feedback valence and expectations matched (e.g., expectations of optimal feedback followed by feedback of optimal valence). If feedback valence was different from participants’
expectations, individuals were classified as having received unexpected feedback (e.g., expectations of optimal feedback followed by feedback of non-optimal valence). A match between the expected and the actual feedback was shown by 68% of recipients. In particular, 509 (63%) participants received optimal cholesterol feedback expectedly while 40 (5%) were expectedly confronted with non-optimal cholesterol feedback. However, 64 (8%) participants expected optimal cholesterol feedback but received non-optimal feedback, while 198 (24%) expected non-optimal cholesterol feedback but received optimal feedback.

4.3.2 Hindsight estimates: Classification

Only these latter participants whose foresight estimation did not match with the actual feedback could theoretically display either accurate recall of their foresight estimates, hindsight bias, or reversed hindsight bias. Among those who correctly foresaw their feedback, a hindsight bias could not have been found: It would be impossible to tell which of two estimates of equal valence (e.g., positive foresight and positive hindsight) is closer to a feedback of the same valence. Thus, in these cases, only accurate recall or a decrease in accuracy could be found. The present study therefore focuses on hindsight following unexpected feedback.

In order to determine which participants showed accurate recall, hindsight bias, or reversed hindsight bias, each participant’s hindsight estimate was subtracted from his or her foresight estimate. If the difference was zero, foresight and hindsight were identical, thus the foresight estimate was correctly recalled in hindsight and the participant did not show any kind of bias. In order to determine the presence of hindsight or reversed hindsight bias, feedback valence had to be taken into account: After unexpected positive feedback, a hindsight estimate lower than the foresight estimate is closer to the feedback and thus indicative of hindsight bias, whereas a hindsight estimate exceeding the foresight estimate is further away from the feedback and thus indicative of a reversed hindsight bias. For unexpected negative feedback, this is
reversed: A hindsight estimate exceeding the foresight estimate is closer to the feedback, thus indicative of hindsight bias, whereas a hindsight estimate lower than the foresight is further away from the feedback and indicative of a reversed hindsight bias. Following this reasoning, each participant was classified as displaying accurate recall, hindsight bias, or reversed hindsight bias, taking into account the valence of his or her feedback.

4.3.3 Hindsight bias as a function of feedback valence

Of the 262 participants who received unexpected feedback, 122 (47%) correctly recalled their foresight estimate, 127 (48%) displayed a hindsight bias, and 13 (5%) displayed a reversed hindsight bias. With 48% displaying a hindsight bias and merely 5% displaying a reversed bias, there is a clear systematic recall bias ($\chi^2(1) = 88.01$, $p < .001$).

The proportions of these three reaction types hindsight bias, no bias, and reversed bias varied significantly between those who received unexpected positive vs. unexpected negative feedback ($\chi^2(2) = 23.94$, $p < .001$): Among the 198 participants who unexpectedly received positive cholesterol feedback, 56% (111) recalled their foresight estimate as more positive than it actually was, thereby displaying a hindsight bias. Among the 64 recipients of unexpected negative feedback, a considerably lower proportion of 25% (16) displayed a hindsight bias, recalling their foresight estimate as more negative than it actually was. Conversely, the proportion of correctly recalled foresight estimates was, at 41% (82 participants), lower among recipients of positive than among those of negative feedback, among whom 63% (40 participants) showed accurate recall. A reversed hindsight bias was shown by 3% (5) of those who received positive feedback: They recalled their foresight estimate as more negative than it actually was. Among recipients of negative feedback, 12% (8) displayed a reversed hindsight bias by recalling their foresight estimate as more positive than it actually was.
Additional Chi-square tests revealed that among the 24 recipients of unexpected negative feedback who did not display accurate recall, reversed hindsight bias (displayed by 16 recipients) and hindsight bias (displayed by 8 recipients) were equally frequent ($X^2(1) = 2.67, p = .10$). Conversely, among the 116 recipients of unexpected positive feedback who did not recall their foresight estimates accurately, hindsight bias (displayed by 111 recipients) was clearly more frequent than reversed hindsight bias (displayed by 5, $X^2(1) = 96.82, p < .001$).

### 4.3.4 Feelings of threat by feedback valence

Three one-way ANOVAs were conducted with feedback valence (positive, negative) as between-subjects factor and worry, perceived threat to health, and pressure to change as dependent variables. Recipients of unexpected negative feedback expressed more worry ($M = 3.70, SD = 1.76$) than recipients of unexpected positive feedback ($M = 2.61, SD = 1.66, F(1) = 20.49, p < .001$). They also perceived their test result as more threatening to their health ($M = 4.68, SD = 1.24$) than the latter ($M = 4.11, SD = 1.75, F(1) = 5.81, p < .05$), and they felt more pressure to change ($M = 1.91, SD = 0.61$) than recipients of unexpected positive feedback ($M = 2.27, SD = 0.89, F(1) = 9.24, p < .01$, please note that higher values indicate less pressure to change). Thus, recipients of negative feedback did in fact feel more threatened by the feedback than recipients of positive feedback.

### 4.3.5 The role of surprise

Before analyzing the responses to the surprise item, the item was recoded, so that higher values indicate more resultant surprise (instead of less), with a value of 1 indicating no surprise at all after recoding and a value of 7 now indicating very high surprise. All following analyses are based on the recoded surprise item.

Firstly, a one-way ANOVA was conducted to determine whether recipients of positive and negative feedback (between-subjects factor feedback valence) rate their
results as equally surprising. Results indicate that recipients of unexpected negative feedback expressed marginally more surprise ($M = 3.30, SD = 2.02$) than recipients of unexpected positive feedback ($M = 2.79, SD = 1.80, F(1) = 3.57, p = .06$). Thus, recipients of positive feedback displayed more hindsight bias and tended to be less surprised at the same time, compared with recipients of negative feedback.

In order to examine the relationship between a display of hindsight bias and surprise more directly, a second one-way ANOVA was conducted with the between-subjects factor reaction type (accurate recall, hindsight bias, reversed hindsight bias) and surprise as dependent variable. A significant main effect was found ($F(2) = 5.49, p = .005$), indicating that recipients with different reaction types differ with regard to the amount of surprise they reported about their feedback: The mean surprise ratings were lowest among those who displayed a hindsight bias ($M = 2.54, SD = 1.66$), followed by those with accurate recall ($M = 3.22, SD = 1.93$), while they were highest among those who displayed a reversed hindsight bias ($M = 3.69, SD = 2.43$). Post hoc tests revealed that those who displayed a hindsight bias expressed significantly less surprise than those with accurate recall ($p = .01$), whereas the differences between those who displayed a reversed hindsight bias and any of the other two groups did not reach significance ($ps > .10$).\(^6\) It should be noted that the surprise means for all groups were within the lower half of the scale, indicating that none of the groups appeared highly surprised in absolute terms.

### 4.4 Discussion

The present study examines hindsight bias for a self-relevant outcome in an Eastern sample for the first time. Results indicate that Korean participants did display hindsight bias after unexpected cholesterol feedback. However, feedback valence played a

\(^6\) It is important to note that the group of recipients displaying a reversed bias merely comprises thirteen people; the power for tests including this group is thus small.
role: Recipients of positive feedback were more likely to show hindsight bias than recipients of negative feedback. They were also marginally less surprised than the latter. Specifically, recipients displaying a hindsight bias were less surprised than those who did not display a bias.

4.4.1 Overall levels of hindsight bias

Overall, recipients of unexpected cholesterol feedback displayed accurate recall and hindsight bias almost equally frequently (47% and 48%, respectively), whereas a reversed hindsight bias was rarely displayed (by 5%). Thus, a substantial amount of hindsight bias was found following self-relevant feedback in an Eastern sample. So far, hindsight bias had been demonstrated for non-self-relevant and self-relevant outcomes in the West (cf. Christensen-Szalansky & Willham, 1991; Guilbault et al., 2004; Hawkins & Hastie, 1990, for overviews) and for non-self-relevant outcomes in the East (Choi & Nisbett, 2000; Heine & Lehman, 1996; Pohl et al., 2002). The present results demonstrate that hindsight bias after self-relevant outcomes is not limited to Western samples, and that hindsight bias in Eastern samples is not limited to non-self-relevant outcomes.

4.4.2 Feedback valence

Among recipients of unexpected negative cholesterol feedback, a lower proportion displayed hindsight bias and a larger proportion displayed accurate recall of their foresight estimates than among recipients of unexpected positive feedback. Moreover, recipients with inaccurate recall were more likely to show hindsight bias than reversed hindsight bias after unexpected positive feedback, but equally likely to show both types of bias after unexpected negative feedback. It is important to note

7 Moreover, a slightly higher proportion displayed a reversed hindsight bias after negative compared with positive feedback, but since the absolute group sizes for reversed hindsight bias were extremely small (≤ 8), the present sample does not seem fit to interpret this result.
that both positive and negative feedback were unexpected. Since all recipients were thus initially surprised by their feedback, it seems plausible to assume that different levels of hindsight bias after positive and negative feedback are at least partly due to motivational processes (cf. also Renner, 2003). This argument is also supported by the higher levels of threat reported by recipients of negative compared with positive feedback.

The present results appear in line with Western studies that have demonstrated a higher amount of hindsight bias after positive compared with negative self-relevant feedback (Louie, 1999; Louie et al., 2000 – but see Renner, 2003), and with Western studies that have demonstrated particularly low levels of hindsight bias for self-relevant negative feedback (Mark et al., 2003; Mark & Mellor, 1991). These results have typically been interpreted in self-serving terms: Hindsight bias is viewed as a sign of taking credit for the outcome, whereas the absence of hindsight bias is seen as a sign of avoiding taking credit (Louie, 1999; Louie et al., 2000; cf. also Mark et al., 2003; Mark & Mellor, 1991). Following this reasoning, higher levels of hindsight bias following positive feedback can be interpreted as a sign of taking credit for a positive self-relevant outcome whereas low levels of hindsight bias following negative feedback can be interpreted as avoiding blame. It is thus possible to interpret the present results in self-serving terms, which is particularly interesting in light of an ongoing debate about whether Easterners differ from Westerners with regard to self-enhancement (cf. Heine & Hamamura, 2007; Heine, Kitayama, & Hamamura, 2007; but see also Sedikides, Gaertner, & Vevea, 2005, 2007).

At first sight, the present results appear less in line with results from Renner (2003), who found hindsight bias immediately after negative unexpected cholesterol feedback with a shift towards reversed hindsight bias over the course of several weeks among recipients of negative feedback. In the present study, hindsight estimates have been assessed somewhat later after the feedback than Renner’s first assessment, as
participants had completed a general thought-listing task in between (cf. Panzer & Renner, 2008). It is therefore possible that recipients of negative feedback in the present study were in the middle of a shift from initial hindsight bias towards a reversed bias, and that this is reflected by their largely accurate recall of foresight estimates. In that case, the underlying motivational processes could be markedly different (cf. Haslam & Jayasinghe, 1995; Renner, 2003). However, this account fits less well with the emergence of hindsight bias following unexpected positive feedback found in the present study.

4.4.3 Resultant surprise

The present results indicate that, across feedback valence, recipients who display a hindsight bias report less resultant surprise than those who display accurate recall. This is in line with findings in Western samples in which lower levels of resultant surprise go along with higher levels of hindsight bias (e.g., Ofir & Mazursky, 1997; cf. also Pezzo, 2003). It is also in line with the sense-making model of hindsight bias (Pezzo, 2003; Pezzo & Pezzo, 2007), which posits that successful sense-making of an outcome makes an outcome less surprising, with low levels of surprise serving as cue for the plausibility of the outcome in hindsight, thus contributing to hindsight bias. The present results suggest that it might be possible to successfully apply the sense-making model of hindsight bias not only to Western, but also to Eastern samples.

However, feedback valence was also found to play a role in resultant surprise: Although all recipients received unexpected feedback, recipients of negative feedback reported marginally more resultant surprise than recipients of positive feedback. While these findings were only marginally significant, there appears to be a tendency for the group displaying more hindsight bias to display lower levels of resultant surprise, and for the group displaying less hindsight bias to show more resultant surprise. It is possible to explain this tendency in line with the sense-making model (Pezzo, 2003) and the motivated sense-making model (Pezzo & Pezzo, 2007). However, since
the results are only marginally significant and since causal attributions of the test result, which would give a more direct measure of sense-making, were not assessed, any explanation in terms of these models remains somewhat speculative. At present, it seems only safe to conclude that the present findings do not contradict these models.

4.4.4 Limitations and Ideas for Future Research

In contrast to many studies on hindsight bias, a real-life self-relevant outcome was used in the present study. Hindsight bias after a self-relevant outcome was demonstrated in an Eastern sample, with higher levels of hindsight bias and marginally lower levels of resultant surprise after unexpected positive compared with unexpected negative feedback. The use of a real-life outcome increases the external validity of the present findings, and previous research from the RACK project reveals that a large portion of participants in fact do look back on their expectations in hindsight spontaneously (Panzer & Renner, 2008; cf. also Panzer & Renner, 2009). However, a more rigorous experimental laboratory setup seems well suited to examine the stability of the findings, and to address several shortcomings of the present study.

Firstly, the present study examined hindsight bias and resultant surprise following positive and negative self-relevant feedback. However, the underlying cognitive and motivational processes were not directly examined. It seems desirable to measure these processes more directly in future studies to allow more definite conclusions. For example, it would surely be interesting to include measures aimed at assessing the sense-making process more directly, particularly ones that are suited for detecting self-serving processes. To measure internal vs. external attributions could be a first step in that direction (cf. also Pezzo, 2003). Without such measures, any attempt to explain levels of hindsight bias in terms of sense-making processes remains rather indirect and open to alternative explanations. Similarly, measures of self-serving attributions over time as well as measures of perceived controllability could be helpful to shed more light on the nature of any motivational processes.
Secondly, the main analyses within the present study are based on a sub-sample of the 32% of participants who received unexpected feedback, since only these participants could display either hindsight bias, accurate recall, or a reversed hindsight bias following a feedback that was essentially dichotomous by nature (optimal, non-optimal). Thus, all participants were initially surprised as defined by Pezzo (2003). Future studies could be set up so that outcome and measurement of expectations are suited to assess all three potential reaction types after both expected and unexpected feedback. This would allow for an examination of the interaction of feedback valence and feedback expectedness, and for a more complete examination of the generalizability of present models of hindsight bias to Eastern samples. Again, an experimental setup seems well suited to these aims.

Thirdly, few (i.e. 13 out of 262) recipients of unexpected feedback displayed a reversed hindsight bias. Among recipients of negative feedback, 12% displayed a reversed hindsight bias, but only 3% of those who received positive feedback did so. Among those who displayed a reversed bias, resultant surprise appeared higher than among recipients who displayed a hindsight bias or accurate recall. It is not possible, however, to interpret these latter results safely, because the low absolute number of recipients displaying a reversed hindsight bias diminishes the power of the respective analyses. Future research is thus needed to explore the role of reversed hindsight bias in greater depth, for example by employing a larger sample.

4.4.5 Implications

To my knowledge, this is the first study to demonstrate hindsight bias following a self-relevant outcome (namely unexpected cholesterol feedback) in an Eastern sample. In line with some research from the West, feedback valence was found to play a role: Higher levels of hindsight bias and marginally lower levels of resultant surprise were found after positive compared with negative feedback, suggesting that self-serving motivational processes might be at work. Participants displaying hindsight bias repor-
ted less resultant surprise than participants displaying accurate recall. Thus, similar
relations between hindsight bias and surprise were found as in Western samples.
These findings give a first hint that hindsight bias following self-relevant feedback
might follow similar processes as discovered in Western samples. However, these con-
cclusions remain tentative until the processes underlying hindsight bias are examined
more directly.

4.5 References

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5 General discussion

5.1 Summary

The present dissertation encompasses three studies aimed at exploring the reception of individual health risk feedback, using blood pressure and cholesterol feedback in a South Korean sample as an example. Most empirical research on the reception of individual health risk feedback has so far been conducted following a researcher-oriented approach, i.e. focusing on the analysis of single cognitive reactions pre-selected by the researcher, such as the particularly well-researched perceived test accuracy (cf. Chapter 1.2.1). The first two studies within the present dissertation (cf. Chapters 2 and 3) contrast this view with a more recipient-oriented approach, in which recipients of health risk feedback are free to express any type of reaction they wish (cf. Chapter 1.2.2). After identifying which factors seem relevant to feedback recipients, the third study within the dissertation (cf. Chapter 4) provides a more detailed examination of one of them, namely looking back on pre-feedback expectations in hindsight. This latter study (Chapter 4) follows a more traditional researcher-oriented approach. Results are discussed within the larger research context (cf. Chapter 5.2), such as the debate about distortion and adaptivity in the reception of health risk feedback, hindsight bias research, and the usefulness of adopting a recipient-oriented approach. First, however, the main findings of the present thesis are summarized in Table 2.
Table 2: Main findings of the present dissertation.

<table>
<thead>
<tr>
<th>Study</th>
<th>Aim(s)</th>
<th>Result(s)</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To broadly explore array and base rates of spontaneous reactions towards individual health risk feedback.</td>
<td>The array of spontaneous reactions can be reliably and comprehensively captured by eight dimensions: Emotions, risk feedback valence, feedback expectedness, future lifestyle, attributions, implications for health, need for information, and acceptance. The first four reaction dimensions were most frequently generated, whereas the last three were generated comparatively rarely. Base rates were stable across feedback valence (optimal, borderline high, high), with the exception of future lifestyle which was mentioned rarely after optimal feedback.</td>
<td>Reactions which seem most relevant to recipients of individual health risk feedback differ substantially from those which have been the center of attention in previous research. Consideration of feedback valence, expectedness, and future lifestyle makes spontaneous reactions appear adaptive.</td>
</tr>
<tr>
<td>2</td>
<td>To explore array, base rates, and co-occurrences of spontaneous reactions towards individual health risk feedback on a more specific level, applying a network perspective. To use the network for identifying reaction patterns of varying adaptivity.</td>
<td>Emotions, risk feedback valence, feedback expectedness, and future lifestyle form large and well-connected nodes in a network of reactions towards individual health risk feedback. Reaction patterns in accordance with the valence of the feedback were predominant after both positive and negative feedback.</td>
<td>The network presents a first step towards a cognitive-affective domain map of reactions towards risk feedback, in which emotions, risk feedback valence, feedback expectedness, and future lifestyle play the most prominent roles. Reaction patterns identified through the network appear predominantly adaptive, even after negative feedback.</td>
</tr>
<tr>
<td>3</td>
<td>To explore hindsight bias following self-relevant feedback in an Asian sample, including the role of feedback valence and resultant surprise.</td>
<td>Hindsight bias was found, with higher levels of bias and marginally lower levels of resultant surprise after unexpected positive compared with unexpected negative feedback. Those who displayed the bias reported lower levels of resultant surprise than those whose hindsight estimates were accurate.</td>
<td>Hindsight bias in Eastern samples can occur after self-relevant outcomes. Feedback valence and surprise appear to play a similar role in our sample as in Western ones. Results point to the presence of motivational processes in an Eastern sample.</td>
</tr>
</tbody>
</table>
5.2 The results in context

In the following, the main findings of the three studies conducted for the present thesis will be discussed in their research context, taking relevant theoretical models and previous empirical research into account and pointing out how the present dissertation advances knowledge regarding the reception of individual health risk feedback.

5.2.1 Value of the recipient-oriented approach

Most research on the reception of individual health risk feedback follows a researcher-oriented approach, meaning that the reactions studied have been pre-selected by the researcher. By pursuing a recipient-oriented, rather than a researcher-oriented, approach in Studies 1 and 2 (cf. Chapters 2 and 3), it was possible (1) to develop a comprehensive and reliable system for classifying reactions to individual health risk feedback (cf. 5.2.1.1), (2) to discover four reactions which appear particularly relevant to feedback recipients, some of which have received little attention previously (cf. 5.2.1.2), and (3) to develop a network of reactions towards individual health risk feedback which can be useful to research and practice (cf. 5.2.1.3).

5.2.1.1 Classifying reactions towards individual health risk feedback

Following the recipient-oriented approach, a thought listing task (Cacioppo & Petty, 1981) was employed to provide recipients with the opportunity to express any reaction they wished in response to their health risk feedback. In order to classify the array of spontaneous reactions expressed via the thought listing task, a coding system was developed, using a combined deductive-inductive approach (cf. Chapters 2 and 3). Reactions were assessed on the level of broad reaction dimensions (namely emotions, risk feedback valence, expectedness, future lifestyle, implications for future health, attribution, need for information, acceptance, and comparison with previous results in the case of repeated feedback, cf. Chapters 2 and 3) as well as on the level of
specific reactions within each dimension (e.g., positive vs. negative emotions, expected vs. unexpected result etc., cf. Chapter 3). Interrater agreement was consistently greater than 89%, and Fleiss' kappa (Fleiss, 1971) was typically substantial or almost perfect (cf. Landis & Koch, 1977), with extremely few exceptions (cf. Study 2). Overall, results from interrater agreement analyses thus imply that the coding system can be considered reliable. Less than 9% of all material coded was allotted to the residual category (cf. Chapters 2 and 3). Generally accepted guidelines for the maximum size of a residual category appear absent because its size varies with the method with which the coding units were obtained (e.g., interview, thought listing etc.) and the breadth of both topic and prompt (e.g., more or less specific interview question on a narrow vs. broad topic; cf. Krippendorff, 2004). With coding material in response to a broad thought listing task and coverage of 91% of the material generated, the present coding system appears fairly comprehensive. To my knowledge, no similar system for classifying reactions towards individual health risk feedback existed previous to the present work. The development of a reliable and comprehensive coding system from the pursuit of a recipient-oriented approach can therefore in itself be seen as a useful addition to research. It allows for structuring the array of possible reactions, and it can be used by others in order to pursue different research questions regarding the reception of individual health risk feedback, as for example the reception of feedback about different health risks, or feedback given in different contexts.

5.2.1.2 Big four reactions towards individual health risk feedback

Emotions, risk feedback valence, feedback expectedness, or future lifestyle were the most frequent reactions in response to cholesterol and blood pressure risk feedback in both studies (cf. Chapters 2 and 3) and might thus be seen as the "big four" of spontaneous reactions towards individual health risk feedback (cf. Chapter 3).

*Emotions.* Of these, emotions were the most frequent response after blood pressure and cholesterol feedback in both studies (cf. Chapters 2 and 3). This is espe-
cially interesting as research on the reception of health risk feedback has focused on cognitive reactions for a long time (e.g., Cioffi, 1991; Croyle, 1990; Croyle, Sun, & Louie, 1993, Study 2; Ditto & Boardman, 1995; Ditto & Jemmott, 1989, Study 1; Ditto, Jemmott, & Darley, 1988; Ditto & Lopez, 1992; Ditto et al., 1998; Jemmott, Ditto, & Croyle, 1986). More recently, emotional reactions have sometimes been assessed, but their assessment has typically been limited to negatively valenced ones such as fear or worry (e.g., Andrykowski, Boerner, Salsman, & Pavlik, 2004; Das, De Wit, & Stroebe, 2003; De Hoog, Stroebe, & De Wit, 2005; French, Hevey, Sutton, Kinmoth, & Marteau, 2006; French, Maissi, & Marteau, 2004, 2006; Hagger & Orbell, 2006; Lipkus, McBride, Pollak, Lyna, & Bepler, 2004; Michie et al., 2002; Wardle et al., 2003). In a few studies, positively valenced emotions were initially assessed, but barely analyzed later (e.g., Bowen, Fries, & Hopp, 1994; Fries, Bowen, Hopp, & White, 1997; Harris & Napper, 2005). However, positively valenced emotional reactions appear frequent, and may even be more relevant to a sample of relatively healthy feedback recipients than negatively valenced ones, as indicated by their large proportion (cf. Chapter 3). It might therefore be interesting to further explore the role of positive emotional responses towards individual health risk feedback – for example, whether the presence of positive emotions after negative feedback, or the absence of them after positive feedback, could be indicative of a larger reaction pattern with potentially adverse consequences like repeated re-testing after positive or lack of intentions to change after negative feedback.

Likewise, emotional reactions are largely absent from models of health behavior change such as the Health Action Process Approach (HAPA, Schwarzer, 1992, 2001, 2008a, 2008b) or the Theory of Planned Behavior (TPB; Ajzen, 1985, 1991; Ajzen & Albarracín, 2007), which aim at predicting health behavior from a set of cognitive variables, such as intentions, planning, or self-efficacy (Schwarzer, 2008a, 2008b). There is, however, some research that points to the importance of emotional
reactions with regard to behavior, such as the risk as feelings hypothesis (Loewenstein, Weber, Hsee, & Welch, 2001; cf. also Slovic, Finuncane, Peters, & MacGregor, 2004). Recently, affective beliefs were for example found to be powerful predictors for smoking and driving above the speed limit (Lawton, Conner, & Parker, 2007). While the present studies do not explore the role of emotions in health behavior change, they do point to the prevalence and potential relevance of emotional reactions towards individual health risk feedback. It therefore seems worthwhile to further investigate the role of emotions in the reception of health risk feedback, up to their potential role in health behavior change.

**Risk feedback valence.** Reactions pertaining to the valence of the feedback were also generated frequently (cf. Chapters 2 and 3), supporting the notion that feedback valence is important in the reception of individual health risk feedback. Numerous empirical studies have shown that individual health risk feedback is usually perceived differently dependent on its valence (e.g., in recent years by Croyle et al., 2006; De Hoog et al., 2005; Ditto et al., 2003; Lipkus et al., 2004). Feedback valence is also the core variable in *motivated reasoning* (MR; Kunda, 1990), a popular approach towards researching reactions to individual and general risk information (e.g., Croyle et al., 2006; Kiviniemi & Rothman, 2006; Liberman & Chaiken, 2003; cf. Croyle, Sun, & Hart, 1997 for an overview of MR in earlier research on the reception of individual health risk feedback). Feedback valence is also acknowledged by more recent models such as the quantity of processing view (QoP, Ditto & Lopez, 1992; Ditto et al., 1998, 2003) and the cue adaptive reasoning account (CARA, Renner, 2004). Thus, there is consensus that feedback valence is crucial for the reception of individual health risk feedback, and the present findings support this view.

**Feedback expectedness.** Thirdly, recipients of blood pressure or cholesterol feedback frequently expressed thoughts regarding the expectedness of their results, implying that feedback expectedness is immediately relevant to them (cf. Chapters 2
and 3). Compared with feedback valence, feedback expectedness has received little attention in empirical research on the reception of individual health risk feedback (but see Bowen et al., 1994; Renner, 2004), and it is absent from models such as MR or QoP. CARA, however, maintains the view that feedback expectedness is an important determinant of feedback reception besides feedback valence (Renner, 2004). Renner (2004) has shown that not only negative, but also unexpected feedback is processed more deeply compared with positive expected feedback. Feedback expectedness is thus related to processing depth, and thereby to other reactions, such as pressure to change (cf. Renner, 2004). Results from Studies 1 and 2 point to the relevance of feedback expectedness, and are thus in line with CARA (cf. also Chapter 5.2.2).

Future lifestyle. Thoughts regarding future lifestyle, and in particular lifestyle change, were also frequently generated. Thoughts about future lifestyle are particularly prominent in health behavior change models: Intentions, e.g., play an important role in HAPA (cf. Schwarzer, 1992, 2001, 2008a, 2008b), TPB (Ajzen, 1985, 1991; Ajzen & Albarracín, 2007), and the corresponding wealth of empirical studies. Intentions to change and preceding cognitions such as self-efficacy are seen as important predictors of health behavior (but see e.g., Schwarzer, 2001, 2008a; Schwarzer & Luszczynska, 2008; Schwarzer & Renner, 2000, for the role of post-intentional processes, including forms of self-efficacy such as coping self-efficacy). Although future lifestyle is thus a core concept in health psychology, empirical research on immediate reactions towards individual health risk feedback has largely focused on feedback-oriented cognitive reactions such as acceptance (cf. Chapter 1.4.4) and has only occasionally included items pertaining to future lifestyle change. Where future lifestyle change was included, results point out that recipients of unfavorable risk information are at least as prone (Bowen et al., 1994; Fries et al., 1997) or more prone to change (Croyle et al., 1993; De Hoog et al., 2005; Johnson, Trimbath, Petersen,
Griffin, & Giardiello, 2002; Liberman & Chaiken, 2003) as recipients of favorable information. This is in line with the present results (cf. Chapters 2 and 3) that show that a substantial amount of feedback recipients already think about lifestyle, and in particular about lifestyle change, early after the feedback was given, and that this is especially true for recipients of negative feedback (cf. Chapter 2).

In contrast to the other three frequent reaction types, reactions pertaining to future lifestyle were frequently generated singly (cf. Chapter 3). This could be indicative of some recipients taking a comparatively direct and intuitive pathway to behavior change, as suggested for example in work on the risk-as-feelings hypothesis (Loewenstein et al., 2001; Slovic et al., 2004). It might be worthwhile to investigate whether recipients who focus immediately on future lifestyle might be more prone to this reaction mode as compared to the more commonly researched relatively analytic and rational pathway.

Other reaction types. Compared with the „big four“ reaction types emotions, risk feedback valence, feedback expectedness, and future lifestyle, other reactions turned out to be comparatively rarely generated. Implications for future health or need for information were rarely mentioned by feedback recipients, and reactions related to feedback acceptance appear of particularly little immediate relevance to feedback recipients, despite their frequent inclusion in previous research (assessed, e.g., by Croyle & Sande, 1988; Croyle et al., 1993; De Hoog et al., 2005; Ditto et al., 1988, 1998, 2003; Ditto & Lopez, 1992; Lipkus et al., 2004; Michie et al., 2002; Hadjistravopoulos, Craig, & Hadjistravopoulos, 1998; Renner, 2004). The pursuit of a recipient-oriented approach has therefore shown some interesting discrepancies in the reactions typically assessed in research and those brought up spontaneously by feedback recipients. It seems worthwhile to further pursue the role of the „big four“ reactions in the reception of health risk feedback, with particular attention to emotions and feedback expectedness, which currently seem especially underrepresented.
5.2.1.3 Health risk reaction network

The use of a recipient-oriented instead of a researcher-oriented approach has made the development of a network of reactions towards individual health risk feedback possible. In Study 2 (cf. Chapter 3), a network of reactions towards health risk feedback was built upon information about the array, frequency, and co-occurrence of broad reaction dimensions, as well as about the array and frequency of specific reactions obtained from following a recipient-oriented approach. The choice of a network format made it possible to clearly display a wealth of largely new information about reactions towards individual health risk feedback at a glance, and the network thus contributes to research on the reception of individual health risk feedback. It can be seen as a first step towards a cognitive-affective map in that domain. The development of such domain-specific maps has been proposed from the cognitive-affective systems theory of personality (CAPS, Mischel & Shoda, 1995; Shoda & Mischel, 2006). A cognitive-affective domain map should include both mental representations and their relationships (Mischel & Shoda, 1995) and can be used as a guidance about the „range of cognitions and affects, and their potential organization“ (Mischel & Shoda, 1995, p. 259). Within the present network, each node (such as emotions or future lifestyle) could be viewed as a mental representation, and together they give a first view at the range of cognitions and affects that appear relevant to recipients of individual health risk feedback. Their co-occurrences, displayed through network paths, can be seen as indicative of the relationships, giving information about the potential organization of cognitions and affects. Following CAPS, individuals can be placed within a cognitive-affective domain map according to the particular cognitions and affects they display (cf. Mischel & Shoda, 1995). The present network could thus serve as a group-level picture about reactions towards individual health risk feedback against which the reactions of individual recipients can be evaluated by researchers or practitioners. In a similar vein, the network can be utilized to explore particular reaction patterns, as demonstrated in Study 2 (cf. Chapter 3, see also Chapter 5.2.2). It
could also provide some guidance for the selection of reactions for future studies, making it a potentially useful tool for future research.

5.2.2 Findings in relation to the debate about distortion and adaptivity in the reception of individual health risk feedback

In Section 5.2.1, three main findings from following a recipient-oriented approach in two of the three studies contained in the present dissertation (Studies 1 and 2, cf. Chapters 2 and 3) have been discussed. In the present section, the results of all three studies are discussed with regard to the debate about distortion and adaptivity in the reception of individual health risk feedback. The first subsection contains a discussion about the extent to which the present findings support MR, and the second subsection entails a discussion of the present findings in relation to CARA, focusing on the adaptivity of reactions towards individual health risk feedback while taking the role of feedback expectedness into account.

5.2.2.1 Support for motivated reasoning

To what extent do the present findings support MR? Firstly, as pointed out in Chapter 5.2.1.2, results from Studies 1 and 2 indicate that feedback valence is one of the “big four” reactions towards individual health risk feedback, appearing relevant to a large proportion of recipients immediately after the feedback. Additionally, results from Study 3 suggest that hindsight on pre-feedback expectations differs in dependence on feedback valence, with recipients of positive unexpected feedback being more likely to display hindsight bias than recipients of negative unexpected feedback. Thus, results from all three studies suggest that feedback valence is an important variable in the context of the reception of individual health risk feedback. This is in accordance with the importance that MR assigns to feedback valence (e.g., Kiviniemi & Rothman, 2006; Kunda, 1990; Liberman & Chaiken, 2003), also in the reception of health risk
feedback (e.g., Croyle et al., 2006; cf. Croyle et al., 1997, for an overview). Thus, the present findings yield some support for one of the basic assumptions of MR.

Secondly, results from Study 2 (cf. Chapter 3) suggest that more reaction patterns are in accordance with feedback valence after positive compared with negative feedback. After positive feedback, more than 90% of identifiable patterns reflected the positive valence of the feedback through reports of positive emotions, positive feedback valence, or positive implications for future health and the absence of similar negatively valenced reactions (cf. Chapter 3). After negative feedback, a smaller proportion of 50% to 73% of identifiable patterns reflected the negative valence of the feedback in a similar way. This difference in the proportion of matching patterns could be explained from a MR perspective: Recipients of positive feedback received a result that may contribute to a positive self-view and should thus be easily accepted. By contrast, recipients of negative feedback received a result that is potentially threatening to a positive self-view, hence it is more likely to be downplayed, which may be reflected in the larger proportion of non-matching reaction patterns (cf. Croyle et al., 1997; Kunda, 1990).

Thirdly, it is possible to interpret the results from Study 3 in self-serving terms, and self-serving mechanisms have in turn been interpreted as one sign of motivated reasoning (Kunda, 1987, 1990; Taylor & Brown, 1988). Relatively high levels of hindsight bias after self-relevant positive feedback emerged, and similar findings have been interpreted as evidence of the recipients' taking credit for positive outcomes (e.g., by Louie, 1999; Louie, Curren, & Harich, 2000). Conversely, relatively low levels of hindsight bias were found following negative self-relevant feedback, and similar findings have previously been interpreted as a sign of avoiding blame (cf. Mark et al., 2003; Mark & Mellor, 1991). In the absence of a more direct examination of the processes underlying hindsight bias following self-relevant feedback, this interpretation remains tentative, and alternative interpretations for at least part of the
findings are conceivable (cf. Chapter 4). However, MR yields one plausible interpretation for the differences in hindsight bias following positive and negative unexpected feedback, and the results from Study 3 do not contradict assumptions from this approach.

5.2.2.2 Support for CARA: Feedback expectedness as determinant of risk feedback reception besides feedback valence and a focus on adaptivity

While some of the findings from the present thesis can at least partially be explained from a MR perspective, they might fit a competing view on the reception of individual health risk feedback such as CARA equally well or even better. A core assumption of CARA is that reactions to individual health risk feedback are ultimately adaptive, and that their sensitivity to feedback expectedness in addition to feedback valence points towards their adaptivity (Renner, 2004). How do the present results relate to this notion?

Firstly, results from Studies 1 and 2 indicate that thoughts related to feedback expectedness are among the „big four“ of reactions towards individual health risk feedback, implying that feedback expectedness is relevant to a relatively large portion of recipients immediately after the feedback (cf. Chapters 2 and 3, see also 5.2.1.2). Thus, while results from Studies 1 and 2 are in accordance with the importance that MR (but also CARA) assigns to feedback valence (cf. 5.2.2.1), they are also in accordance with the importance that CARA assigns to feedback expectedness (Renner, 2004). The present findings on spontaneous reactions to health risk feedback therefore appear more in line with the assumptions that CARA, rather than MR, makes with regard to which determinants of the reception of individual health risk feedback should be considered important.

Secondly, findings from Study 2 (cf. Chapter 3) suggest that most patterns of spontaneous reactions towards health risk feedback are in accordance with feedback
valence (e.g., positive emotions and implications for health following positive feedback; negative perceived feedback valence after negative feedback). While the proportion of patterns accurately reflecting feedback valence was larger after positive compared with negative feedback (cf. 5.2.2.1), the proportion of patterns that matched feedback valence was greater than the proportion of non-matching patterns, even after negative health risk feedback (cf. Chapter 3). Thus, already shortly after feedback reception, a majority of recipients appears to fully take the valence of their feedback into account, even if the feedback is negative. It certainly seems adaptive to acknowledge the valence of individual health risk feedback early on (cf. Baumeister et al., 2001), and the large proportion of recipients with reaction patterns in accordance with feedback valence points towards the adaptivity rather than the distortion of most immediate reactions. To fully support this assumption it is, however, desirable to examine empirically whether recipients with matching patterns actually behave in a way that appears adaptive in the long run (cf. 5.3.1).

A third hint at the potential adaptivity of reactions towards individual health risk feedback comes from the findings regarding future lifestyle change (cf. Studies 1 and 2): Thoughts regarding future lifestyle were generated comparatively frequently (cf. Chapters 2, 3, 5.2.1.2), some of which were even expressed as intentions. Thinking about future lifestyle seems adaptive because various behavior-related cognitions such as outcome expectancies or self-efficacy appear to be important predictors for intentions (e.g., Renner & Schwarzer, 2003; Schwarzer, 1992, 2001), and intentions themselves are considered an important determinant of actual lifestyle change (e.g., Ajzen, 1991; Schwarzer, 2001; but see e.g. Schwarzer, 2008a for the role of post-intentional processes). Even if not all thoughts about future lifestyle directly match any such construct, it seems plausible to assume that some thought about future lifestyle needs to be present in order to form an intention or to think about the efficacy or one's personal capability of a behavior. It is also important to note that thoughts
regarding future lifestyle change were especially frequently generated after negative health risk feedback (cf. Chapter 2). This also appears adaptive, since blood pressure and cholesterol are intermediary risk factors for cardiovascular disease which are to some degree modifiable by lifestyle changes (WHO, 2004, cf. Chapter 1.1.1), and since recipients of negative feedback have more reason to change their behavior from a medical point of view.

It is less clear what results from Study 3 imply with regard to the adaptivity of reactions towards self-relevant health risk feedback. In the literature on hindsight bias, there is not only controversy on which motivational processes might impact hindsight bias (cf. Chapter 4), but also no clear consensus on whether the bias itself is adaptive or not. Many researchers have argued that the hindsight bias might be detrimental (e.g. Blank, Musch, & Pohl, 2007; Fischhoff, 1975; Louie, 1999; Mark & Mellor, 1991; Ofir & Mazursky, 1997; Pezzo & Beckstead, 2008), for example by making it more difficult to learn from past experiences, but this argument was typically made on a purely theoretical basis. Following this reasoning, several attempts at reducing the bias through interventions have been made, but they have usually been unsuccessful (cf. Guilbault, Bryant, Brockway, & Posavac, 2004). To the degree that hindsight bias is detrimental to adaptive learning, a reduction of the bias following negative compared with positive feedback could actually be construed as adaptive. However, other researchers have argued that the bias might not be as detrimental to learning as first assumed, but that it can in contrast be construed as a by-product of an adaptive process, namely knowledge-updating in the face of new information (Hoffrage, Hertwig, & Gigerenzer, 2000). Blank, Musch, and Pohl (2007) recently concluded that the debate about the adaptivity of hindsight bias remains open in the absence of conclusive empirical research. It is therefore not possible to draw any clear conclusions regarding the adaptivity of the reactions found in Study 3, except to note that they do not necessarily need to be maladaptive.
5.2.3 Findings in the context of research on the hindsight bias

Since the third study of the present thesis examined one particular reaction towards individual health risk feedback more deeply, namely hindsight bias, its results can additionally be discussed in a different context from that of Studies 1 and 2 as outlined below (please see Chapter 4 for a more thorough discussion).

The most basic result from Study 3 is that hindsight bias was found among almost half of recipients following unexpected cholesterol feedback. Thus, hindsight bias was demonstrated following a self-relevant outcome in an Eastern sample for the first time. Secondly, lower levels of hindsight bias were found after negative compared with positive feedback. These findings appear in line with some results from Western samples (cf. Louie, 1999; Louie et al., 2000; Mark et al., 2003; Mark & Mellor, 1991), where they have been interpreted as indicative of self-serving processes: It has been argued that the presence of hindsight bias after self-relevant positive outcomes could be a sign for taking credit for the outcome (Louie, 1999; Louie et al., 2000) and that the absence of hindsight bias after self-relevant negative feedback could be a sign of avoiding blame for the outcome (Mark et al., 2003; Mark & Mellor, 1991). However, it is also possible that recipients of negative feedback were in the middle of a shift from hindsight bias to reversed hindsight bias, which could be interpreted as an adaptive move from initially motivated fear control to later danger control processes (cf. Renner, 2003), although this latter account would not explain the presence of hindsight bias following positive feedback. In the absence of measures aimed at capturing the underlying processes, the implications of the present results regarding the exact nature of the processes involved must remain tentative.

Thirdly, marginally less resultant surprise was reported among recipients of positive feedback and overall, those who displayed hindsight bias reported less resultant surprise than those displaying accurate recall of their foresight estimates. It is possible to interpret these findings in line with the sense-making model and the
motivated sense-making model of hindsight bias (Pezzo, 2003; Pezzo & Pezzo, 2007): Following the sense-making model, unexpected outcomes trigger a sense-making process. If the process is successful, the outcome makes sense and is perceived as relatively unsurprising, with low levels of surprise contributing to the emergence of hindsight bias (Pezzo, 2003). The motivated sense-making model posits that, for negative self-relevant outcomes, the sense-making process is biased in a self-serving way, namely towards finding external and avoiding internal reasons for the outcome. Following this model, a lack of hindsight bias after a negative self-relevant outcome is likely if it is not easy to generate external causes for the outcome, but if at the same time no undeniable internal causes come to mind. While the present study does not provide a clear test of this assumption, its results are not contradictory to the model.

Overall, the present results give first hints that hindsight bias following self-relevant feedback likely works similarly in East and West. It seems likely that motivational processes are present in the East, too, and that models of hindsight bias developed in the West can possibly be applied to Eastern samples.

5.3 Limitations

In this section, several limitations are discussed that need to be acknowledged for interpreting the results from the three studies of the present dissertation.

5.3.1 Limitations regarding the conclusions about the adaptivity of the reception of individual health risk feedback

It was argued that the present findings yield some support for the assumption that reactions towards individual health risk feedback appear adaptive (cf. 5.2.2.2). This conclusion is, however, drawn from reactions assessed very early after feedback reception. Ultimately, reaction adaptivity would have to be reflected in some kind of action,
e.g. in behavior change after high-quality negative health risk feedback. The present studies do not yield information whether seemingly adaptive initial reactions or reaction patterns actually contribute to adaptive behavior in the long run. A longitudinal examination would be necessary to find out whether the initial adaptive-appearing reactions hold up over time. Actual behavioral reactions would yield stronger support for reaction adaptivity than thoughts and feelings expressed immediately after feedback reception. Behavior change, however, is a complex phenomenon dependent on a number of variables. A small part of immediate reactions, namely those related to future lifestyle change in the form of intentions, is likely to be related to behavior change (cf. Ajzen, 1991; Ajzen & Albarracín, 2007; Conner & Norman, 1996; Schwarzer, 1992, 2001, 2008a, 2008b), although an intention alone is not sufficient for behavior change (cf. e.g., Schwarzer, 2001, 2008a; Schwarzer & Luszczynska, 2008; Schwarzer & Renner, 2000 for the role of post-intentional processes). For other immediate reactions, their relation to potential adaptive behavior is even less clear. There is some evidence that emotional reactions can be related to actual behavior (Lawton et al., 2007; Loewenstein et al., 2001; cf. also Slovic et al., 2004). It also seems plausible that the acknowledgment of feedback valence is related to risk perceptions – after all, acknowledging e.g. the reception of negative feedback should reflect acknowledgment of being at risk at least to some degree – but these relations are rather distal to actual behavior that could inform about reaction adaptivity (cf. also van der Pligt, 1998). Thus, while the present results do yield some support for the assumption of adaptivity in the reception of individual health risk feedback, research employing a longitudinal perspective and actual behavioral data would be helpful in making a stronger case for the adaptivity of reactions towards individual health risk feedback.
5.3.2 Limitations arising from the study sample

Each of the three studies in the present thesis relies on data from the RACK project, using a community-based sample of volunteers from Seoul and Kyungki-Do, South Korea (cf. Table 3).

Table 3. Characteristics of the South Korean population, the RACK samples, and the study samples.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>% women</th>
<th>Age (years)</th>
<th>Cholesterol (mg/dl)</th>
<th>Mean blood pressure (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Korea</td>
<td>47,041,434*</td>
<td>50%*</td>
<td>M = 36</td>
<td>M = 187†</td>
<td>120/ 78†</td>
</tr>
<tr>
<td>RACK W1</td>
<td>951</td>
<td>57%</td>
<td>M = 33</td>
<td>M = 169</td>
<td>125/ 82</td>
</tr>
<tr>
<td>SD = 18</td>
<td></td>
<td></td>
<td>SD = 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study 1</td>
<td>629</td>
<td>55%</td>
<td>M = 31</td>
<td>M = 167</td>
<td>124/ 81</td>
</tr>
<tr>
<td>SD = 16</td>
<td></td>
<td></td>
<td>SD = 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study 3</td>
<td>811</td>
<td>55%</td>
<td>M = 32</td>
<td>M = 167</td>
<td>n/ a</td>
</tr>
<tr>
<td>SD = 17</td>
<td></td>
<td></td>
<td>SD = 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RACK W2</td>
<td>597</td>
<td>53%</td>
<td>M = 31</td>
<td>M = 162</td>
<td>123/ 81</td>
</tr>
<tr>
<td>SD = 18</td>
<td></td>
<td></td>
<td>SD = 23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study 2</td>
<td>423</td>
<td>51%</td>
<td>M = 31</td>
<td>M = 160</td>
<td>122/ 81</td>
</tr>
<tr>
<td>SD = 18</td>
<td></td>
<td></td>
<td>SD = 22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Korea National Statistical Office, 2005, † Kang et al., 2006
n/a = not applicable

Study samples differ somewhat from the South Korean population (for dropout analyses regarding the differences between the RACK samples and each study sample, see the methods sections of Chapters 2 to 4). The mean cholesterol level of RACK participants, and of each subsample used for Studies 1 to 3, is below the cholesterol level for the South Korean population. However, the mean blood pressure of RACK participants, and also within each subsample, is comparable to that of the South Korean population. Whenever possible, the reception of both cholesterol and blood pressure feedback was examined. In each study that used both types of feedback, results were highly similar for blood pressure and cholesterol feedback. It is
therefore unlikely that the present results would have looked very differently if the cholesterol levels of the present samples had been closer to the population cholesterol level.

It is, however, always possible that a self-selected sample differs from the population in some regards. We cannot know for sure, for example, whether those who did not volunteer to participate in RACK would have shown the same reactions demonstrated in the three studies. However, it is important to keep in mind that the participation in screenings, and thus the reception of health risk feedback, is in fact voluntary in many real-life situations. This may be especially true for newly emerging situations in which individual health risk feedback can be obtained (cf. also Chapter 1). Individuals can usually chose whether to accept an invitation to participate in a national screening program, whether to purchase a self-administered test, whether to fill in a health risk appraisal instrument on the Internet, or whether to seek genetic screening. Therefore, the findings on the reception of individual health risk feedback obtained in the present studies may generalize more easily to voluntary screening participants than to the entire population. Volunteers may have more in common with a self-selected sample such as the RACK sample than those who do not seek to obtain individual health risk feedback.

### 5.3.3 Limitations arising from the study design

The RACK project allowed for examining the reception of real-life blood pressure and cholesterol feedback in a South Korean sample. Three limitations arise from this setup.

*South Korean sample.* Countries differ with regard to a variety of cultural variables (e.g., Hofstede, 2001; Triandis, 1995, 2001). Like most studies that do not explicitly focus on cross-cultural differences, the present study was conducted in a single country, namely in South Korea. This country can be assumed to differ from most Western societies in some regards. Most notably, South Korea can be assumed to
be more collectivistic and possibly also less individualistic (Hofstede, 2001; Hyun, 2001; but see Kitayama, 2002, and Oyserman, Coon, & Kemmelmeier, 2002, on the difficulties of assigning these attributes to countries). Related to the higher level of collectivism, an interdependent construal of the self is likely to be more prevalent in South Korea compared with an independent self-construal, which is more prominent in individualistic countries (Markus & Kitayama, 1991a). An individual’s cognitions, emotions, and motivation can vary partly depending on his or her self-construal (Markus & Kitayama, 1991a, 1991b). There is, however, some evidence that the reception of self-relevant health risk feedback may work similarly in South Korea and in Western countries despite differences in self-construal. Health behavior change following risk feedback, for example, appears to be predictable by the HAPA in South Korea to a similar degree as in Western societies (Renner et al., 2008; Renner, Spivak, Kwon, & Schwarzer, 2007; Spivak, 2007). There is also some debate about whether self-enhancement can also be found in Eastern countries. While Heine, Lehman, Markus, and Kitayama (1999) argue in their review that „the need for positive self-regard, as it is currently conceptualized, is not a universal“ (p. 766), there is also some more recent evidence that self-enhancement as a motive may also be prevalent in Eastern cultures if conceptualized somewhat broader (e.g., Sedikides, Gaertner, & Toguchi, 2003). With regard to risk perception, unrealistic optimism appears prevalent in both countries (Panzer, Oeberst, & Renner, 2005). Moreover, the present results on the hindsight bias are to some degree comparable to similar results from Western studies (cf. Louie, 1999; Louie et al., 2000; Mark et al., 2003; Mark & Mellor, 1991; cf. also Heine & Lehman, 1996, for evidence of similarities in hindsight bias in Eastern and Western cultures). Thus, it seems reasonable to assume that the present results would not look completely different if the study had been conducted with a Western sample. However, to what degree results obtained in a single socio-cultural context can be generalized to different contexts is a question that can ultimately only be
answered empirically. Thus, more research is needed to determine the degree of generalizability of the results, in particular the ones of Studies 1 and 2 of the present dissertation, to different socio-cultural contexts.

**Blood pressure and cholesterol feedback.** A second issue is the generalizability of the present results to other risk factors. The present dissertation explored the reception of individual health risk feedback, using two intermediary risk factors for cardiovascular disease (WHO, 2004), namely blood pressure and cholesterol, as an example. CVD is a major health concern in many countries around the world (WHO, 2004, 2007, 2008), and thus an important area to study. Still, in the face of an abundance of conditions for which individual health risk feedback can be obtained (cf. e.g., National Cancer Institute, 2006; U.S. FDA, 2008) the question remains whether the results from the present studies can be generalized to other types of health risk feedback. The reception of health risk feedback has been studied using a broad array of risks, including as diverse risk feedback as that on the fictitious condition TAA (cf. Ditto & Croyle, 1995, for an overview), feedback on dietary fat (e.g., Fries et al., 1997), cholesterol feedback (e.g., Croyle et al., 2006; Renner, 2004), feedback about genetic risk for breast cancer (e.g., Hamann et al., 2008), or genetic susceptibility to lung cancer (e.g., Lipkus et al., 2004). While these (and other) studies on the reception of risk feedback vary in focus, phenomena such as the differential acceptance of positive vs. negative feedback have been found stable across different risks (e.g., Bowen et al., 1994, for dietary fat feedback; Ditto et al., 2003, for TAA; Michie et al., 2002, for genetic testing for familial adenomatous polyposis, or Renner, 2004, for cholesterol feedback). Thus, it seems plausible to assume that there are basic mechanisms to the reception of individual health risk feedback which are likely to work similarly across a variety of risk factors. However, different types of individual health risk feedback can differ with regard to a number of variables, such as the time line, consequences, causes, and control of the illness with which the risk factor is associated (cf. Leventhal
et al., 1997; Leventhal, Brissette, & Leventhal, 2003; Leventhal, Nerenz, & Steel, 1984). Such differences may be one reason why reactions to risk information are often researched with regard to a particular current health risk topic such as BRCA1/BRCA2 gene mutations (e.g., Hamann et al., 2008), or screening for type 2 diabetes (e.g., Eborall et al., 2007). In order to gain knowledge about the generalizability of the present results, it is thus desirable to study the reception of individual health risk feedback for a broad spectrum of conditions.

Real-life feedback. A third issue is the use of real-life blood pressure and cholesterol feedback in the present studies. Participants knew that they received information regarding their actual blood pressure and cholesterol readings, and that these readings have real-life implications for their personal health. The main advantage is that this procedure increases the external validity of the present studies. It does, however, decrease its internal validity: Because recipients were not randomized to receive feedback of a certain valence (cf. Chapters 2-4; experimentally manipulated e.g. by Croyle et al., 1993) it is possible that people with certain characteristics were more likely to receive a certain type of feedback. But if this is the case it is likely that recipients will have similar characteristics when confronted with real-life health risk feedback in other situations, such as at the doctor’s. Secondly, lack of randomization has led to unequal group sizes, as more than 80% of participants received optimal compared with non-optimal feedback (cf. Studies 1 and 3). The distribution of optimal vs. non-optimal feedback recipients can be expected to be skewed in real life as well, as the majority of South Koreans has, in fact, optimal blood pressure (WHO, 2007) and cholesterol levels (Choi, Song, & Sung, 2007; Kim, Suh, & Choi, 2004; Suh et al., 2001). The use of an experimental design or a less healthy sample would have made it possible to examine more complex interactions, such as the one between feedback valence and feedback expectedness with regard to the spontaneous responses.
5.4 Overall implications

So far, the results of the present dissertation have been summarized (cf. 5.1), discussed in their context (cf. 5.2), and some limitations to their interpretation have been pointed out (cf. 5.3). On the basis of these sections, the following section focuses on the implications that the present results can have for both research (cf. 5.4.1) and practice (cf. 5.4.2).

5.4.1 Implications for research

The implications that the present results can have for future research in related fields have already been touched upon in Section 5.2. A recipient-oriented approach was taken in Studies 1 and 2 (cf. Chapters 2 and 3), and some of its results were used to guide a more researcher-oriented study (cf. Chapter 4). The present thesis demonstrates the usefulness of complementing traditional researcher-oriented work with a more recipient-oriented approach. Following a recipient-oriented approach might be useful in other fields as well, and those who would like to pursue recipient-oriented research on risk perception could make use of the coding system developed for the present dissertation. Results from Studies 1 and 2 show that previously well-researched reactions are not spontaneously brought up by most recipients, whereas previously rarely researched reactions appear relevant to a large group of recipients (cf. 5.2.1.2). The present results could thus be useful in guiding the selection of variables and reactions for future research, suggesting a shift in focus from cognitive, particularly acceptance-related reactions to the „big four“, where positive emotional reactions and expectancies appear especially rarely researched. The present work represents a first step towards a cognitive-affective domain map of the reception of health risk feedback (cf. 5.2.1.3). Future research could focus on elaborating that domain map, for example by examining reactions to feedback about different health risks, or feedback given in different socio-cultural contexts (cf. 5.3.3). As discussed in
Section 5.2.2, the present results appear to yield at least some support for CARA, since they support the role of expectancies and a focus on adaptivity in the reception of individual health risk feedback. However, so far much more research has been conducted in the tradition of MR than following CARA. It therefore seems promising for future research to focus more on the adaptivity of reactions towards health risk feedback, preferably employing longitudinal, behavioral measures (cf. 5.3.1), and considering models such as CARA. Since the third study within the present dissertation focused on hindsight bias following self-relevant feedback as an example of one frequently generated specific reaction, there are some implications specific to the field of hindsight bias. In particular, the present results suggest that hindsight bias can emerge after self-relevant feedback in Eastern societies, and that feedback valence and resultant surprise play a role in its emergence. Future research is needed to explore the exact nature of the underlying motivational and cognitive processes, and to determine to what degree the bias is or is not adaptive.

5.4.2 Implications for practice

The three studies of the present dissertation were oriented towards basic research. Nevertheless, particularly the results obtained from Studies 1 and 2 (cf. Chapters 2 and 3) might have some implications useful to practitioners. Firstly, they suggest that simply asking recipients about their thoughts and feelings regarding their individual health risk feedback can yield useful information. A large proportion of recipients is likely to offer thoughts related to emotions, feedback valence, or future lifestyle. These responses can give first hints at the presence of more or less adaptive reaction patterns, depending on their match with actual feedback valence. By incorporating a single brief question into clinical practice, health care professionals could thus identify possibly problematic reactions, and could be particularly responsive to these recipients' needs, for example by discussing the results and their implications in greater detail.
Secondly, the health risk reaction network presented in Chapter 3 could be a useful tool not only for researchers, but also for practitioners. It can inform them of typical vs. atypical reactions towards health risk feedback, and thus provide a background against which any individual recipient’s reactions can be judged. In this sense, the network could be used as a cognitive-affective domain map (Mischel & Shoda, 1995; Shoda & Mischel, 2006) of reactions towards individual health risk feedback by practitioners. For example, if a recipient mentions future lifestyle change, the network indicates that this is likely the main issue of immediate concern for the recipient at that moment, with other reactions likely being of less immediate concern. Practitioners could use such information to adequately respond to recipients’ main concerns, and to take these into consideration during any further discussion of the results or future procedure.

Thirdly, results suggest that recipients’ expectations are crucial in the reception of individual health risk feedback. These expectations can quickly and easily be assessed by simply asking individuals what kind of result they expect before conducting a test. As research by Renner (2004) suggests, recipients of unexpected positive feedback may be less likely to fully accept their results than one might first assume. It could therefore be useful to take more time to discuss the results and their implications in more detail, e.g. to explain why re-testing may not be necessary if it appears unnecessary from a medical point of view.

5.5 References


Psychosocial effects of screening for disease prevention and detection (pp. 144-181). London: Oxford University Press.


The self-regulation of health and illness behaviour (pp. 43-65). New York: Routledge.


Appendix A: Plan of procedures of the Study „Risk Appraisal Consequences in Korea“ (RACK)

In the course of RACK, participants from Seoul and Kyungki-Do, South Korea, took part in two blood pressure and cholesterol screenings. There was an interval of about six months between the first blood pressure and cholesterol screening and the second one. Figure A1 shows the procedure that was undertaken at the first screening. The third questionnaire (cf. Station 7) was filled in at home and sent back to the researchers by mail. At the second screening, a highly similar procedure was followed (except that no invitation to a further screening wave was given).

Figure A1: Plan of procedures of the RACK study.
Appendix B: Items from the RACK Study

The following items are excerpted from the English language version of the RACK scale documentation developed by Renner and Schwarzer (2005). Only items on which the three studies of the present thesis are based are presented here. A complete version of the RACK scale documentation can be found at http://www.gesundheitsrisiko.de/rinstruments.html.

B.1 Items from Questionnaire 1

Expected physiological values

Immediately after completing this questionnaire, your cholesterol level will be measured.

<table>
<thead>
<tr>
<th>What cholesterol level do you expect?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ 1 very low</td>
</tr>
<tr>
<td>low</td>
</tr>
</tbody>
</table>

Immediately after completing this questionnaire, your blood pressure will be measured.

<table>
<thead>
<tr>
<th>What blood pressure do you expect?</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ 1 very low</td>
</tr>
<tr>
<td>low</td>
</tr>
</tbody>
</table>
B.2 Items from Questionnaire 2

Thought listing

Please list within 1 minute any thoughts you had after receiving your cholesterol test results.

Please list within 1 minute any thoughts you had after receiving your blood pressure test results.
Perceived severity

How serious a threat to your health is your cholesterol?

<table>
<thead>
<tr>
<th>Not serious (can be ignored)</th>
<th>Moderately serious (as if someone would have the flu)</th>
<th>Very serious (life threatening)</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How serious a threat to your health is your blood pressure?

<table>
<thead>
<tr>
<th>Not serious (can be ignored)</th>
<th>Moderately serious (as if someone would have the flu)</th>
<th>Very serious (life threatening)</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓</td>
<td>↓</td>
<td>↓</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Surprise

How surprised were you by the results of your cholesterol test?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very surprised</td>
<td>not at all surprised</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How surprised were you by the results of your blood pressure test?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very surprised</td>
<td>not at all surprised</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Recall of expected values

Please think back to the first short survey which took place before your cholesterol and blood pressure were measured. What cholesterol and blood pressure readings did you expect during the measurement?

What blood pressure reading did you expect?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very low</td>
<td>low</td>
<td>somewhat</td>
<td>normal</td>
<td>somewhat</td>
<td>high</td>
<td>very high</td>
</tr>
<tr>
<td>blood pressure</td>
<td>blood pressure</td>
<td>blood pressure</td>
<td>blood pressure</td>
<td>blood pressure</td>
<td>blood pressure</td>
<td>blood pressure</td>
</tr>
</tbody>
</table>

What cholesterol reading did you expect?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>very low</td>
<td>low</td>
<td>somewhat</td>
<td>normal</td>
<td>somewhat</td>
<td>high</td>
<td>very high</td>
</tr>
<tr>
<td>cholesterol</td>
<td>cholesterol</td>
<td>cholesterol</td>
<td>cholesterol</td>
<td>cholesterol</td>
<td>cholesterol</td>
<td>cholesterol</td>
</tr>
</tbody>
</table>

Concern

How concerned are you about the result of your cholesterol test? I am...

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all concerned</td>
<td>concerned</td>
<td>extremely concerned</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How concerned are you about the result of your blood pressure test? I am...

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>not at all concerned</td>
<td>concerned</td>
<td>extremely concerned</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pressure to change**

| It is necessary for me to take action in order to lower my blood pressure. |
|---|---|---|---|
| exactly true | moderately true | hardly true | not at all true |
| 1 | 2 | 3 | 4 |

| It is necessary for me to take action in order to lower my cholesterol level. |
|---|---|---|---|
| exactly true | moderately true | hardly true | not at all true |
| 1 | 2 | 3 | 4 |
Appendix C: Coding system

C.1 Long version

The following pages contain the long version of the coding system as used for the main coding in Study 2, including all coding instructions. For differences in the coding system used for Study 1, please see Chapter 3. Please note that for the purposes of Studies 1 and 2, the categories B1 (result description) and B2 (result evaluation) were merged to form the category risk feedback valence. The coders additionally took part in a training session on the coding system.

Coding system:

The RACK study (Risk Appraisal Consequences in Korea)

The present coding system has been developed as part of the RACK study. In the course of the RACK study, more than 1000 South Koreans took part in a blood pressure and cholesterol screening. After their blood pressure and cholesterol were taken, they were informed of their individual results on these medical tests. After that, they were asked to please write down, within one minute, any thoughts or ideas they had immediately after receiving the result. The same procedure was repeated half a year later, and the answers to the questions from this second wave of data collection are being coded here.

Coding units

Answers are to be coded separately for thoughts after blood pressure and cholesterol feedback (i.e. two answers per participant). One coding unit is one cell per column “Translations”, regardless of whether this space remains empty or not.

Context for coding units

Words that the translator may have written in parentheses (example) do not belong to the coding unit. However, they can be used in order to make sense of the coding unit, i.e. as context for the coding unit. That means that information that is only contained
in the parentheses should not be coded, but if it is not clear what the words outside the parentheses mean, the information within the parentheses can be used for clarification.

Sometimes a participant refers to what s/he has written as an answer to the second open question (e.g., refers for thoughts about the cholesterol level to thoughts about the blood pressure or vice versa). In these cases, the second coding unit can be used to make sense of the coding unit.

**Participant codes**

In the leftmost column of the translation sheet, there is a code for each participant. It is extremely important that you write this code into the appropriate SPSS-column for each answer. Please enter the code without any spaces, e.g. CW0007 instead of CW0007, and check carefully for spelling mistakes (especially that you entered the appropriate number of zeros). This is very important for merging your data with those of the other coders, and also with previously collected questionnaire data from the same participants.

**General structure of coding system**

The following paragraph is intended to give you a rough overview over the structure of the coding system. You will find more exact instructions on when to use which category in the coding system itself.

The coding system consists of two parts. **Part A** consists of two questions regarding the processing depth of each answer. First, you are asked to indicate whether a verbal answer was at all given. This question has to be answered for each participant by entering the appropriate number. If no verbal answer was given, the coding for this unit ends. However, if a verbal answer was given, you are asked to rate its relevance (second question Part A). Moreover, you are asked to rate each relevant answer in Part B as to its exact content.

In **Part B**, each coding unit must be allotted to at least one category, but can be allotted to several categories as one answer can have more than one aspect of content. That means that for each relevant answer, each category of Part B must be checked. For example, an answer can be allotted to the categories “result description” and “hindsight” if it contains a description of the participant’s test results as well as a
reference to the participant looking back on his or her prior expectations. For categories to which the coding unit is not allotted, the respective SPSS cell is simply to be left empty. Within each category, one coding unit can only be allotted to one subcategory. For example, an answer containing a result description can be allotted to the subcategory “high” or the subcategory “average/normal” or the subcategory “low”, but not to more than one of them.

**General guidelines**

It is extremely important that you interpret as little as possible while coding the answers. That means that you must not infer the participant's result from his or her answer if it is not stated explicitly. For example, if someone describes her result as „good“ that does not necessarily mean that the result is average, normal, or low. Also, if someone says he expected a good result, that does not necessarily mean that he did not get a good result. These are just two examples, but the principle of interpreting as little as possible can in the same way be applied to many answers.

It is also extremely important that you carefully follow the instructions in the category system. Please read each category description carefully and look at the examples given. Please put an emphasis on coding the answers in close accordance with the instructions.

Please do not talk to your fellow coders about how to code an individual answer. It is very important that you do the coding entirely on your own. If you talked about the coding with other coders, that might influence interrater agreement which is undesirable because a realistic estimate of interrater agreement is an important indicator of the quality of this research.

**Explanation of Tables**

<table>
<thead>
<tr>
<th>Part &amp; Nr.</th>
<th>Lead question</th>
<th>Description of subcategory a</th>
<th>Examples of answers fitting subcategory a → how to proceed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Nr. to be put in SPSS)</td>
<td><strong>Yes</strong> (rough answer)</td>
<td>Description of subcategory a</td>
<td>Examples of answers fitting subcategory a → how to proceed</td>
</tr>
<tr>
<td>0 (Nr. to be put in SPSS)</td>
<td><strong>No</strong> (rough answer)</td>
<td>Description of subcategory b</td>
<td>Examples of answers fitting subcategory b → how to proceed</td>
</tr>
<tr>
<td>A1</td>
<td>Was a verbal answer given?</td>
<td>caverb...</td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>---------------------------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>1 Yes</td>
<td>Participant did write down at least one full word.</td>
<td>I had a good feeling. Mmm, it is normal. Calm. → proceed with next question</td>
<td></td>
</tr>
<tr>
<td>2 No</td>
<td>Participant did not write down at least one full word, e.g. - answering space left empty, - sign without word.</td>
<td>... → stop coding this answer, proceed with new answer</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A2</th>
<th>Is the answer relevant? (with regard to the screening result, cardiovascular disease, or its risk factors)</th>
<th>carel...</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Yes</td>
<td>At least one part of the answer is related to: - the screening result (e.g. description, evaluation, feelings about it, relating lifestyle to it), - implications of the result, - topic of cardiovascular disease or its risk factors (e.g. prior knowledge), - need for more information/comprehension problem/any kind of question.</td>
<td>I need to exercise more. As I expected. I was glad with my average result I feel fortunate. Do I really have high blood-pressure? What a relief. I am healthy. Consumption of organic vegetables. I'm not very worried. I didn't understand what they were saying. I want more precise results. Mmm, it is normal. → proceed with Part B</td>
</tr>
<tr>
<td>2 No</td>
<td>No part of the answer is related to any of the above, but e.g. related to: - result-independent screening aspect (like needle), - altogether unrelated topic (like weather), - negation of any reaction at all. <strong>If in doubt, rate 1!</strong></td>
<td>The needle must hurt. I was worried that the check-up might take long since I need to do my English homework soon. I had no thoughts. I had no specific feelings. → stop coding this answer, proceed with new answer</td>
</tr>
<tr>
<td></td>
<td>Result description</td>
<td>Details</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>High</td>
<td>Result is described as high or too high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[fictitious]:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>My blood pressure is very high.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I am worried about my high blood pressure.</td>
</tr>
<tr>
<td>2</td>
<td>Average, normal</td>
<td>Result is described as normal or average.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mm, it is normal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>As always, I turned out to be average.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I feel good that I received a normal reading.</td>
</tr>
<tr>
<td>3</td>
<td>Low</td>
<td>Result is described as low or too low.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I don't have a high blood pressure! I actually have a very low blood-pressure!</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I always thought that I had a high cholesterol level, and I am dumbfounded by my low reading.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It's slightly low.</td>
</tr>
<tr>
<td></td>
<td>Not given</td>
<td>Result is not at all described.</td>
</tr>
</tbody>
</table>
## B2 Result evaluation

**Please note:** Only make a rating of 1, 2, or 3 for this category if the result is explicitly evaluated by the participant as good/positive/favorable or bad/negative/unfavorable. Please do not infer an evaluation from a mere description (see B1). If the participant describes what the result means for his or her health, please use category B4.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Unfavorable</strong></td>
<td>Result is evaluated as bad, negative, or unfavorable.</td>
<td>I didn’t appreciate having a bad result yet once again, when I already had similar results in the past. → proceed</td>
</tr>
<tr>
<td><strong>2 Favorable</strong></td>
<td>Result is evaluated as good, positive, or favorable.</td>
<td>[fictitious] It is good. → proceed</td>
</tr>
<tr>
<td><strong>3 Unclear</strong></td>
<td>Result is explicitly evaluated, but it is unclear whether the evaluation is overall favorable or unfavorable. Result is evaluated in a mixed way (both favorable and unfavorable aspects are mentioned).</td>
<td>[fictitious] I don’t know whether this is good or bad. It’s ok. → proceed</td>
</tr>
<tr>
<td>Not given</td>
<td>Result is not explicitly evaluated.</td>
<td>→ leave cell empty, then proceed</td>
</tr>
</tbody>
</table>

## B3 Result acceptance

**Please note:** Only make a rating of 1 or 2 in this category if some part of the answer makes reasonably clear that the participant doubts or accepts his or her result. If the participant asks a question, please consider carefully whether a rating of 1 should be made in this category in addition to category B7, and only make the rating additionally in the present category if it contains an explicit reference as described below.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Doubts</strong></td>
<td>Explicit reference to the possibility that the result may not be reflecting the real medical values, e. g. because test was unreliable or invalid. Code 1 even if slight doubts are expressed and independent of result valence.</td>
<td>I am happy with such a low result, but I will have a re-examination. → proceed</td>
</tr>
<tr>
<td>2</td>
<td>Explicit acceptance</td>
<td>Explicit reference that the result is reflecting the real medical values (i.e. it is correct, true, accurate).</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Not mentioned</td>
<td>No reference is made to whether the recipient thinks that his/ her result is true, accurate, or reflecting his/ her real medical values.</td>
<td>→ leave cell empty, then proceed</td>
</tr>
</tbody>
</table>

### B4 Result implications (for risk status/ health)

<table>
<thead>
<tr>
<th>1</th>
<th>Unfavorable</th>
<th>Unfavorable implications of screening result for risk status or health mentioned.</th>
<th>I have been told that a low reading is also an indication of poor health. The fact that I am quite tired recently adds to my concern.</th>
<th>→ proceed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Favorable</td>
<td>Favorable implications of screening result for risk status or health mentioned.</td>
<td>The results say that I am in good health, so I am very happy. I can now have a safe assumption that I am in good health, with my result as support. I have no problems with my health. I am healthy.</td>
<td>→ proceed</td>
</tr>
<tr>
<td>3</td>
<td>Unclear</td>
<td>Implications mentioned, not clear whether they are perceived as favorable or not. Implications mentioned that are partly favorable and partly unfavorable.</td>
<td>[fictitious] I don't know what this means for my health. Am I more at risk now?</td>
<td>→ proceed</td>
</tr>
<tr>
<td>Not mentioned</td>
<td>No reference to implications of the result with regard to participant's risk status or health.</td>
<td>→ leave cell empty, then proceed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**B5  Hindsight**

**Please note:** This category has various residual subcategories. When coding a somewhat unclear answer, please consider carefully which one to use (3 – different from expectations, but unclear how, 6 – as expected, but unclear how, or 7 – reference to expectations, but generally unclear).

**Please also note:** If an answer fitting the category does not contain a result description as specified in B1, but merely a result evaluation or a reference to the result implications, please use one of the residual subcategories and do not infer the actual result from evaluation or implications.

<table>
<thead>
<tr>
<th></th>
<th><strong>Result higher than expected</strong></th>
<th><strong>Result lower than expected</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Result is higher than expected. This can be reported explicitly or implicitly by mentioning surprise by a high result.</td>
<td>I thought that I will turn out to have a low blood-pressure, but I was comforted by the result that stated otherwise. I am convinced to be more cautious. The result was unexpectedly higher. I was surprised with my high blood pressure reading. I was surprised by my unexpectedly high blood-pressure reading.</td>
</tr>
<tr>
<td>2</td>
<td>Result is lower than expected. This can be reported explicitly or implicitly by mentioning surprise by a low, average, or normal result.</td>
<td>I anticipated a very high result, so I am glad that it turned out to be lower than I expected. The result was lower than I expected. I anticipated a very high cholesterol level, but I am very happy with my very low result. I thought that I might end up with a high result, but I am rest assured with one that is not. I always thought that I had a high cholesterol level, and I am dumbfounded by my low reading.</td>
</tr>
<tr>
<td></td>
<td><strong>Result</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>---</td>
<td>------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>3</td>
<td>Result different from expectations</td>
<td>Result is not as expected, but it is not clear whether it is higher or lower than expected. This can be reported explicitly or implicitly by mentioning surprise by the result.</td>
</tr>
<tr>
<td>4</td>
<td>High as expected</td>
<td>Result is high as expected.</td>
</tr>
<tr>
<td>5</td>
<td>Low or normal as expected</td>
<td>Result is low, normal, or average, as expected.</td>
</tr>
<tr>
<td>6</td>
<td>As expected</td>
<td>Result is as expected, but it is not clear whether a high, low, or normal result was expected.</td>
</tr>
<tr>
<td>7</td>
<td>Unclear</td>
<td>Expectations are mentioned, but result is not compared with them.</td>
</tr>
</tbody>
</table>

|   | **Expectations not mentioned** | Participant does not look back on expectations s/he had before the screening. | | leave cell empty, then proceed |
**B6 Feelings**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| **1 Negative** | Negative mood, feeling, or emotion after screening (e.g. anger, anxiety, distress; also worry, concern). | I felt insecure (discomforted).  
I was slightly afraid.  
This result will constantly be on my nerves.  
I feel depressed.  
I felt slightly upset, as I was told that I have a low blood-pressure.  
I am deeply concerned that I have a lower blood-pressure than when I was pregnant.  
I am worried about what I should do.  
I am a little worried that I have a slightly high blood-pressure.  
→ proceed |
| **2 Positive** | Positive mood, feeling, or emotion after screening (e.g. happiness, comfort, relief). | I had a good feeling.  
It felt good.  
I anticipated a very high result, so I am glad that it turned out to be lower than I expected.  
I thought that I will turn out to have a low blood-pressure, but I was comforted by result that stated otherwise.  
I am happy with such a low result, but I will have a re-examination.  
Whew! What a relief! [...]  
I think that I am fortunate.  
I am rest assured as the doctor told me that my result is normal.  
→ proceed |
| **3 Mixed** | Both positive and negative feelings after screening | [fictitious] I feel mostly good, but still a little worried.  
→ proceed |
4 Unclear

Feelings mentioned, but not clear whether they are positive or not, or feelings mentioned that clearly occurred before the screening.

- I’m not bothered too much.
- I’m not very worried.
- I feel okay.
- I feel calm.
- So-so.

→ proceed

B7 Need for information

1 Yes

- Need or wish for more information,
- insufficiency of information given
- *any* kind of question
- comprehension problems

- I didn’t understand what they were saying. I didn’t understand what “LO” meant.
- Why am I “10 W” on my reading?
- How much more does it have to drop?
- Am I not supposed to have a low blood-pressure?

I want more precise results.

→ proceed

Not mentioned

- No reference to feelings after result.

→ leave cell empty, then proceed

Not mentioned

→ leave cell empty, then proceed
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifestyle</td>
<td>One or more aspects of previous or current lifestyle mentioned. Please put:</td>
<td>1 I feel that the result reflects my obsession over dried squids.</td>
</tr>
<tr>
<td></td>
<td>1 for nutrition</td>
<td>With a staple diet consisting of fermented bean soup, Kimchi, garlic etc., I thought this result was expected.</td>
</tr>
<tr>
<td></td>
<td>2 for exercise</td>
<td>[fictitious] Maybe I should have exercised more.</td>
</tr>
<tr>
<td></td>
<td>3 for smoking</td>
<td>[fictitious] I shouldn’t have smoked so much.</td>
</tr>
<tr>
<td></td>
<td>4 for alcohol</td>
<td>[fictitious] Since I’ve been drinking much soju, the result is bad.</td>
</tr>
<tr>
<td></td>
<td>5 for a single other specific lifestyle aspect, e.g. check-ups, medication taking etc.</td>
<td>I have thought: Since I have been taking medicine, I am more or less within the normal range.</td>
</tr>
<tr>
<td></td>
<td>6 for more than one lifestyle aspect</td>
<td>[fictitious] Since I’ve been taking medicine and eating a staple diet, the result is no surprise.</td>
</tr>
<tr>
<td></td>
<td>7 for lifestyle in general</td>
<td>[fictitious] I lead a healthy life, so the result could be expected.</td>
</tr>
<tr>
<td>8 Unchangeable circumstances</td>
<td>Result attributed to luck or chance, or mentioned that not much can be done about result.</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Please note: Answers referring e.g. to luck or fortune should also be coded in category B6 (feelings)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I was lucky. [fictitious] There's nothing I can really do about it.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Not mentioned</th>
<th>→ leave cell empty, then proceed</th>
</tr>
</thead>
</table>


**B9  Future lifestyle**

**Please note:** The expression lifestyle refers to one or more aspects that are recurrent in the participant's life, e.g. nutrition or exercise habits, smoking, alcohol consumption, but also regular medical checkups and the like. **Please also note:** This category has several residual subcategories. When coding a somewhat unclear answer, please check carefully which one fits best: some unclear kind of lifestyle change is suggested (7), or lifestyle is mentioned but it is unclear whether it should be changed or not (15).

<table>
<thead>
<tr>
<th>Changes suggested</th>
<th>One or more aspects of new future lifestyle suggested. Instead of ? put:</th>
<th>1</th>
<th>→finished</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I think that I need to control my diet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I am convinced to try a dietetic treatment.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I'll exercise more.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I need to do more physical exercise.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I need to exercise more.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[fictitious] I should quit smoking.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[fictitious] I guess I'll have to drink less.</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I will have regular check-ups.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I think that I need more control over my diet and my daily routine.</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I need to drink less, exercise more and I need to eat less.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I will exercise more often, and have regular check-ups.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I am convinced to be more cautious.</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I need to look after myself now.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Let's be more careful.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 8 Continuation suggested

Continuation of one or more aspects of lifestyle mentioned, e.g. nutrition, exercise, smoking, alcohol, other aspect, several aspects, lifestyle in general.

- [fictitious] I need to maintain my diet. → proceed
- [fictitious] I'll continue going to the gym twice a week.
- [fictitious] A glass of wine as usual cannot hurt.
- [fictitious] I'll continue having regular check-ups.
- I thought that I need to continue being careful.
- I am determined to maintain my health.

### 15 Unclear

Lifestyle mentioned, but not clear whether continuation or change, or not clear whether past, current, or future.

- Consumption of organic vegetables. → proceed
- In my opinion, if you have a balanced, healthy diet, and a relatively guarded lifestyle, there is no need to worry about health.

### Not mentioned

No aspects of past, current, or future lifestyle mentioned. → leave empty, proceed

### B10 Comparison with previous results

<table>
<thead>
<tr>
<th></th>
<th>Higher or worse</th>
<th>Lower or better</th>
<th>Different</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Result is described as higher or worse than previously.</td>
<td>Result is described as lower or better than previously.</td>
<td>Result is described as different than previously, but it is unclear how it is different.</td>
</tr>
<tr>
<td></td>
<td>[fictitious] It is worse than last time.</td>
<td>[fictitious] I am happy that it is lower now.</td>
<td>[fictitious] When my doctor measured it it was different.</td>
</tr>
<tr>
<td></td>
<td>→ proceed</td>
<td>→ proceed</td>
<td>→ proceed</td>
</tr>
<tr>
<td></td>
<td>Result</td>
<td>Previous Description</td>
<td>Action</td>
</tr>
<tr>
<td>---</td>
<td>--------</td>
<td>----------------------</td>
<td>--------</td>
</tr>
<tr>
<td>4</td>
<td>High or bad</td>
<td>Result is high or bad like previously.</td>
<td>proceed</td>
</tr>
<tr>
<td>5</td>
<td>Low or good</td>
<td>Result is low or good as previously.</td>
<td>proceed</td>
</tr>
<tr>
<td>6</td>
<td>Same</td>
<td>Result is the same as previously, but it is unclear how it is.</td>
<td>proceed</td>
</tr>
<tr>
<td>7</td>
<td>Unclear</td>
<td>Previous result mentioned, but unclear whether it is different or similar to the current one.</td>
<td>proceed</td>
</tr>
<tr>
<td></td>
<td>Not mentioned</td>
<td>No comparison with previous results drawn.</td>
<td>leave empty, proceed</td>
</tr>
</tbody>
</table>

**B11 Other**

<table>
<thead>
<tr>
<th></th>
<th>Answers that have been coded as relevant in Part A but that did not fit any of the previous categories of Part B. E. g.:</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
<td>I am a health-conscious person.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[fictitious] I usually have high blood pressure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• general description of oneself which may or may not apply to the screening</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• general statement, without indication of whether it applies to the participant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Answer has been coded with a number in at least one of the other categories in part B.</td>
</tr>
</tbody>
</table>
C.2 Overview

Together with the long version of the coding system, each coder was given a one-page overview of the categories as depicted in Figure C1. The original version fitted a DIN A4 page. The coders were informed that all coding should be based on the long version of the coding system, and that the sole purpose of the overview was to provide an easy glimpse of all available categories.
Part A: The first question must always be answered

<table>
<thead>
<tr>
<th>Verbal answer given?</th>
<th>Cavel...</th>
<th>1 yes</th>
<th>&gt; next question must be answered</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2 no</td>
<td>&gt; stop</td>
</tr>
<tr>
<td>Answer relevant?</td>
<td>Carel...</td>
<td>1 yes</td>
<td>&gt; part B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 no</td>
<td>&gt; stop</td>
</tr>
</tbody>
</table>

Part B: Several categories can be used per answer, but within each category, only one number can be assigned. If a category is not applicable, leave respective cell empty.

<table>
<thead>
<tr>
<th>General result described</th>
<th>Cbades...</th>
<th>1 high</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2 average or normal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 low</td>
<td></td>
</tr>
</tbody>
</table>

| Result evaluation | Cbeva... | 1 unfavorable |                          |
|                  |          | 2 favorable   |                          |
|                  |          | 3 unclear    |

| Result acceptance | Cbaac... | 1 doubts about correctness of result |                          |
|                  |          | 2 explicit acceptance |

| Result implications for health | Cbimp... | 1 unfavorable implications |                          |
|                               |          | 2 favorable implications |                          |
|                               |          | 3 unclear implications |

| Hindsight | Cbhin... | 1 result higher than expected |                          |
|           |          | 2 result lower than expected |                          |
|           |          | 3 result different from expectations, but unclear how | |
|           |          | 4 high as expected |                          |
|           |          | 5 low or normal as expected |                          |
|           |          | 6 as expected, but unclear how |                          |
|           |          | 7 unclear |                          |

| Feelings | Cbfe... | 1 negative |                          |
|          |         | 2 positive |                          |
|          |         | 3 mixed    |                          |
|          |         | 4 unclear  |

| Need for information | Cbinfo... | 1 need for information/ questions/ comprehension problems |                          |
|                      |           | 2 attribution to previous/ current nutrition |                          |
|                      |           | 3 attribution to previous/ current exercising |                          |
|                      |           | 4 attribution to previous/ current smoking |                          |
|                      |           | 5 attribution to specific other lifestyle aspect |                          |
|                      |           | 6 attribution to several lifestyle aspects |                          |
|                      |           | 7 attribution to lifestyle in general |                          |
|                      |           | 8 attribution to unchangeable circumstances |

| Lifestyle changes | Cblflu... | 1 nutrition changes suggested |                          |
|                  |           | 2 exercise changes suggested |                          |
|                  |           | 3 smoking changes suggested |                          |
|                  |           | 4 alcohol consumption changes suggested |                          |
|                  |           | 5 other specific change suggested |                          |
|                  |           | 6 several changes suggested |                          |
|                  |           | 7 general lifestyle change suggested |                          |
|                  |           | 8 lifestyle continuation suggested |                          |
|                  |           | 15 unclear whether changes suggested |                          |

| Comparison with previous result | Cbcomp... | 1 higher or worse than at wave 1 |                          |
|                                 |           | 2 lower or better than at wave 1 |                          |
|                                 |           | 3 different than at wave 1, but unclear how |                          |
|                                 |           | 4 high or bad as at wave 1 |                          |
|                                 |           | 5 low or good as at wave 1 |                          |
|                                 |           | 6 same as at wave 1, but unclear how |                          |
|                                 |           | 7 previous result mentioned, but unclear whether it is different |

| Other | Cbrest... | Relevant according to part A but unifying any of the previous categories in part B |

Figure C1. Overview of categories in the coding system.
Declaration

I declare that I have written this thesis independently and that this thesis has not been submitted at another University for the conferral of a Degree.

– Martina Panzer

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