Biased Reasoning: Adaptive Responses to Health Risk Feedback

Britta Renner
University of Greifswald, Germany

The present study examined reactions toward repeated self-relevant feedback. Participants in a community health screening received feedback about their cholesterol level on two separate occasions. Reactions to the first feedback were examined with regard to feedback valence and expectedness. The findings showed that negative feedback was devalued, but only when it was unexpected. Feedback consistency was incorporated into analyses of the second feedback. Again, results showed that negative feedback was not always devalued—only when it was inconsistent with the first feedback. Furthermore, positive feedback was not unconditionally accepted. When receiving unexpected positive feedback of low consistency, recipients were doubtful about its accuracy. Conversely, expected positive feedback was accepted regardless of its consistency. These results suggest that negative or unexpected positive feedbacks evoke greater sensitivity to feedback consistency, indicating elaborate cognitive processing. Theoretical accounts of these findings are discussed.

Keywords: *risk perception; expectations; motivation; feedback; reasoning*

The present study examined the reception of self-relevant feedback in relation to consequential and personally relevant information, extending the work of experimental studies that have demonstrated differential acceptance of feedback in dependence of its positivity and expectedness. Furthermore, the present study compared predictions derived from four theoretical perspectives that assume that differential feedback acceptance reflects either motivational biased reasoning caused by positivity or consistency strivings, or reflects an asymmetrical allocation of processing resources.

FEEDBACK VALENCE: POSITIVITY STRIVINGS VERSUS ALLOCATION OF PROCESSING RESOURCES

Experimental studies in various contexts have shown that individuals receiving self-relevant negative feedback often question its validity and accept it less readily than positive feedback (for reviews, see Campbell & Sedikides, 1999; Kunda, 1990; Pyszczynski & Greenberg, 1987; Taylor & Brown, 1988). The phenomenon of differential acceptance also can be observed after the provision of health-related feedback (Croyle, Sun, & Hart, 1997). For instance, participants who believe they suffer from fictitious thioamine acetylase (TAA) enzyme deficiency perceived their test result as less accurate and rated TAA deficiency as a less serious health threat than participants who believed that they showed no TAA deficiency (e.g., Jemmott, Ditto, & Croyle, 1986). Similar results were found in experimental studies of appraisals of blood pressure and cholesterol test results (Croyle, 1990; Croyle, Sun, & Louie, 1993, Study 1), gum disease test results (McCaul, Thiesse-Duffy, & Wilson, 1992), and a hypothetical bacterial condition (Cioffi, 1991).

Differential feedback acceptance is commonly interpreted as evidence for motivational biased reasoning that primarily serves the desire to achieve or maintain a positive sense of self. Depending on the feedback valence, different self-defensive processing strategies are invoked: Whereas positive feedback elicits reasoning that supports the validity of the given information, negative feedback leads to strategies that undermine it (e.g., Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Croyle et al., 1997; Dawson, Gilovich, & Regan, 2002; Kunda, 1990; Pyszczynski & Greenberg, 1987; Taylor & Brown, 1988). Thus, inherent in the motivated reason-

Author's Note: This research was supported by the Deutsche Forschungsgemeinschaft (Grants Re 1583/2-1 and Schw 208/11-01-03) and the Techniker Krankenkasse Berlin-Brandenburg. I would like to thank Harald Schupp for numerous helpful comments and suggestions. I also gratefully acknowledge helpful comments by Hannelore Weber, Judith Bäßler, and Tony Arthur. Correspondence concerning this article should be addressed to Britta Renner, University of Greifswald, Psychology, Franz-Mehring-Str. 47, 17487 Greifswald, Germany; e-mail: renner@uni-greifswald.edu.

ing conception is the notion that information from the environment is molded according to motivational needs, that is, self-defensive positivity strivings. However, a theoretical alternative to the positivity striving perspective has recently been proposed.

According to the quantity of processing view (QoP) (Ditto & Lopez, 1992; Ditto, Scepansky, Munro, Apanovitch, & Lockhart, 1998), feedback valence does not determine qualitatively different processing strategies, as assumed by the positivity striving conception, but reflects an asymmetrical allocation of processing resources. Whereas negative feedback serves as a strong cue for attention and elaborated cognitive processing, positive information generates superficial processing in comparison. Thus, people scrutinize negative information carefully, showing sensitivity to details of the given information. However, if cognitive analysis reveals that the negative feedback is of rather dubious quality, it will probably be rejected. Conversely, positive feedback is processed superficially and, therefore, people are less sensitive to the details of the information and are likely to accept feedback of low quality. According to this view, differential acceptance appears as a byproduct of the quantity of processing.

The assumption that negative information receives more attention and effortful cognitive analysis than positive information is supported in various domains of social psychology and health psychology (Baumeister et al., 2001; Ditto & Lopez, 1992; Pratto & John, 1991; Taylor, 1991). For instance, Liberman and Chaiken (1992) reported that individuals receiving health-threatening information invested more effort in reading the message than did individuals who received less health-threatening information. A more stringent test of the QoP perspective is provided by a study that manipulated information quality (Ditto et al., 1998). A similar methodological strategy has been frequently used to test for shallow or elaborate processing in persuasion research and attributional inferences (Gilbert & Malone, 1995; Petty & Cacioppo, 1986). Consistent with the assumption of shallow processing, participants receiving positive feedback were insensitive to TAA feedback quality. Participants receiving negative feedback were highly sensitive to this detail of feedback information, presumably as a reflection of elaborate feedback processing. Thus, negative feedback of low quality was relatively less accepted than negative feedback of high quality. Moreover, negative feedback of high quality was similarly accepted as positive feedback.

FEEDBACK EXPECTEDNESS: CONSISTENCY STRIVINGS VERSUS ALLOCATION OF PROCESSING RESOURCES

Differential acceptance might not only be consequent on the valence of the feedback information but also may arise where information is inconsistent with preexisting expectancies. Information that is unexpected is generally perceived as less trustworthy and diagnostically accurate than information that is concordant with preexisting expectancies (e.g., Edwards & Smith, 1996; Shrauger, 1975; Swann, Griffin, Predmore, & Gaines, 1987). Although comparatively few studies have explored this phenomenon in the context of health psychology, some observations suggest that expectancies moderate feedback processing. For instance, a study with cancer patients undergoing chemotherapy revealed that unexpected positive health information (rapid tumor shrinking), as opposed to expected information (gradual tumor shrinking), can elicit serious distress and negative effects (Nerenz, Leventhal, Love, & Ringler, 1984; but see Shepperd & McNulty, 2002). As for the reception of negative feedback, the differential acceptance of expectancy-consistent as opposed to expectancy-inconsistent information is commonly considered from a motivational biased reasoning perspective. The preference for consistent information and the devaluation of inconsistent feedback are assumed to reflect the striving for consistency in cognitions about the self, which enables feelings of control and predictability (Swann, 1983).

However, the principal logic underlying the negative feedback–driven QoP view also may hold for expectancy-inconsistent feedback information. Already, several lines of research suggest that expectancy-inconsistent information is subjected to an elaborate stimulus analysis (e.g., Edwards & Smith, 1996; Hilton, Klein, & von Hippel, 1991; for review, see Stangor & McMillan, 1992). For instance, research on argument evaluation showed that belief-incompatible arguments induce a longer reading time and more thought and are judged as weaker than belief-compatible arguments (Edwards & Smith, 1996; see also Lord, Ross, & Lepper, 1979; Petty & Cacioppo, 1986). The QoP approach has consequently been extended to incorporate these findings. For brevity, this conception is denoted as the cue adaptive reasoning account (CARA). The model assumes that both negative feedback and unexpected feedback serve as cues that draw attentional resources for elaborate stimulus processing. Following more general conceptions on the affect system and self-regulation (cf. Baumeister et al., 2001; Taylor, 1991), the preferential allocation of processing resources to negative or unexpected information is considered an adaptive response. In a world where many stimuli and varying demands compete for processing resources, investment of processing resources to self- and survival relevant stimuli fosters successful adaptations to environmental challenges and demands (cf. Baumeister et al., 2001; Ditto et al., 1998). The reasoning triggered by feedback information varies

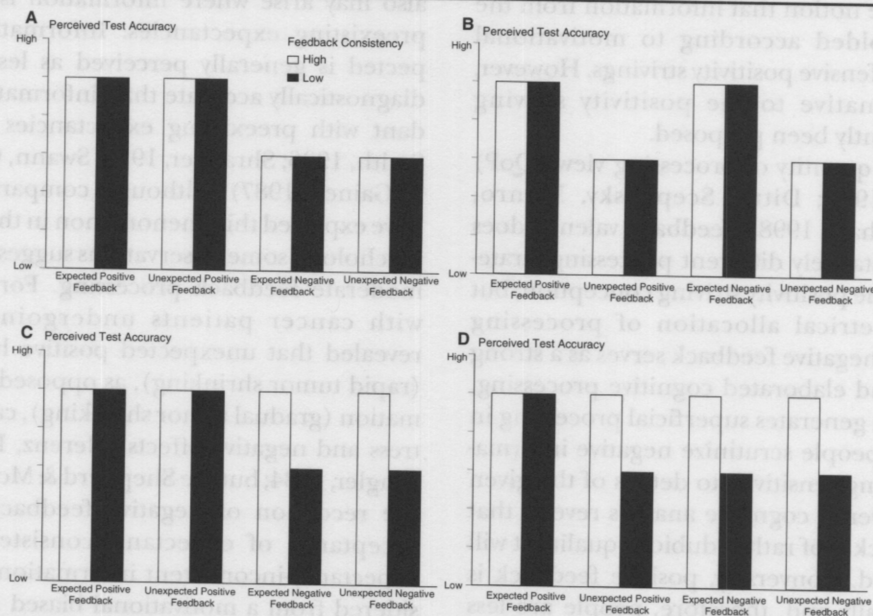

Figure 1 Hypothetical means of perceived test accuracy used to illustrate the predictions of the positivity striving (Panel A), the self-consistency (Panel B), the QoP (Panel C), and the CARA (Panel D) accounts.
NOTE: Qop = quantity of processing, CARA = cue adaptive reasoning account.

theoretically on a continuum ranging from shallow to elaborate information processing, with negative and unexpected feedback triggering more elaborate processing. If, as CARA suggests, negative or unexpected information is processed in a more detail-oriented manner, individuals receiving unexpected negative, expected negative, or unexpected positive feedback should be more likely to accept high quality feedback than low quality feedback. Conversely, expected positive feedback should initiate little cognitive analysis and individuals should therefore demonstrate relative insensitivity to feedback quality.

THE PRESENT STUDY

Participants received cholesterol feedback on two occasions, which were 6 months apart. The first cholesterol feedback provided the opportunity to assess feedback reception as a function of Feedback Expectancy and Feedback Valence. Accordingly, analysis of Time 1 (T1) primarily addressed the question of whether feedback reception varies as a function of either Feedback Valence, as predicted by the self-defensive positivity striving account, or as a function of Feedback Expectedness, as predicted by the self-consistency account. By also considering Feedback Consistency, the reception of the second feedback allowed the examination of motivational biased reasoning perspectives (positivity and self-consistency strivings) and the allocation of processing resources perspective (QoP and CARA). Previous research experimentally manipulated the quality of information by providing bogus information about the reliability of the feedback (Ditto et al., 1998, Study 3). In this study, it was assumed that people in principle consider consistent repeated feedback as more reliable than inconsistent feedback. Hence, the sensitivity to this aspect of the feedback information served as a tool to probe the quantity of information processing.

To facilitate comparison across the models, Figure 1 provides the hypothetical means of accuracy ratings as a function of Feedback Expectancy, Feedback Valence, and Feedback Consistency for each model. Predictions regarding the positivity and self-consistency striving views were identical for the first screening.[1] The self-defensive positivity striving view predicts only a significant main effect for Feedback Valence (Panel A). As shown in Panel B, the primary prediction of the self-consistency model is that participants will consider feedback information as less accurate when it conflicts with their expectancies, irrespective of Feedback Valence or Feedback Consistency (resulting in a Feedback Expectancy × Feedback Valence interaction).

Focusing on the allocation of processing resources perspective (QoP and CARA), more complex result patterns emerge due to the critical significance of Feedback Consistency. Following the QoP view (Panel C), Feedback Valence and Feedback Consistency interact in that

negative feedback of low consistency is considered to be less accurate than negative feedback of high consistency or positive feedback of either consistency. As shown in Panel D, CARA extends the QoP approach by assuming that not just negative feedback but also unexpected feedback triggers more effortful cognitive analysis. Thus, CARA is the only model predicting a triple interaction among Feedback Expectancy, Feedback Valence, and Feedback Consistency. As shown, decomposing the triple interaction for positive and negative feedback separately, a main effect of Feedback Consistency is expected for negative feedback, whereas an interaction of Feedback Valence and Feedback Consistency is predicted for positive feedback. Alternatively, when decomposing the triple interaction for low and high consistent feedback separately, a significant interaction Feedback Expectancy × Feedback Valence effect is only predicted for low consistent information. Both methods of decomposing the triple interaction should reflect the predictions that (a) unexpected positive feedback, expected negative feedback, and unexpected negative feedback should lead to deeper processing and, therefore, high consistent feedback should, on average, be viewed as more accurate than low consistent feedback; and (b) participants receiving expected positive feedback should readily accept the feedback irrespective of Feedback Consistency.

The measure of perceived accuracy, which is also referred to as perceived fact, is complemented by measures of perceived implications for the self (Croyle et al., 1993). In general, a similar pattern is predicted by the different accounts, except that negative feedback should generate more perceived threat for the self and pressure to change than positive feedback. Thus, according the motivational biased perspective, participants should show relative insensitivity to Feedback Consistency. Conversely, the allocation of processing resources view predicts that participants receiving unexpected or negative feedback are sensitive to Feedback Consistency.

METHOD

Participants

A large proportion of the participants (66%) were recruited for a health screening conducted by the Free University of Berlin and the Technician's Health Insurance Agency (Techniker Krankenkasse) through advertisements placed in local newspapers in Berlin, Germany. The remaining participants (34%) were recruited by a letter that was sent to people insured with the Technician's Health Insurance Agency who lived near the four study locations (two universities and two city halls). In total, 1,487 individuals were recruited for the first cholesterol screening and, of these, 604 participants also took part in the second screening. From these 604 participants, 14 participants (2%) had to be excluded from the data set because they failed to complete the questionnaires. In the data analyses, only participants who provided complete data sets for the first and second screening were included (study sample n = 590). The mean age of this sample was 45 years (SD = 15), and 51% were male. The average cholesterol level was 225 mg/dl (SD = 45) and 218 mg/dl (SD = 46) at the first and second measurement, respectively, which is below the mean German population cholesterol level of 237 mg/dl (Troschke, Klaes, Maschewsky-Schneider, & Scheuermann, 1998).

Control analyses showed that the study sample was, on average, 7 years older; had higher cholesterol levels (M = 225 mg/dl vs. M = 214 mg/dl), $ts(1,471) > 4.7$, $ps < .001$; and received more frequent expected negative feedback and less frequent expected positive feedback than the dropout group, $\chi^2(1) = 20.52$, $p < .001$. Analyses of the reactions toward the first cholesterol feedback showed that the study sample and the dropouts did not differ systematically with respect to perceived accuracy and perceived threat, $Fs < 1$, *ns*, respectively. However, the study sample felt more pressure to change than the dropouts (M = 2.9 vs. M = 2.6), $F(1, 1465) = 6.31$, $p = .012$. No interaction between Feedback Expectancy, Feedback Valence, and the Sample Group (study sample vs. dropouts) was significant, $Fs < 2.5$, *ns*.

Measures

Feedback expectancy. Individuals completed an initial questionnaire, which included a measure of the expected cholesterol test result. Specifically, participants were asked, "Immediately after completing this questionnaire your cholesterol level will be measured. What cholesterol level do you expect?" Participants rated their expected cholesterol test result on a scale of 1 (*very low*) through 4 (*optimal*) to 7 (*very high*). Participants were divided according to whether they expected an optimal or lower cholesterol test result (positive expectancy) or an elevated reading (negative expectancy).

Perceived feedback accuracy. Two questions were asked regarding participants' beliefs about the accuracy of their cholesterol test result. First, "How likely do you think it is that your cholesterol test result is false or inaccurate?" (1 = *very likely* and 7 = *very unlikely*). Second, "How likely do you think it is that your cholesterol measure represents a temporary fluctuation?" (1 = *very likely* and 7 = *very unlikely*). The two measures were significantly correlated (first feedback, $r = .69$, $p < .001$; second feedback, $r = .64$, $p < .001$) and thus they were averaged to generate a single measure of the perceived accuracy of the test result.

Perceived threat. Two items served to assess perceived threat. Participants were asked to rate how serious a health threat their cholesterol level was on a 7-point scale, anchored by 1 (*very low*) through 4 (*moderately high*) to 7 (*very high*). They also were asked to rate how worried they felt due to their cholesterol test result. Ratings were made on a scale of 1 (*absolutely not worried*) through 4 (*worried*) to 7 (*very worried*). These two measures were also highly correlated (first feedback, $r = .83$, $p < .001$; second feedback, $r = .81$, $p < .001$) and were therefore averaged to create an overall perceived threat score.

Perceived pressure to change. Pressure to change reflects the extent to which a person feels pressured to lower their cholesterol level and change their behavior (cf. Fuchs, 1996). Participants were given the following statement: "It is necessary for me to do something to lower my cholesterol level." The responses were given on a 4-point scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*).

Perceived changes in nutrition behavior. At the second screening, before the feedback was given, participants were asked whether they had adopted a more healthy nutrition since the first screening. The general stem was as follows: "Have you changed your nutrition since the last screening half a year ago?" (a) "I have lowered my cholesterol intake," (b) "I have lowered my calorie intake," and (c) "I have lowered my fat intake." Responses were made on a dichotomous scale where 1 = yes and 2 = no. When people indicated that they had changed at least one of these three behaviors, it was coded as perceived change in behavior.

Feedback valence. Participants were divided according to whether they had received positive feedback (total cholesterol < 201 mg/dl) or negative feedback (total cholesterol > 200 mg/dl).

Feedback consistency. When the valence of the second feedback was in concurrence with the valence of the first, it was coded as being of high consistency ($n = 479$). Conversely, when the second feedback was discrepant to the first feedback, it was coded as being of low consistency ($n = 111$). Because feedback was based on actual feedback, a comparable low prevalence of inconsistent feedback has to be expected.

Procedure

After arriving at the screening site, participants received a brief description of the study and signed a consent form. Participants then answered a questionnaire that included a measure of the expected cholesterol test result. Afterward, participants' weight and height were measured. Trained laboratory assistants then measured the total cholesterol level using a fingerstick blood draw and a Reflotron desktop analyzer. Following the cholesterol measurement, participants were provided with their exact actual cholesterol level. Furthermore, participants received feedback on their cholesterol level risk category according to international standards (National Heart, Lung, and Blood Institute, 1995). Participants with a cholesterol level of 200 mg/dl or less were told that their cholesterol level was optimal and did not pose a risk for cardiovascular diseases. Individuals with either borderline high cholesterol levels (between 201 mg/dl and 249 mg/dl) or high cholesterol levels (above 249 mg/dl) were informed about the potential risks of borderline and high cholesterol levels for cardiovascular diseases.[2] Shortly after receiving the cholesterol feedback, participants were given a second questionnaire. Among the filler questions, participants were asked to report on the results of their cholesterol test. After completing the second questionnaire, participants received individualized follow-up recommendations, were thanked for their participation, and received an invitation for the second screening, which took place half a year later. The second screening followed a similar procedure except that participants also were asked whether they had changed nutrition-related behaviors since receiving the first feedback.

RESULTS

Feedback Expectancy and Feedback Valence

At the first and second cholesterol screening, 227 and 324 (39% and 55%) participants expected positive cholesterol feedback, whereas 363 and 266 (61% and 45%) expected a negative test result. Based on the actual cholesterol reading, 177 and 218 (30% and 37%) individuals received positive feedback and 413 and 372 (70% and 63%) were confronted with negative feedback.

In total, 65% and 67% of the study sample showed a match between the expected feedback and the actual feedback at the first and second screening. In particular, 99 and 173 (17% and 29%) participants received positive feedback expectantly and 285 and 218 (48% and 37%) were confronted with negative feedback expectantly; 128 and 154 (22% and 26%) expected positive feedback but received negative feedback and therefore demonstrated an optimistic bias. Conversely, 78 and 45 (13% and 8%) expected negative feedback but received positive feedback, demonstrating a pessimistic bias. Hence, if participants made an inaccurate estimation of their actual feedback, they were more likely to make an unrealistically optimistic estimation than an unrealistically pessimistic one, $\chi^2(1) = 12.14$ and 61.11, $p < .001$, for T1 and Time 2 (T2), respectively.

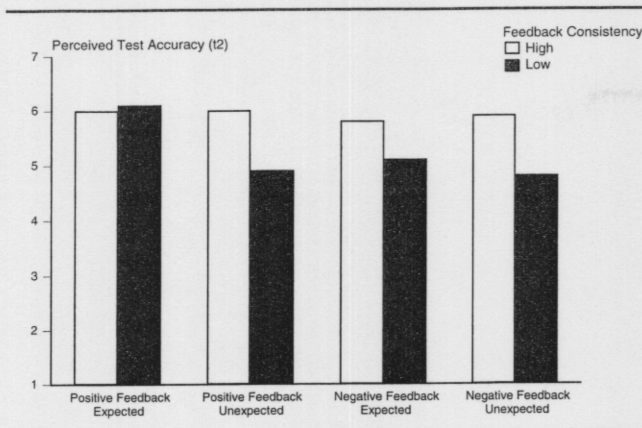

Figure 2 Reactions to the first feedback as a function of Feedback Expectancy and Feedback Valence.
NOTE: t2 = Time 2.

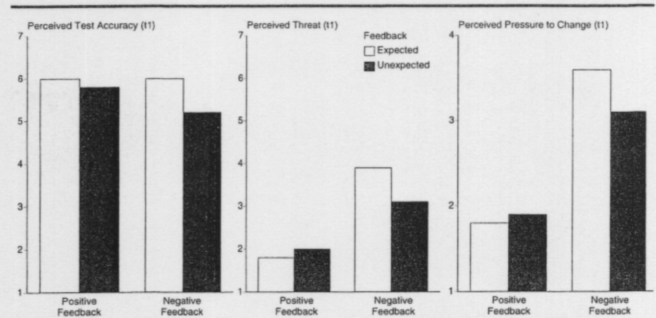

Figure 3 Perceived accuracy of the second feedback as a function of Feedback Expectancy, Feedback Valence, and Feedback Consistency.
NOTE: t1 = Time 1.

Perceived Test Accuracy

Reactions toward the first cholesterol feedback (T1). The analyses of the perceived test accuracy included both participants' prior expectancies (positive vs. negative) and the received valence of the cholesterol feedback (positive vs. negative), which were analyzed in a 2 × 2 ANOVA design with additional post hoc Bonferroni contrasts.

Results indicated a significant main effect for Feedback Valence, $F(1, 586) = 4.88$, $p = .028$. However, this main effect was further qualified by a significant Feedback Expectancy × Feedback Valence interaction, $F(1, 586) = 15.48$, $p < .001$. As shown in Figure 2, participants receiving unexpected negative cholesterol feedback ($M = 5.2$, $SD = 1.5$) gave significantly lower accuracy estimates compared to the other three groups, $ts > 2.5$, $ps = .01$, which did not differ from each other (expected negative $M = 5.9$, $SD = 1.3$; expected positive $M = 6.0$, $SD = 1.2$; unexpected positive $M = 5.8$, $SD = 1.2$; $ts < 1.2$, *ns*).

Reactions toward the second cholesterol feedback (T2). The analyses of the perceived test accuracy at T2 included not only Feedback Expectancy (positive vs. negative) and Feedback Valence (positive vs. negative) but also the additional variable Feedback Consistency (low vs. high), which were analyzed in a 2 × 2 × 2 ANOVA design and post hoc Bonferroni contrasts.

The ANOVA revealed the triple interaction among Feedback Expectancy × Feedback Valence × Feedback Consistency, $F(1, 582) = 5.13$, $p = .024$, which was predicted by the CARA account. Accordingly, the triple interaction was followed up by analyzing the Feedback Expectancy × Feedback Consistency interactions and their corresponding main effects for the positive and negative feedback group, respectively.

Negative feedback. Within the negative feedback group, the main effect for Feedback Consistency reached statistical significance, $F(1, 582) = 5.62$, $p = .018$. As Figure 3 demonstrates, participants receiving consistent feedback ($M = 5.8$, $SD = 1.4$) showed, on average, higher acceptance than did participants receiving inconsistent feedback ($M = 4.9$, $SD = 1.6$). Neither the main effect Feedback Expectancy nor the interaction Feedback Expectancy × Feedback Consistency were significant, $Fs < 1$, *ns*.

Positive feedback. Analyses within the positive feedback group yielded a significant Feedback Expectancy × Feedback Consistency interaction, $F(1, 582) = 4.82$, $p = .029$, indicating that Feedback Consistency mattered only for participants receiving unexpected positive health feedback. Thus, unexpected positive feedback of low consistency was rated, on average, as significantly less accurate compared to unexpected positive feedback of high consistency or expected positive feedback of either high or low consistency, $ts > 4.2$, $p < .001$. In contrast, expected positive feedback was accepted equally whether it was of high or low consistency, $F < 1$, *ns*.

Low versus high consistency feedback. A second approach to complement the significant triple interaction Feedback Expectancy × Feedback Valence × Feedback Consistency is to consider the low and high consistency feedback groups separately. For participants receiving highly consistent information, neither Feedback Expectancy nor Feedback Valence had any impact on reported test accuracy, $Fs < 1$, *ns*. Thus, highly consistent information was generally accepted as accurate independently of whether it was unexpected, negative, or even both. Conversely, those receiving information of low consistency revealed differential accuracy ratings as a function of both Feedback Expectancy and Feedback Valence, $F(1, 582) = 7.11$, $p = .008$. Although risk feedback of low consistency was equally devalued by participants receiving

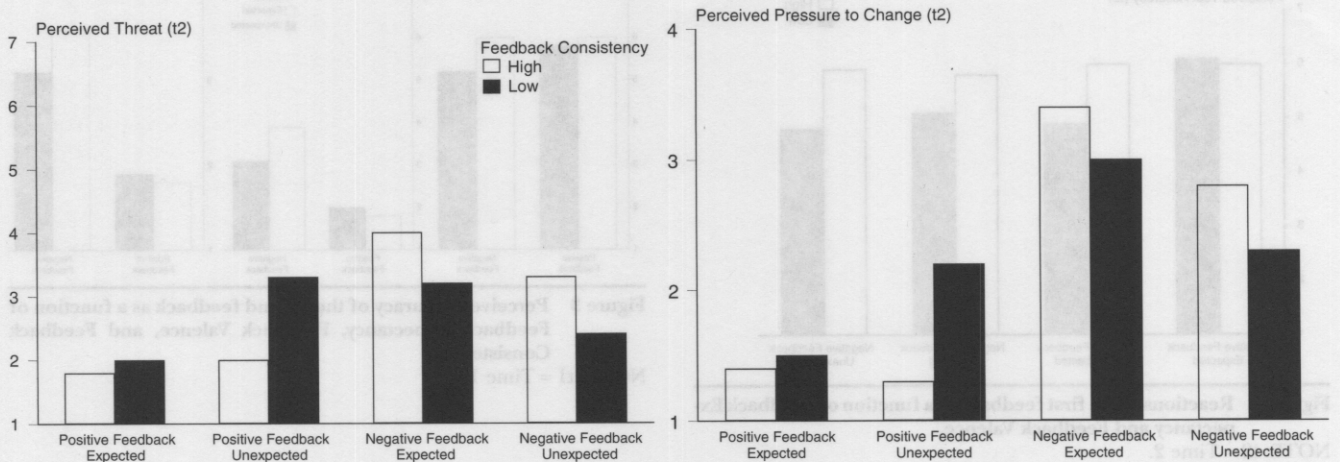

Figure 4 **Perceived threat and pressure to change of the second feedback as a function of Feedback Expectancy, Feedback Valence, and Feedback Consistency.**
NOTE: t2 = Time 2.

unexpected positive feedback, expected negative feedback, or unexpected negative feedback, *ts* > 1, it was accepted as highly valid by participants receiving expected positive feedback, *ts* > 2.7, *ps* < .05.

Perceived Implications

Reactions toward the first cholesterol feedback (T1). Perceived threat and pressure to change elicited by the first cholesterol feedback were analyzed with a 2 × 2 ANOVA including Feedback Expectancy and Feedback Valence as between-subjects variables. Both measures converge in the findings. As expected, negative feedback elicited higher perceived threat and pressure to change than did positive feedback, $Fs(1, 586) = 156.24$ and 317.30, $ps < .001$. In addition, the main effect for Feedback Expectancy was significant, $Fs(1, 586) = 17.34$ and 8.88, $ps < .01$. However, these main effects were further qualified by a significant Feedback Expectancy × Feedback Valence interaction, $Fs(1, 586) = 7.57$ and 6.06, $ps < .01$. As Figure 2 illustrates, perceived threat and perceived pressure to change were low for positive feedback, irrespective of Feedback Expectancy, $Fs < 1$, *ns*. In contrast, negative feedback caused significantly more perceived threat and pressure to change when it was already expected by the recipients than when it was unexpected, $Fs(1, 586) > 22.32$, $ps < .001$.

Reactions toward the second cholesterol feedback (T2). Perceived threat and pressure to change elicited by the second cholesterol feedback were analyzed with a 2 × 2 × 2 ANOVA including Feedback Expectancy, Feedback Valence, and Feedback Consistency as between-subjects variables.

Again, as expected, ANOVAs for perceived threat and pressure to change yielded a significant main effect for Feedback Valence, $Fs(1, 582) = 24.33$ and 99.36, $ps < .001$. Negative feedback generated more perceived threat and pressure to change than did positive feedback. Furthermore, a significant main effect for Feedback Expectancy was observed for both measures, $Fs(1, 582) = 17.00$ and 8.65, $ps < .005$. However, these main effects were not further qualified by the predicted triple interaction, $Fs < 2$, *ns*, but by a significant Feedback Valence × Feedback Consistency interaction, $Fs(1, 582) = 16.40$ and 16.59, $ps < .001$, for perceived threat and for perceived pressure to change, respectively. Additional simple effects and planned comparisons were conducted to test the specified hypotheses within both the positive and negative feedback groups (see also Figure 4).

Negative feedback. Converging with the results for perceived test accuracy, participants receiving consistent negative feedback, on average, reported more threat and pressure to change than participants who received inconsistent negative feedback, $F(1, 582) = 8.18$, $p = .004$, for perceived threat and $F(1, 582) = 4.36$, $p < .05$, for pressure to change. In contrast to the previous perceived accuracy analysis, however, the main effect for Feedback Expectancy was significant, $Fs(1, 582) = 8.71$ and 10.32, $ps < .01$. Thus, after receiving expected negative feedback, participants reported higher threat and pressure to change than after receiving unexpected negative feedback. The interaction Feedback Expectancy ×

Feedback Consistency was not significant for either of the analyses, *Fs* < 1.5, *ns*.

Positive feedback. For the positive feedback group, the only significant effect was the interaction Feedback Consistency × Feedback Expectancy, observed for both measures (perceived threat and pressure to change), *Fs*(1, 582) = 4.54 and 5.72, *ps* < .04. As Figure 4 illustrates, individuals receiving unexpected positive feedback of low consistency felt, on average, more threatened and under higher pressure to change compared to those receiving high consistency feedback, *Fs*(1, 582) = 7.94 and 18.18, *ps* < .006, or compared to individuals receiving expected positive feedback (high or low consistency), *ts* > 4, *ps* < .05. In contrast, individuals receiving expected positive feedback were not sensitive to Feedback Consistency for either perceived threat or pressure to change, *Fs* < 1.

Control Analyses

Changes in expectancy. The analysis of the reception of the second cholesterol feedback provided empirical support for the view that feedback reception varies as a function of Feedback Consistency. However, alternatively, one might assume that the consistency of the Feedback Expectancy might have influenced the reception of the second feedback. Overall, 69% of the participants had stable expectancies across both feedback sessions. As expected, positive feedback for T1 was more likely to change participants' expectancies than was negative feedback for T1 (39% vs. 28%), $\chi^2(1) = 6.22$, $p = .013$. However, for participants receiving positive feedback at T1, change of expectancy varied as a function of Feedback Expectancy at T1. Specifically, only 4% of the expected positive feedback group, but 81% of the unexpected positive feedback group, changed their expectancy. In contrast, expectancy change was similarly pronounced for participants receiving expected and unexpected negative feedback (30% and 27%).

These differences in expectancy change also are reflected in the analyses of the second cholesterol feedback, which was based on the feedback given at T2 and the expectancy of the second test. Thus, participants who expected positive feedback for T2 were significantly more likely to have changed their expectancy after the first feedback than were participants who expected negative feedback for T2 (43% vs. 21% expectancy change), $\chi^2(1) = 50.49$, $p < .001$. More specifically, 38% and 28% of the expected and unexpected positive feedback group and 13% and 48% of the expected and unexpected negative feedback group had changed their expectations.

Finally, whether participants did or did not change their expectancies might systematically influence the reception of the second feedback. Because only 13% of the expected negative feedback group changed their expectancy between T1 and T2, this group had to be excluded from the analyses. Accordingly, the three measures of feedback reception were analyzed in a 3 × 2 × 2 ANOVA design with the three factors Feedback Group at T2 (expected positive, unexpected positive, and unexpected negative feedback), Feedback Consistency (high vs. low), and Expectancy Change (yes vs. no). Neither perceived accuracy nor the two measures of perceived implications yielded a significant main effect or a significant interaction effect involving the factor Expectancy Change, *Fs* < 2.6, *ns*. Hence, whether participants changed their expectancy between T1 and T2 or not did not significantly influence the reception of the feedback at T2.

Perceived changes in diet behaviors. Forty-three percent of the participants reported that they had adopted a healthier diet after the first feedback, supporting the notion that the cholesterol feedback was perceived as consequential and personally relevant information. As expected, negative feedback was significantly more likely to induce (self-reported) behavior change than positive feedback (50% vs. 26%), $\chi^2(1) = 26.98$, $p < .001$. More specifically, 54% and 43% of the expected and unexpected negative feedback group and 24% and 28% of the expected and unexpected positive feedback group stated that they had changed their behavior.

Examining the frequency of self-reported changes in nutrition from the perspective of the second feedback showed that the negative feedback group was more likely to have changed their nutrition than the positive feedback group (49% vs. 32%), $\chi^2(1) = 14.79$, $p < .001$. More specifically, 52% and 44% of the expected and unexpected negative feedback group and 31% and 39% of the expected and unexpected positive feedback group reported that they had changed their nutrition.

Finally, to explore whether participants' reported behavioral change affected the reception of the feedback at T2, the three measures of feedback reception were analyzed in a 2 × 2 × 2 × 2 ANOVA design with the factors Feedback Expectancy at T2, Feedback Valence at T2, Feedback Consistency, and perceived Behavior Change (yes vs. no). The analyses of perceived test accuracy and perceived threat yielded neither a significant main effect nor a significant interaction effect for the factor Behavior Change, (*Fs* < 2, *ns*). For perceived pressure to change, the analysis yielded the effects reported previously for Feedback Expectancy, Feedback Valence, and Feedback Valence × Feedback Consistency (*Fs* > 5, $p < .05$). However, in addition, the main effect for Behavior Change, $F(1, 574) = 6.24$, $p = .013$, and the Feedback Valence × Behavior Change interaction, $F(1, 574) = 7.95$, $p = .005$, were significant. The Feedback Valence × Behavior Change interaction indicates that participants

who received positive feedback felt equally low perceived pressure to change independently of self-reported behavioral changes ($M = 1.5$ vs. $M = 1.7$; $F < 1$, *ns*). Conversely, those who received negative feedback reported more pressure to change when they reported that they had already adopted a more healthy diet than when they had not ($M = 2.7$ vs. $M = 3.3$), $F(1, 574) = 19.21$, $p < .001$.

DISCUSSION

The present study addressed the question of how people respond to feedback that is personally consequential. The main goal of the present study was to examine whether differential feedback acceptance reflects an asymmetrical allocation of processing resources. The allocation of processing resources was probed by testing whether participants showed sensitivity to the consistency of cholesterol feedback given on two occasions. The analysis of the feedback accuracy ratings revealed a significant triple interaction Feedback Expectancy × Feedback Valence × Feedback Consistency, which was consistent with the predictions made by CARA.

The QoP view (Ditto et al., 1998; Ditto & Lopez, 1992) and CARA suggest that both expected and unexpected negative feedback trigger elaborate feedback processing and, therefore, sensitivity to information consistency. Consistent with these assumptions, participants receiving negative feedback of high consistency accepted the feedback as being more valid than did participants receiving negative feedback of low consistency. Moreover, and in line with the predictions by CARA, participants receiving unexpected positive feedback also showed sensitivity to feedback consistency: When the feedback was of high consistency it was rated as more accurate than when it was of low consistency. This contrasts clearly with the insensitivity to feedback consistency shown by participants receiving expected positive information.

Extending the QoP view, CARA assumes that unexpected positive feedback also serves as a cue for systematic processing. Specifically, in the context of personally consequential feedback, people might examine unexpected positive information carefully to prevent terminating protective actions erroneously due to potentially "false-negative" health information, which might cause severe harm in the future. A complementary explanation emerges from considering that individuals brace for possible negative outcomes by lowering their expectations strategically beforehand (Shepperd, Findley-Klein, Kwavnick, Walker, & Perez, 2000). Presumably, participants securitized unexpected positive feedback more carefully to avoid disappointments in the future. However, people might examine unexpected positive information carefully only when the issue at hand is important and the potential cost of erroneous acceptance of the feedback is high (cf. Michie et al., 2002).

A number of important control analyses ensured that the sensitivity to feedback consistency primarily reflected Feedback Valence and Feedback Expectancy rather than the consistency of expectancies across both feedback sessions or perceived behavior changes. One interesting result of these control analyses was that negative feedback is more likely to induce self-reported preventive behaviors than is positive feedback. Furthermore, unexpected positive feedback was highly effective in changing participants' expectancies. However, it is particularly relevant that perceived feedback accuracy did not vary systematically as a function of expectancy or self-reported behavior change.

Taken together, the analysis of feedback accuracy reveals the pattern of results predicted by CARA, an extension of the QoP view (Ditto et al., 1998; Ditto & Lopez, 1992). If one accepts the contention that sensitivity to feedback consistency probes the amount of effortful cognitive processing of the given feedback information, the data suggest that unexpected positive feedback, expected negative feedback, and unexpected negative feedback serve as cues for the increased allocation of processing resources. However, although sensitivity to details of the information has served as a measure of elaborate cognitive processing in numerous studies in persuasive communication and attribution research (Gilbert & Malone, 1995; Petty & Cacioppo, 1986), further research is necessary to provide direct evidence for the elaborate processing of information after receiving negative or unexpected information.

Motivational Biased Reasoning and the Reception of Consequential Health Risk Feedback

The differential acceptance of negative health feedback as a function of feedback consistency is difficult to explain from a motivational biased reasoning perspective. Considering positivity and self-consistency strivings simultaneously, as suggested by multiple motives conceptions, unexpected negative feedback constitutes the most aversive information (e.g., Jussim, Yen, & Aiello, 1995; Sedikides, 1993; Shrauger, 1975; Stahlberg, Petersen, & Dauenheimer, 1999; Swann & Schroeder, 1995; Taylor, Neter, & Wayment, 1995). When both self-consistency and self-defensive strivings combine against accepting the information, individuals should be highly motivated to undermine its validity. Conversely, both motives support the acceptance of expected positive feedback. However, in contrast to these predictions, negative feedback of high consistency, whether unexpected or expected, was accepted to a similar degree as expected positive feedback. This is remarkable because, theoretically, estimations by the expected positive feed-

back group should be unbiased or should even reflect overestimated accuracy ratings.

A further challenge for positivity striving perspectives is the sensitivity to feedback consistency of the unexpected positive feedback group. If people predominately strive to attain or maintain a positive view of the self, this group should readily accept the feedback as valid information. However, participants receiving unexpected positive feedback of low consistency were as rigorous in rejecting the given feedback as participants receiving negative feedback of low consistency. Similarly, from the self-consistency perspective, one might argue that participants may have been reluctant to accept unexpected positive feedback because it conflicted with self-consistency needs and the desire to protect feelings of control. In contrast, both unexpected and expected positive feedback of high consistency was highly accepted.

Sensitivity to Feedback Consistency and Perceived Implications

Providing further support for the CARA perspective, measures of perceived implications (perceived threat and pressure to change) also revealed sensitivity to feedback consistency: Participants receiving expected negative feedback, unexpected negative feedback, or unexpected positive feedback showed sensitivity to feedback consistency, whereas participants receiving expected positive feedback were insensitive to its consistency. Despite these overall similarities of measures of perceived fact and implications, they did not mirror each other completely. Specifically, differences emerged for the reception of negative feedback. Whereas perceived accuracy varied only as a function of feedback consistency, perceived implications varied as a function of two independent effects—feedback consistency and expectedness. Thus, unexpected negative feedback was less threatening than expected negative feedback, irrespective of the consistency of the feedback.

These differences presumably reflect that perceived fact and implication tap into different aspects of feedback processing. The CARA and the QoP approach only specify conditions under which more effortful and elaborate feedback processing might occur, but not what kinds of specific information are considered for appraising different aspects of the feedback. From a normative perspective, the valence of feedback is of great consequence for self-related implications (e.g., threat for the self), but it is not informative for appraising its general aspects (e.g., feedback accuracy, general threat, and implications). Of interest, perceived threat apparently not only reflects feedback valence but participants calculate the danger they potentially face as a result of the given feedback in conjunction with their expectancy and perceived previous behavior changes.

The finding that unexpected negative feedback was perceived as less threatening than expected negative feedback might be considered as evidence for motivational biased reasoning. Positivity and consistency strivings combine for this feedback group; thus, the motivation to downplay information is most pronounced. According to this perspective, the first line of defense as indexed by perceived accuracy might have been more difficult to derogate, whereas the second line of defense indexed by measures of perceived threat allowed more leeway to downplay unwanted information (Croyle et al., 1993). However, from this perspective it is difficult to explain why participants receiving positive feedback of low consistency felt substantially more threatened when the feedback was unexpected than when it was expected.

The Reception of Health Feedback: The Need to Consider Expectancies and Valence

The typical finding in health psychology is that people derogate negative in comparison to positive health feedback (cf. Croyle et al., 1997). However, the present study observed that feedback reception varied as a function of both Feedback Valence and Feedback Expectancy. Although an interaction of Feedback Valence and Feedback Expectancy emerged for both feedback sessions, the first screening is of particular relevance because it employed a setting comparable to previous studies. Considering the first health feedback, participants receiving unexpected negative feedback considered the test result to be less accurate than did participants receiving expected negative feedback.

Previous experimental studies providing health feedback (for a review, see Croyle et al., 1997) might have inadvertently confounded Feedback Expectancy and Feedback Valence. In these studies, differential acceptance of health feedback was presumably observed because people who received positive feedback received it expectantly, whereas negative feedback probably took them by surprise. Support for this notion is derived from the many studies that demonstrate that individuals harbor unrealistic positive expectancies about their health and their future (e.g., Renner, in press; Weinstein, 1980, in press).

This reasoning is further supported by studies of unrealistic optimism, which suggest that people who underestimate their risk are prone to defensiveness (Davidson & Prkachin, 1997; Radcliffe & Klein, 2002; Weinstein & Klein, 1995; Wiebe & Black, 1997). For example, similar to the present study, Radcliffe and Klein (2002) found that unrealistically optimistic individuals worried less about their risk than did others (who

were either accurate or pessimistic). In a similar vein, Avis, Smith, and McKinlay (1989) reported that optimistically biased individuals were rather resistant in changing their risk perception of having a heart attack after receiving unexpected negative feedback (66% demonstrated stable risk perception). These findings converge with the present study. Seventy percent of the unrealistic optimists maintained the expectancy of a positive cholesterol feedback after receiving negative feedback at T1, whereas only 30% of the unrealistic pessimists maintained a negative expectancy. A similar asymmetry was observed for the expected feedback groups. Taken together, individuals might not only harbor positive unrealistic positive expectancies about their health but also may show resistance to negative feedback. In particular, the finding of asymmetrical patterns of expectancy change for unrealistic optimists and unrealistic pessimists might be considered as evidence for defensiveness (Irle & Krolage, 1973; Weinstein & Klein, 1995).

However, a more cautionary perspective on this reasoning is suggested by considering the self-reported behavioral changes that were induced by the feedback. Specifically, although 70% of the unrealistic optimists maintained their expectancy, 42% of them reported that they had changed their behavior after receiving unexpected negative feedback. The behavioral changes reported within the unexpected negative group might be due to an increase in perceived risk immediately after receiving negative feedback at T1, which in turn might have motivated them to change their behavior. However, once participants believe that they have modified their risk behavior, expectancies might reflect these behavior changes because they have removed or reduced the source of the risk (Kreuter & Strecher, 1995). Thus, maintaining a positive expectancy despite receiving negative feedback might reflect either defensiveness or the belief that the modification of risk behaviors was effective in reducing health risk. Furthermore, the measure of perceived behavior change probably underestimates the probability of people being motivated to actually change their behavior because health behavior change depends on additional variables, for example, outcome expectancies or perceived self-efficacy (cf. Renner & Schwarzer, in press; Schwarzer & Renner, 2000).

Methodological Limitations

The phenomenon of biased reasoning was explored here in a field study, and limitations of the internal and external validity of the present study must therefore be acknowledged. People who choose to be tested are by definition self-selected and may, in part, be psychologically and behaviorally prepared for dealing with bad news. Consequently, the degree to which the findings generalize to people who refrained from testing is limited. Although typical for public health screening studies with volunteers (cf. Glanz & Gilboy, 1995), a clear restriction for the external validity might be that the attrition rate between the first and second screening led to a systematic sample bias. There are a number of variables (e.g., education, age) that might possibly contribute to the attrition rate that cannot be completely ruled out in this study. However, control analyses showed that the dropouts and the study sample did not differ systematically in their reception of the first feedback (i.e., perceived accuracy, perceived threat), except that the dropouts felt less pressure to change than the study sample. In addition, the dropouts had a lower total cholesterol level than did the study sample. Thus, participants probably did not abstain from retesting because they were especially threatened by the first feedback or because they were more defensive.

A further limitation of the present study is that the cholesterol feedback was not randomly assigned to the recipients but was based on their actual cholesterol test results. The advantage of giving actual feedback is that it is naturalistic and personally important. Moreover, it appears that random assignment to experimental conditions is only ethically feasible for studying short-term effects because negative health feedback is emotionally upsetting for the recipients (cf. Baumann, Cameron, Zimmerman, & Leventhal, 1989; Croyle et al., 1997). Conversely, without any question, a priori differences between the two feedback groups might have impaired internal validity. Although previous studies have shown no direct relationship between risk factor appraisals and individual difference variables such as self-esteem, monitoring versus blunting coping style, repression-sensitization, or dispositional optimism (Croyle et al., 1993; Ditto, Jemmott, & Darley, 1988; Radcliffe & Klein, 2002), dispositions might influence feedback expectancies and, consequently, risk feedback reception.

However, the observed pattern might primarily apply to personally consequential settings that are at least partly under behavioral control. Dunning (1995), for example, observed that feedback about a stable (noncontrollable) aspect of personality induced self-defensive reactions, whereas feedback about a malleable aspect generated more unbiased reactions (see also Ditto et al., 1988). Considering these findings in conjunction with the present study leads to the conclusion that perceived controllability might be an important mediator that needs further investigation.

NOTES

1. According to the motivational biased reasoning perspective, processing of "wanted" (positive or expected) information elicits reason-

ing that supports the validity of the information, whereas "unwanted" (negative or unexpected) information leads to reasoning that undermines it. Thus, processing of both wanted and unwanted information is equally vigorous but directed toward different ends (cf. Ditto, Scepansky, Munro, Apanovitch, & Lockhart, 1998). In addition, many researchers assume that positivity and self-consistency strivings are limited by the desire to maintain an "illusion of objectivity" or by reality constrains (e.g., Kunda, 1990; Pyszczynski & Greenberg, 1987; Taylor & Brown, 1988). However, the desire to maintain an illusion of objectivity should be operative whether the received feedback is wanted or unwanted. According to this reasoning, one would expect an additional main effect Feedback Consistency. It should be noted that no interaction involving Feedback Consistency is derived by this additional reasoning.

2. Control analyses revealed that borderline and high cholesterol feedback groups did not differ significantly in their accuracy ratings at Times 1 and 2, $Fs < 1.6$, *ns*. As expected, the high cholesterol feedback group felt somewhat more threatened and more pressure to change than did the borderline cholesterol feedback group, $Fs < 53$, $p < .001$. In addition, the borderline high cholesterol feedback reported, on average, higher threat and pressure to change than did the optimal cholesterol feedback group, $Fs > 28$, $p < .001$. Given these findings, borderline and high cholesterol feedback groups were combined in the analyses.

REFERENCES

Avis, N. E., Smith, K. W., & McKinlay, J. B. (1989). Accuracy of perceptions of heart attack risk: What influences perceptions and can they be changed? *American Journal of Public Health, 79,* 1608-1611.

Baumann, L. J., Cameron, L. D., Zimmerman, R. S., & Leventhal, H. (1989). Illness representations and matching symptoms. *Health Psychology, 8,* 449-469.

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology, 5,* 323-370.

Campbell, W. K., & Sedikides, C. (1999). Self-threat magnifies the self-serving bias: A meta-analytic integration. *Review of General Psychology, 3,* 23-43.

Cioffi, D. (1991). Asymmetry of doubt in medical self-diagnosis: The ambiguity of "uncertain wellness." *Journal of Personality and Social Psychology, 61,* 969-980.

Croyle, R. T. (1990). Biased appraisal of high blood pressure. *Preventive Medicine, 19,* 40-44.

Croyle, R. T., Sun, Y. C., & Hart, M. (1997). Processing risk factor information: Defensive biases in health-related judgments and memory. In K. L. Petrie & J. A. Weinman (Eds.), *Perceptions of health and illness* (pp. 267-290). Amsterdam: Harwood Academic.

Croyle, R. T., Sun, Y. C., & Louie, D. H. (1993). Psychological minimization of cholesterol test results: Moderators of appraisal in college students and community residents. *Health Psychology, 12,* 503-507.

Davidson, K., & Prkachin, K. (1997). Optimism and unrealistic optimism have an interacting impact on health-promoting behavior and knowledge changes. *Personality and Social Psychology Bulletin, 23,* 617-625.

Dawson, E., Gilovich, T., & Regan, D. T. (2002). Motivated reasoning and performance on the Wason Selection Task. *Personality and Social Psychology Bulletin, 28,* 1379-1387.

Ditto, P. H., Jemmott, J. B., & Darley, J. M. (1988). Appraising the threat of illness: A mental representational approach. *Health Psychology, 7,* 183-201.

Ditto, P. H., & Lopez, D. F. (1992). Motivated skepticism: Use of differential decision criteria for preferred and nonpreferred conclusions. *Journal of Personality and Social Psychology, 63,* 568-584.

Ditto, P. H., Scepansky, J. A., Munro, G. D., Apanovitch, A. M., & Lockhart, L. K. (1998). Motivated sensitivity to preference-inconsistent information. *Journal of Personality and Social Psychology, 75,* 53-69.

Dunning, D. (1995). Trait importance and modifiability as factors influencing self-assessment and self-enhancement motives. *Personality and Social Psychology Bulletin, 21,* 1297-1306.

Edwards, K., & Smith, E. E. (1996). A disconfirmation bias in the evaluation of arguments. *Journal of Personality and Social Psychology, 71,* 5-24.

Fuchs, R. (1996). Causal models of physical exercise participation: Testing the predictive power of the construct "pressure to change." *Journal of Applied Social Psychology, 26,* 1931-1960.

Gilbert, D. T., & Malone, P. S. (1995). The correspondence bias. *Psychological Bulletin, 117,* 21-38.

Glanz, K., & Gilboy, M. B. (1995). Psychosocial impact of cholesterol screening and management. In R. T. Croyle (Ed.), *Psychosocial effects of screening for disease prevention and detection* (pp. 39-64). London: Oxford University Press.

Hilton, J. L., Klein, J. G., & von Hippel, W. (1991). Attention allocation and impression formation. *Personality and Social Psychology Bulletin, 17,* 548-559.

Irle, M., & Krolage, J. (1973). Kognitive Konsequenzen irrtümlicher Selbsteinschätzungen [Cognitive consequences of erroneous self-judgments]. *Zeitschrift für Sozialpsychologie, 4,* 36-50.

Jemmott, J. B., Ditto, P. H., & Croyle, R. T. (1986). Judging health status: Effects of perceived prevalence and personal relevance. *Journal of Personality and Social Psychology, 50,* 899-905.

Jussim, L., Yen, H. J., & Aiello, J. R. (1995). Self-consistency, self-enhancement, and accuracy in reactions to feedback. *Journal of Experimental Social Psychology, 31,* 322-356.

Kreuter, M. W., & Strecher, V. J. (1995). Changing inaccurate perceptions of health risk: Results from a randomized trial. *Health Psychology, 14,* 56-63.

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin, 108,* 480-498.

Liberman, A., & Chaiken, S. (1992). Defensive processing of personally relevant health messages. *Personality and Social Psychology Bulletin, 18,* 669-679.

Lord, C. G., Ross, L., & Lepper, M. R. (1979). Biased assimilation and attitude polarization: The effects of prior theories on subsequently considered evidence. *Journal of Personality and Social Psychology, 37,* 2098-2109.

McCaul, K. D., Thiesse-Duffy, E., & Wilson, P. (1992). Coping with medical diagnosis: The effects of at-risk versus disease labels over time. *Journal of Applied Social Psychology, 22,* 1340-1355.

Michie, S., Weinman, J., Miller, J., Collins, V., Halliday, J., & Marteau, T. M. (2002). Predictive genetic testing: High risk expectations in the face of low risk information. *Journal of Behavioural Medicine, 25,* 33-50.

National Heart, Lung, and Blood Institute. (1995). *Recommendations regarding public screening for measuring blood cholesterol* (NIH Publication No. 95-3045). Bethesda, MD: National Institutes of Health.

Nerenz, D. R., Leventhal, H., Love, R. R., & Ringler, K. E. (1984). Psychological aspects of cancer chemotherapy. *International Review of Applied Psychology, 33,* 521-529.

Petty, R. E., & Cacioppo, J. T. (1986). *Communication and persuasion: Central and peripheral routes to attitude changes.* New York: Academic Press.

Pratto, F., & John, O. P. (1991). Automatic vigilance: The attention-grabbing power of negative social information. *Journal of Personality and Social Psychology, 61,* 380-391.

Pyszczynski, T., & Greenberg, J. (1987). Toward an integration of cognitive and motivational perspectives on social inference: A biased hypothesis-testing model. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 20, pp. 297-340). San Diego, CA: Academic Press.

Radcliffe, N. M., & Klein, W. M. P. (2002). Dispositional, unrealistic, and comparative optimism: Differential relations with the knowledge and processing of risk information and beliefs about personal risk. *Personality and Social Psychology Bulletin, 28,* 836-846.

Renner, B. (in press). Hindsight bias after receiving self-relevant health risk information: A motivational perspective. *Memory.*

Renner, B., & Schwarzer, R. (in press). Social-cognitive factors predicting health behavior change. In J. Suls & K. Wallston (Eds.), *Social psychological foundations of health and illness.* Oxford, UK: Blackwell.

Schwarzer, R., & Renner, B. (2000). Social-cognitive predictors of health behavior: Action self-efficacy and coping self-efficacy. *Health Psychology, 19,* 487-495.

Sedikides, C. (1993). Assessment, enhancement, and verification determinants of the self-evaluation process. *Journal of Personality and Social Psychology, 65,* 317-338.

Shepperd, J. A., Findley-Klein, C., Kwavnick, K. D., Walker, D., & Perez, S. (2000). Bracing for loss. *Journal of Personality and Social Psychology, 78,* 620-634.

Shepperd, J. A., & McNulty, J. K. (2002). The affective consequences of expected and unexpected outcomes. *Psychological Science, 13,* 85-88.

Shrauger, J. S. (1975). Responses to evaluation as a function of initial self-perceptions. *Psychological Bulletin, 82,* 581-596.

Stahlberg, D., Petersen, L. E., & Dauenheimer, D. (1999). Preferences for and evaluation of self-relevant information depending on the elaboration of the self-schemata involved. *European Journal of Social Psychology, 29,* 489-502.

Stangor, C., & McMillan, D. (1992). Memory for expectancy-congruent and expectancy-incongruent information: A review of the social and social developmental literatures. *Psychological Bulletin, 111,* 42-61.

Swann, W. B., Jr. (1983). Self-verification: Bringing social reality into harmony with the self. In J. Suls & A. G. Greenwald (Eds.), *Social psychological perspectives on the self* (Vol. 2, pp. 33-66). Hillsdale, NJ: Lawrence Erlbaum.

Swann, W. B., Jr., Griffin, J. J., Predmore, S. C., & Gaines, B. (1987). The cognitive-affective crossfire: When self-consistency confronts self-enhancement. *Journal of Personality and Social Psychology, 52,* 881-889.

Swann, W. B., Jr., & Schroeder, D. G. (1995). The search for beauty and truth: A framework for understanding reactions to evaluations. *Personality and Social Psychology Bulletin, 21,* 1307-1318.

Taylor, S. E. (1991). Asymmetrical effects of positive and negative events: The mobilization minimization hypothesis. *Psychological Bulletin, 110,* 67-85.

Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin, 103,* 193-210.

Taylor, S. E., Neter, E., & Wayment, H. A. (1995). Self-evaluation processes. *Personality and Social Psychology Bulletin, 21,* 1278-1287.

Troschke, J. von, Klaes, L., Maschewsky-Schneider, U., & Scheuermann, W. (1998). *Die Deutsche Herz-Kreislauf-Präventionsstudie* [*The German cardiovascular prevention study*]. Bern, Germany: Huber.

Weinstein, N. D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology, 39,* 806-820.

Weinstein, N. D. (in press). Exploring the links between risk perceptions and preventive health behavior. In J. Suls & K. Wallston (Eds.), *Social psychological foundations of health and illness.* Oxford, UK: Blackwell.

Weinstein, N. D., & Klein, W. M. (1995). Resistance of personal risk perceptions to debiasing interventions. *Health Psychology, 14,* 132-140.

Wiebe, D. J., & Black, D. (1997). Illusional beliefs in the context of risky sexual behaviors. *Journal of Applied Social Psychology, 27,* 1727-1749.

Received December 23, 2002

Revision accepted August 11, 2003