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Bracing for the Worst: Severity, Testing, and Feedback Timing as Moderators of the Optimistic Bias

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People are remarkably optimistic in their personal predictions. However, people occasionally will be pessimistic, bracing themselves for negative feedback, if they anticipate that their optimistic outlook might be challenged. The authors examined the effects of event severity, testing, and feedback timing on personal predictions. Participants believed they would or would not be tested for a medical condition with or without severe consequences. At the beginning of the experiment, participants who anticipated being tested believed they would receive their test results in 3 to 4 weeks. At the end of the experiment, these participants learned that they would receive their test results in a few moments. As predicted, participants who were tested were most pessimistic when anticipating immediate feedback for a deficiency with severe consequences. Further analyses revealed that participants' personal predictions were related to their affect.

Few things are as important as the ability to predict one's environment. For most organisms, survival depends on the ability to forecast the whims of Mother Nature as well as the behavior of prey and predator. Among humans, the farmer must predict the weather, the broker must predict the market, and the gambler must predict the roll of the die. The need to predict events in one's environment is so important that some theorists have offered it as a fundamental motivation underlying much human cognition and behavior (Heider, 1958; Jones & Davis, 1965; Kelley, 1967; Langer, 1975). In general, people seem pretty good at predicting their environment and the behavior of others. However, when it comes to making predictions about the self, people are remarkably inaccurate or biased in their forecasts, often displaying excessive optimism in their personal predictions (Perloff, 1987; Weinstein, 1980), but occasionally displaying excessive pessimism (Shepperd, Ouellette, & Fernandez, 1996). The present research examines factors that influence when people will

be excessively optimistic versus excessively pessimistic in their personal predictions.

The Evidence for Optimism and Pessimism

The optimistic bias is the tendency for people to believe that they are more likely than others to experience positive events and less likely than others to experience negative events (Weinstein, 1980, 1983, 1987). In one of the first studies to examine the optimistic bias, Weinstein (1980) had college students estimate their chances of experiencing a variety of positive and negative life events relative to other students their age. The students reported that they were more likely than others to experience positive events, such as liking their post-graduation jobs, owning their own home, or having good starting salaries, and less likely than others to experience negative life events, such as having a drinking problem, divorcing after marriage, and experiencing various diseases (Weinstein, 1980). Subsequent research has shown the optimistic bias to be quite robust (particularly for negative events) for both college and community samples and for a variety of events including drug addiction, lung cancer, tooth decay, skin cancer, HIV, auto injury, unemployment, divorce, suicide, and burglary (Bauman & Siegel, 1987; Drake, 1984; Long & Sangster, 1993; Perloff & Fetzer, 1986; Schwarzer, 1994; Segerstrom, McCarthy, Caskey, Gross, & Jarvik, 1993; Tennen & Afleck, 1987; Weinstein, 1980, 1983, 1987).

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Although evidence for the optimistic bias is substantial, people are not always uniformly optimistic in their personal predictions. For example, in one study, participants predicted their performance on an anagram test that was scheduled immediately or in 4 weeks (Nisan, 1972). Participants who anticipated an immediate test estimated a lower score than did participants who anticipated the test in 4 weeks (Nisan, 1972; see also Gilovich, Kerr, & Medvec, 1993; Shepperd et al., 1996). In another study, college sophomores, juniors, and seniors estimated the starting salary of their first postgraduate jobs at the beginning of the spring term and again at the end of the term, 2 weeks prior to graduation for the seniors. Only seniors estimated a lower salary at the end of the term. Moreover, the lower estimate was entirely due to those seniors who were looking for jobs immediately after graduation (Shepperd et al., 1996, Experiment 1). More important, with no objective standards with which to compare these estimates, it is difficult to determine whether the participants in these experiments were being excessively pessimistic or were merely reporting less optimism.

The above examples aside, people overwhelmingly err on the side of optimism, rather than pessimism, in their personal predictions. However, this may be due largely to the type of events examined in past research and the way optimism is operationalized. In the typical study, participants are asked to estimate their likelihood of experiencing some event in the future (e.g., injury in a car accident). Optimism is operationalized by comparing participants' estimates of the likelihood that the event will happen to them relative to the likelihood that the event will happen to someone else (e.g., the average student or person). Rarely is there any standard against which to judge the accuracy of the predictions. Although data for the population may be available (e.g., Rothman, Klein, & Weinstein, 1996), there is no way of knowing in advance whether a specific person will be injured in a car accident in his or her lifetime. In the absence of individual outcome data, people have considerable leeway in their predictions, allowing them to be quite optimistic without fear of being shown incorrect.

However, when individual outcome data are available and anticipated in the near future, people no longer have the freedom to think what they want about the future—they no longer have the luxury of being optimistic. Instead, they face the possibility that their optimistic outlook may be disconfirmed. The prospect of disconfirmation can lead to greater accuracy in personal predictions, perhaps because of accountability concerns (Tetlock, 1992), but can also lead to pessimism. For example, in one study, students predicted an exam score on several occasions. When the exam was a month away, the students were quite optimistic in the scores they

predicted receiving. After the exam, the students were more realistic in their estimates, estimating scores that were quite close to the scores they actually received. More important, however, were the estimates in the seconds prior to when the students received their exam scores. When feedback was only moments away, students became pessimistic in their predictions, estimating scores lower than they actually received (Shepperd et al., 1996, Experiment 2).

The decline in optimism in anticipation of self-relevant feedback likely stems from an attempt to brace for the worst, presumably to avoid disappointment associated with performing below expectations. Past research indicates that satisfaction with a particular outcome is determined in part by expectations regarding the occurrence of that outcome (Feather, 1967, 1969). Most notably, negative outcomes tend to be perceived as more unpleasant if they are unexpected than if they are expected. In other words, people find unexpected negative outcomes more aversive. Accordingly, the prospect that personal predictions will be challenged induces people to be more modest, perhaps even pessimistic, in their predictions in an attempt to avoid the negative feelings arising from the disconfirmation of positive expectations.

Personal Predictions and Outcome Severity

There is some evidence that the degree of optimism expressed varies according to the seriousness of the event. That is, some studies have found greater optimism for events that are judged more serious or grim (Heine & Lehman, 1995; Kirscht, Haefner, Kegeles, & Rosenstock, 1966). On the other hand, other research has failed to find a relationship between event severity and optimism for the event (e.g., van der Velde, van der Pligt, & Hooykaas, 1992; Weinstein, 1987). It is important to note that prior research examining event severity and optimism has been exclusively correlational. Participants are asked to rate their likelihood of experiencing a variety of events as well as the severity of the events (Eiser, Eiser, & Pauwels, 1993; Heine & Lehman, 1995; van der Velde et al., 1992; Weinstein, 1982, 1987). Unfortunately, these events typically vary in more ways than severity. They often also vary in controllability, the population incidence, the valence (positive vs. negative), age of onset, and so forth. In short, the relationship between optimism and event severity in these prior studies may have been obscured or amplified by some third variable.

We suspect that for many events, the relationship between optimism and event severity is positive. Indeed, optimism may be motivated by an attempt to regulate the unpleasant feelings associated with negative events. That is, people anticipating no challenge to their optimistic outlook may underestimate the likelihood of negative events occurring because it feels good to think that one

is not at risk and is distressing to acknowledge that one is at risk. In short, when their optimistic beliefs will not soon be challenged, people may express the greatest optimism for severe events because severe events have the potential for generating the most negative feelings.

By the same token, it seems likely that *in anticipation of feedback*, people will also display the greatest pessimism or bracing for events with severe consequences. Because severe events (e.g., lung cancer, serious injury, HIV infection) can impose dramatic life changes, they often are extremely threatening. They also are likely to be regarded as particularly upsetting if they are unexpected. Consequently, we predict that people will brace the most when they anticipate testing and feedback for an event with severe consequences. If, however, the event does not have severe consequences, no testing is anticipated, or the test feedback is distant, then we anticipate that people will be inclined toward optimism in their predictions.

Overview

We examined the effects of being tested for a health condition, the severity of the condition, and the immediacy of test feedback regarding the condition on personal risk predictions. Participants believed they would or would not be tested for a medical condition with or without severe consequences. At the beginning of the experiment, participants in the test condition believed they would receive their test results in 3 to 4 weeks. Participants in the no-test condition believed that they were not being tested for the medical condition. At the end of the experiment, participants in the test condition learned that they would receive their test feedback in a few moments. Participants in the no-test condition continued to believe that they would not be tested for the medical condition. Participants estimated their risk for the disease twice: once at the beginning of the experiment and once at the end of the experiment just prior to when participants in the test condition anticipated receiving their test results.

The procedure of testing for a fictitious health condition has been used in prior research. For example, Jemmott, Ditto, and Croyle (1986; see also Ditto & Lopez, 1992) found that participants testing positive for a fictitious enzyme deficiency rated the deficiency as less serious and were more likely to derogate the validity of the test than were participants testing negative for the deficiency. Rather than looking at the participants' judgments of the seriousness of the health condition or the validity of the test results, the present study examined participants' judgments of the likelihood of testing positive for the deficiency as a function of the seriousness of the condition, whether participants were being tested, and the proximity of the test feedback.

We anticipated that participants would experience the greatest threat and would thus be most inclined to brace for the worst when they anticipated immediate test feedback about a condition with severe consequences. Therefore, we predicted that participants in the test/severe/immediate-feedback condition would be most likely to estimate that they would test positive for the medical condition. We anticipated that participants would feel least threatened, and thus would be least inclined to brace for the worst, when the consequences of the condition were not severe or when they were not being tested or believed that they would not receive their test results for several weeks.

The bracing process is undoubtedly driven by some underlying psychological variable such as focus of attention, anxiety, or greater information processing. Of these variables, anxiety, or some similar negative affect, seems the most promising. Specifically, in the study of exam score estimates described earlier (Shepperd et al., 1996), self-reported anxiety correlated (albeit weakly) with pessimism, and the most common explanation participants gave for lowering their estimates as feedback became imminent was that they felt nervous. The present study included a more reliable measure of negative affect administered multiple times during the experiment, thereby permitting a clearer examination of the role that negative affect plays in personal predictions. We predicted that participants' personal predictions would correspond to their self-reported affect. Specifically, people would be most optimistic in their personal predictions when they reported the least negative affect (i.e., in the no-test/not-severe condition). Likewise, people would be least optimistic in their personal predictions when they reported the greatest negative affect (i.e., in the test/severe/immediate-feedback condition).

METHOD

Overview and Design

Participants believed they were or were not being tested for an enzyme deficiency that had or did not have severe health consequences. In the test condition, participants initially believed that they would receive their test results in 3 to 4 weeks. All participants then estimated the likelihood that they had the enzyme deficiency (Time 1). At the end of the experiment, participants in the test condition learned that they would receive their test results immediately after testing. All participants then estimated the likelihood that they had the enzyme deficiency a second time (Time 2). The design was thus a 2 (deficiency consequences: severe vs. not severe) \times 2 (testing vs. no testing) \times 2 (time of estimate: Time 1 vs. Time 2) mixed-model factorial with severity of thioamine acetylase (TAA) deficiency and opportunity for testing

serving as between-subjects factors and time of estimate serving as a within-subjects factor.

Participants

Seventy-three introductory psychology students (27 male, 46 female) signed up for participation in a study described simply as requiring the completion of various medical questionnaires. Participants were randomly assigned to conditions and run in sessions of 3 to 4 students. Each participated in partial fulfillment of a course requirement.

PROCEDURE

On arriving at the laboratory, participants were met by a female experimenter who was wearing a white lab coat and a name tag denoting that she was from the Department of Endocrinology of the university medical school. Participants learned that the study was part of a nationwide effort to collect health information from student populations at various universities across the country. Participants next completed a packet of materials designed to support the cover story of the experiment. Embedded in the packet were five items (upset, distressed, good, happy, and satisfied) measuring current affect (Houston, 1990). Participants responded to each affect item with how they felt "at this moment in time" using a Likert-type scale, ranging from 1 (*not at all*) to 9 (*extremely*).

Next, the experimenter described a fictitious medical condition called "TAA deficiency" involving the absence from the body of an enzyme called thioamine acetylase (Croyle & Hunt, 1991; Ditto & Lopez, 1992; Jemmott et al., 1986). Participants learned that the absence of TAA was a genetic condition and thus not under personal control. Specifically, the experimenter explained that unlike the way people can control the risk of heart disease by exercising and avoiding fatty foods, people cannot control their level of TAA. The experimenter further explained that about 20% of the population had TAA deficiency. She added that although recent advances allowed for the testing of the deficiency, no known cure for people testing positive for the deficiency was currently available. Participants then learned that the presence or absence of TAA could be detected by examining saliva and that a chemically coated test paper would soon appear on the market for home testing. The ostensible purpose of the study was to examine how comfortable people would feel about self-testing for TAA deficiency.

SEVERITY MANIPULATION

All participants learned that TAA deficiency produced problems for the pancreas that would soon manifest themselves. In the *not-severe condition*, participants learned that the result was an increase in saliva produc-

tion that would lead to more swallowing. In the *severe condition*, participants learned that the result was a gradual deterioration of the pancreas and eventually severe medical complications. The experimenter then explained to all participants that it was important to better understand TAA deficiency and diagnose people early in the hopes of alleviating some of the problems in the future.

TEST MANIPULATION

Half of the participants believed that they would be tested for TAA deficiency, whereas half believed they would not be tested. In the *test condition*, participants learned that test strips would be available in stores for self-testing soon. The experimenter then explained to these participants that they were supposed to use the test strips to analyze their own saliva during the experiment. However, the person who was supposed to deliver the strips from the medical school had not yet arrived. Therefore, participants would be unable to analyze their saliva immediately. Instead, participants were told they would spit into a petri dish at the end of the experiment and their saliva would be analyzed later. The experimenter explained that participants would receive their individual results by mail in 3 to 4 weeks. In the *no-test condition*, participants learned that they would not be tested for the enzyme deficiency. Rather, they would complete a number of questionnaires assessing their thoughts and feelings. Participants in the test and no-test conditions then completed a questionnaire consisting of manipulation check items and four items asking participants about the likelihood of testing positive for TAA deficiency (Time 1).

Next, all participants completed a lengthy medical history questionnaire designed to lend credibility to the cover story of the study. The medical history questionnaire was a modified version of a questionnaire used at the university hospital that included items about current or past ailments as well as family medical history. All information from the medical history questionnaires was kept confidential during the experiment and discarded immediately afterward. As participants completed the medical history questionnaire, the experimenter excused herself to another room for about 5 minutes.

On her return, the experimenter announced to participants in the test condition that she had just received delivery of the test strips and that the saliva test and analysis would thus be conducted immediately. The experimenter then distributed an 8-cm test strip to each participant in the test condition with instructions of how participants were to test themselves for TAA deficiency. Participants learned that the test strip (actually a strip of Ph paper) had to be held in the mouth for 30 seconds

for the full reaction to take place. While participants held a portion of the test strip in their mouths, they completed a final questionnaire (Time 2).

Participants in the no-test condition also received test strips consisting of Ph paper and completed the final questionnaire while holding a portion of the test strip in their mouths. However, the no-test participants believed that the strip was untreated and thus would not reveal whether they had TAA deficiency. The experimenter instructed the no-test participants that they would need to hold the untreated test strip in their mouths to simulate a real self-testing situation.

The final questionnaire included the same five items measuring affect that participants completed at the beginning of the experiment and the same four items completed earlier asking participants about the likelihood of testing positive for TAA deficiency. After all participants completed the final questionnaire, the experimenter collected the questionnaires and the test strips and then thoroughly debriefed participants.

Risk Estimates

Participants estimated their risk of testing positive for TAA deficiency in two ways. First, using a 9-point scale (1 = *not at all likely*, 9 = *very likely*), participants estimated (a) the likelihood that they have TAA deficiency and (b) the likelihood that the average student their age and sex has TAA deficiency. Second, participants read instructions explaining that some people feel uncomfortable with using rating scales and prefer instead to make percentage judgments. Using a scale ranging from 0% to 100%, participants then estimated (c) the probability that they have TAA deficiency and (d) the probability that the average student their age and sex has TAA deficiency. Our rationale for using two measures of estimated risk was simple. We wanted a means of assessing participants' risk estimates that would allow us to compare their estimates to the 20% population rate we supplied. Thus, we had participants estimate their probability of testing positive on a percentage scale. However, pilot research revealed that, because of tremendous within-cell variance, the percentage scale was not useful in comparing participants' estimates relative to the average student or across conditions (see also Windschitl & Wells, 1996). Therefore, we also had participants estimate the likelihood of testing positive on a 9-point scale.

RESULTS

Data from 5 participants (2 male, 3 female) were excluded from analysis, 4 because of suspicion about the study, which resulted from having participated in a prior deception study involving estimates about the future and 1 because of failure to supply responses to the primary dependent measures. Aside from these participants, no

participant expressed doubt about TAA deficiency, the test procedures, or the population incidence of the condition.

Preliminary analyses revealed no reliable main effects or interactions involving sex of participants for participants' risk estimates. Therefore, all analyses reported collapsed across sex.

Manipulation Checks

The manipulation of event severity was quite successful. Two items directly assessed the effectiveness of the severity manipulation and both yielded a single, significant effect in the predicted direction. The first item revealed that participants in the severe condition ($M = 4.9$) agreed more than participants in the not-severe condition ($M = 2.7$) that having TAA deficiency is a serious health risk, $F(1, 64) = 37.77, p < .0001$. The second item revealed that participants in the severe condition ($M = 4.9$) agreed more than participants in the not-severe condition ($M = 2.7$) that serious health problems could arise from the absence of TAA, $F(1, 64) = 12.72, p < .0007$. In addition, responses to several ancillary measures provided additional evidence that the severity manipulation was effective. First, there was a marginally significant tendency for participants in the severe condition ($M = 3.5$) to agree more than participants in the not-severe condition ($M = 2.8$) that they felt threatened by the idea of having TAA deficiency, $F(1, 64) = 3.71, p < .06$. Second, participants in the severe condition ($M = 4.6$) agreed more than participants in the not-severe condition ($M = 3.6$) that they would be upset if they had TAA deficiency, $F(1, 64) = 5.03, p < .05$.

More important, the main effect for the item asking participants how upset they would be also yielded a significant interaction of severity and testing, $F(1, 64) = 6.76, p < .05$. Posthoc analyses using the Shaffer-Holm procedure to control for Type I error revealed that participants in the test/severe condition ($M = 5.1$) agreed more than participants in the test/not-severe condition ($M = 3.2$) that they would be upset if they had TAA deficiency, $t(34) = 3.10, p < .05$. Participants in the no-test/severe condition ($M = 4.1$) and the no-test/not-severe condition ($M = 4.2$) did not differ in their responses. Apparently being tested for an enzyme deficiency with severe consequences was regarded as more distressing than being tested for an enzyme deficiency without severe consequences.

A criticism that can be raised against past investigations of severity is that the controllability of the event or outcome varied with the event or outcome's severity, making it difficult to determine whether differences in optimism across conditions resulted from differences in the severity of the outcome or differences in the controllability of the outcome. We included two items to test

TABLE 1: Mean Estimates of Own Risk and Average-Student's Risk of TAA Deficiency

	Own Risk	Average-Student's Risk	Difference	F	p
Time 1					
No test/not severe	2.27	3.73	1.46	17.44	.0001
No test/severe	2.56	3.72	1.16	13.24	.0005
Test/not severe	3.22	3.67	0.45	1.92	<i>ns</i>
Test/severe	3.35	4.24	0.89	7.15	.01
Time 2					
No test/not severe	2.53	3.47	0.94	8.74	.005
No test/severe	2.61	3.56	0.95	10.73	.002
Test/not severe	3.11	3.83	0.72	6.28	.02
Test/severe	3.76	4.23	0.47	2.52	<i>ns</i>

NOTE: Higher numbers indicate greater reported likelihood of having thioamine acetylase (TAA) deficiency.

whether perceptions of controllability were equivalent across conditions. The first item asked participants whether they believed they could control TAA deficiency. The second item asked participants whether they believed TAA deficiency was controllable. Analysis yielded no main effects or interactions for either item, all F s < 1.

Risk Estimates

In line with previous research, we hypothesized that participants would generally be optimistic, estimating that their personal likelihood of having TAA deficiency was less than that of the average student. We also predicted, however, that participants would be less optimistic in their risk estimates when the consequences of TAA deficiency were severe, when they were being tested for the deficiency, and when feedback from the test was imminent. To probe these predictions, we compared participants' estimates of their own risk of TAA deficiency with (a) their estimates of the average student's risk and (b) the 20% population risk level.

RISK ESTIMATES RELATIVE TO THE AVERAGE STUDENT

Using a 9-point scale (1 = *not at all likely*, 9 = *very likely*), participants estimated the likelihood that they had TAA deficiency and the likelihood that the average student had the deficiency. Participants made their estimates once at the beginning of the experiment and once at the end of the experiment while they held a test strip in their mouths, and just moments prior to the time immediate-feedback participants would receive their test results. Table 1 presents the participants' estimates of the likelihood that they and the average student had TAA deficiency. The first column represents the participants' own risk estimates, the second column represents participants' estimates for the average stu-

dent, and the third column represents the difference of participants' own and average-student risk estimates.

The estimates were analyzed statistically by using a Time \times Target \times Testing \times Severity mixed-model analysis of variance (ANOVA) in which test and severity were treated as between-subject variables and time of estimate and target (own risk vs. average-student risk) were treated as within-subject variables. Analysis revealed a significant main effect of target, $F(1, 64) = 35.21$, $p < .0001$. Consistent with prior research on the optimistic bias, participants estimated that they ($M = 2.94$) were less likely than the average student ($M = 3.70$) to test positively for TAA deficiency. More important, analysis revealed a significant four-way interaction, $F(1, 64) = 5.58$, $p < .05$. No other effects in this analysis were significant (all p s > .10).

We operationalized optimism in terms of participants' own risk estimates relative to their risk estimates for the average student. Thus, we explored the four-way interaction by using planned within-subjects pairwise comparisons of participants' estimates of own and average-student risk based on the multivariate pooled error term. The results of the pairwise comparisons are presented in Table 1 and reveal that participants rated their own risk of having TAA deficiency as significantly lower than that of the average student in all conditions except two: the test/not-severe condition at Time 1 and the test/severe condition at Time 2. The finding that participants in the test/severe condition at Time 2 did not differ in their own risk estimates and the ratings of the average student was just as predicted. As the moment of truth neared, participants in the test/severe condition became less optimistic in their predictions. The absence of a significant difference between own and average risk estimates at Time 1 in the test/not-severe condition was unexpected.

More important, the series of pairwise comparisons just described do not reveal whether the manipulations of testing, severity, and feedback timing affect participants' estimates of their own risk of TAA deficiency or their estimates of the average student's risk of TAA deficiency. From a practical standpoint, this issue is important because it addresses whether manipulations or interventions designed to reduce the optimistic bias are effective because they increase people's estimates of their own risk or because they reduce people's estimates of the average person's risk. If the manipulations affect participants' estimates of the risk of the average person, then they likely would be ineffective in producing changes in behavior to reduce personal risk. However, if the manipulations affect participants' personal risk estimates, then they may be useful as for increasing precautionary behaviors.

To examine this question, we reanalyzed the data separately for participants' own risk estimates (Table 1, column 1) and their risk estimates for the average student (Table 1, column 2). Analysis of participants' own risk estimates revealed a significant interaction of time, testing, and severity, $F(1, 64) = 4.59, p < .05$. To examine whether a decline in risk estimates was affected by the severity of the deficiency, we compared participants' personal risk estimates at Time 1, when the test feedback was distant or unexpected, with their personal risk estimates at Time 2, when feedback for participants in the test condition was only a few moments away. A series of pairwise comparisons using the multivariate pooled error term revealed that only participants in the test/severe condition anticipating immediate test feedback significantly increased their estimate of the likelihood they would test positive for TAA deficiency from Time 1 to Time 2, $F(1, 67) = 5.81, p < .05$. All other participants displayed no change in their personal risk estimates (all $ps > .14$).

A Time \times Testing \times Severity ANOVA of participants' estimates of the risk faced by the average student at Time 1 and Time 2 yielded no significant main effects or interactions (all $ps > .10$). Moreover, pairwise comparisons using the multivariate pooled error term revealed no significant change in estimates of average student's risk across time, all $ps > .17$. Apparently, the severity, testing, and timing manipulations affected participants' estimates of their own risk for testing positive for TAA deficiency but did not affect participants' risk estimates for the average student.

In sum, participants were generally optimistic in their risk estimates, estimating that they were less likely than the average student to test positive for TAA deficiency. As predicted, however, participants were not optimistic when they anticipated immediate feedback for a deficiency with severe consequences. That is, in the test/severe/immediate-feedback condition, participants' estimates of the likelihood that they would test positive for TAA deficiency did not differ significantly from their estimates of the average student's likelihood of testing positive for TAA deficiency. Finally, further probing revealed that the manipulations of testing, severity, and immediacy of feedback affected participants' estimates of their own risk rather than their estimates of the average students' risk.

RISK ESTIMATES RELATIVE TO THE POPULATION INCIDENCE

Using a 0% to 100% scale, participants also estimated the probability that they had TAA deficiency and the probability that the average student their own age and sex had the deficiency. Again, participants made their estimates once at the beginning of the experiment and once at the end of the experiment, just moments prior

TABLE 2: Mean Difference Between Own Risk Estimate and Population Risk (20%)

	Residual %	F	p
Time 1			
No test/not severe	1.07	< 1	ns
No test/severe	4.61	1.02	ns
Test/not severe	4.94	1.18	ns
Test/severe	9.41	4.04	.05
Time 2			
No test/not severe	0.40	< 1	ns
No test/severe	5.17	1.31	ns
Test/not severe	4.94	1.20	ns
Test/severe	11.18	5.77	.02

NOTE: Positive numbers indicate pessimism.

to the time immediate-feedback participants would receive their test results. We compared participants' estimates to the 20% population risk we supplied at the beginning of the experiment. Table 2 presents participants' estimates of the probability that they would test positive for TAA deficiency after subtracting 20% from each estimate. A positive number indicates that participants were pessimistic, estimating that their risk was greater than the population rate. A negative number indicates that participants were optimistic, estimating that their risk was less than the population rate. Because we were interested in whether the residuals differed significantly from zero, we conducted a series of dependent t tests. We predicted that participants would brace most when they anticipated testing and feedback for an event with severe consequences. Thus, we predicted that participants would be most pessimistic in the test/severe conditions, particularly at Time 2 when feedback was presumably only moments away. As evident in Table 2, the residuals were positive in all conditions. However, the residuals differed significantly from zero only in the test/severe condition at Time 1 and Time 2. Thus, only participants in the test/severe condition estimated that their chances of testing positive for TAA deficiency were greater than the 20% population incidence. Finally, a dependent t test using the pooled error term and comparing participants' probability estimates in the test/severe condition at Time 1 and Time 2 revealed, as expected (see Shepperd et al., 1996), a marginally significant tendency for participants to estimate that they were more at risk at Time 2 ($M = 11.18$) than at Time 1 ($M = 9.41$), $t(1, 64) = 1.51, p < .07$, one-tailed.

We also compared participants' risk estimates for the average student with the 20% population incidence (see Table 3). A series of pairwise comparisons using the pooled error term revealed that participants estimated that the average student's risk was greater than 20% in all four conditions at both Time 1 and Time 2, all $F_s(1, 68) > 4.74$, all $ps < .05$.

TABLE 3: Mean Difference Between Other Risk Estimate and Population Risk (20%)

	Residual %	F	p
Time 1			
No test/not severe	13.07	7.47	.01
No test/severe	13.22	9.18	.005
Test/not severe	9.50	4.74	.05
Test/severe	15.29	11.60	.005
Time 2			
No test/not severe	11.00	5.80	.05
No test/severe	13.78	10.93	.005
Test/not severe	10.06	5.82	.05
Test/severe	15.29	12.72	.001

NOTE: Positive numbers indicate pessimism.

In sum, analyses of participants' probability estimates revealed that participants were generally evenhanded in their own risk estimates relative to the 20% population incidence, estimating that their own risk of testing positive for TAA deficiency was similar to that of the population risk. The exception was in the test/severe condition, both at Time 1, when test feedback was anticipated in 3 weeks, and again at Time 2, when test feedback was presumed to be only moments away. Clearly, merely being tested for a deficiency with severe consequences produced higher estimates of personal risk. However, anticipating immediate test feedback exacerbated the effect of testing. Finally, participants estimated that the average student's risk of testing positive for TAA was greater than the population risk across all conditions at both Time 1 and Time 2. We will return to this intriguing finding in the discussion.

Analysis of Affect

We proposed initially that the bracing process might be driven by negative affect. To examine this possibility, we analyzed participants' responses to the five items completed at the beginning of the experiment and the same five items completed at the end of the experiment just prior to when participants made their second risk estimate. Negative items were reverse coded and the five items were summed to yield a measure of affect for Time 1 and Time 2, with higher scores indicating more positive affect. Chronbach's alpha for the two measures was quite high at both Time 1 ($\alpha = .84$) and Time 2 ($\alpha = .91$).

We submitted participants' negative affect scores at Time 1 and Time 2 to a Time \times Testing \times Severity ANOVA to examine whether participants' affect changed in response to the manipulations. Because of an oversight, negative affect scores were not available at Time 1 for the first 19 participants in the study. Thus, the analyses are based on data from 49 participants. Analysis revealed a Time \times Testing interaction, $F(1, 45) = 5.75, p < .05$,

TABLE 4: Reported Affect as a Function of Time and Condition

Condition	Time 1	Time 2	Difference
No test/not severe	28.38	29.92	1.54
No test/severe	24.42	27.92	3.50
Test/not severe	27.00	28.18	1.18
Test/severe	28.00	24.23	-3.77

NOTE: Higher numbers indicate more positive affect.

qualified by a significant Time \times Testing \times Severity interaction, $F(1, 45) = 4.72, p < .05$. The mean negative affect scores for each condition are presented in Table 4 and correspond closely to the personal risk estimates provided by participants in Table 1. Pairwise comparisons revealed no difference in affect across time for participants in the no-test/not-severe and test/not-severe conditions, both $ps > .30$. However, whereas the affect of participants in the no-test/severe condition became more positive from Time 1 to Time 2, $F(1, 45) = 4.77, p < .05$, the affect of participants in the test/severe condition became less positive, $F(1, 45) = 5.99, p < .02$.

To examine whether participants' dire predictions in the test/severe condition were driven by affect, we included negative affect as a covariate in the analysis of participants' risk estimates, using procedures recommended by Hull, Tedlie, and Lehn (1992). If the change in participants' risk estimates was driven by negative affect, then the significant Time \times Testing \times Severity interaction reported earlier would no longer be significant when the covariate was included in the analysis. To simplify the analysis, we entered difference between affect at Time 1 and Time 2 as the covariate. Analysis revealed that the Time \times Testing \times Severity interaction for participants' risk estimates was no longer significant when the difference in affect was entered as a covariate, $F < 1$.

We proposed that affect is driving the relationship between the manipulated variables (testing, feedback timing, and severity) and participants' estimates in the present study. That is, imminent feedback about the results of an event with severe consequences produces negative affect, which, in turn, produces a change in estimates. It is possible, however, that negative affect was a consequence of the change in estimates rather than the mechanism driving the change. That is, the imminent feedback may have directly produced a change in participants' estimates, which, in turn, produced an increase in negative affect. To examine this possibility, we conducted an additional set of analyses testing this alternative model. Specifically, we conducted an initial analysis using the manipulated variables to predict negative affect and then repeated this analysis including participants' estimates as a covariate. As noted earlier, the initial analysis yielded a significant Time \times Testing \times Severity

interaction, $F(1, 45) = 4.72, p < .05$. When participants' risk estimates were entered as a covariate, the Time \times Testing \times Severity interaction, although nonsignificant, was still sizable, $F(1, 42) = 2.55, p < .12$. Nevertheless, the results of this latter analysis prohibit us from concluding with certainty that negative affect is a mechanism driving the bracing process.

DISCUSSION

Two decades of research reveal that people are overwhelmingly optimistic in their personal predictions. Our goal in this study was to examine conditions moderating the optimistic bias. We predicted that participants would generally be optimistic in their personal predictions, estimating that they were less likely than the average person their same age and sex, and less likely than the 20% population rate, to test positive for TAA deficiency. However, we also predicted that people would brace themselves for the worst, abandon their optimistic outlook in favor of a pessimistic outlook, if they anticipated receiving immediate test feedback for a health condition with severe consequences. The results generally supported the predictions with some surprising twists.

Regarding estimations of risk relative to the average person, participants were largely optimistic, rating their own risk of TAA deficiency as less than the risk of the average student. This pattern was most evident in the two no-test conditions where participants rated themselves as less at risk than the average student at both Time 1 and Time 2. Clearly, when people do not anticipate a challenge to their optimistic outlook, they choose to be optimistic in their predictions. In the test condition, however, participants were optimistic only some of the time. Specifically, as predicted, participants in the test/severe condition were optimistic at Time 1, when test feedback was presumably several weeks away, but they were not optimistic at Time 2, when test feedback was just moments away. With feedback only moments away, it appears that participants were no longer free to believe what they wanted about themselves and faced the possibility that their optimistic outlook might be disconfirmed. Interestingly, participants in the test/not-severe condition rated their risk as similar to that of the average student at Time 1, but not at Time 2. Inspection of the means reveals that estimates of the average student's risk in this condition were somewhat lower than estimates of the average student's risk in the other testing conditions. Thus, the absence of an effect in the test/not-severe condition may be due largely to participants rating the risk of the average student as low (rather than rating their own risk as high). Consistent with this interpretation was the finding from the analysis of participants' own risk estimates independent of their estimates of the average student. The pattern of means revealed that

participants were no less optimistic in the test/not-severe condition at Time 1 (when test feedback was presumably weeks away) than at Time 2 (when test feedback was only moments away).

Finally, further analysis revealed that the decrease in optimism seen in the test/severe condition at Time 2 was due to variations in participants' own risk estimates (i.e., judging their own risk as greater) rather than to variations in the risk estimates of the average student. This point is important because some prior studies of moderators of the optimistic bias have identified factors that moderate estimates of another's risk while producing no change in estimates of one's own risk. For example, Perloff and Fetzer (1986) found that varying the closeness of the comparison target (e.g., from average student to best friend) produced variations in the risk estimates of the "other" while having no impact on participants' own risk estimates. To the extent that the optimistic bias can lead to risky behavior or a failure to engage in precautionary behavior, attention should be focused on factors that affect perceptions of personal risk rather than on factors that influence perceptions of the risk of comparison targets.

Regarding estimations relative to the 20% population risk level, participants were generally realistic in their estimates, rating their own risk of testing positive for TAA deficiency as equal to that of the population. The one exception was in the test/severe condition where participants rated their own risk as exceeding the population risk. This was true at Time 1, when feedback was weeks away, and even more so at Time 2, when feedback was moments away.

The Source of the Optimistic Bias

When participants' estimates relative to the average student are viewed alongside their estimates relative to the 20% population risk, an intriguing inconsistency becomes apparent. The estimates relative to the average student suggest that participants were generally optimistic in their personal predictions but were realistic (estimating that their own risk was no less than the average student's risk) in the test/severe/immediate-feedback condition. In contrast, the estimates relative to the population incidence suggest that participants were generally realistic in their personal predictions but were pessimistic (estimating that their own risk was greater than the population risk) in the test/severe condition, particularly when feedback was imminent. It appears that how one operationalizes risk estimates (i.e., relative to the estimates for the average student, as is typically done, vs. relative to some objective standard) can have a profound effect on the results obtained and any ensuing interpretation.

Research on the false consensus and false uniqueness effects has also revealed differences in results depending on whether the researchers examine estimates relative to the population incidence versus estimates relative to other people. For example, Suls and colleagues found that a sample of patients diagnosed with various fears and phobias overestimated the absolute percentage of people in the population sharing similar fears and phobias, thus displaying an inaccuracy. However, those in a community sample with no such diagnosis were even more inaccurate in their estimates of the population incidence of the fears and phobias (Suls, Wan, Barlow, & Heimberg, 1990; see also Suls & Wan, 1987). In short, depending on which comparison is examined, patients appeared to display a false consensus effect (relative to the population effect) and a false uniqueness effect (relative to the estimates of nonpatients).

The inconsistency in the present study raises questions about the source of the optimistic bias. Perhaps when participants rate themselves as less at risk than the average student, they are not being biased in their own risk estimates so much as they are being biased in their risk estimates of the average student. In line with this interpretation is research by Rothman et al. (1996), showing that people are more inclined to overestimate others' risks than they are to underestimate their own risk. In short, people may be relatively evenhanded or realistic in making judgments about their own risk but may overestimate the risk of the average student. Consistent with this interpretation is a finding that emerged from the probability judgments. Although participants generally rated their own risk as similar to the 20% population risk, they consistently rated the risk of the average student as significantly higher than the population risk.

This is not a trivial finding. It suggests that we may need to alter one of the fundamental questions driving much of the research examining the optimistic bias. Instead of asking why people are optimistic in their own risk estimates, perhaps we should ask why people are pessimistic in their risk estimates for others. In the present study, the answer to this question may lie in research on the better-than-average effect—a tendency for people to want to view themselves as better than average and thus to rate themselves higher than the average person on desirable characteristics (e.g., intelligence, attractiveness, friendliness) and lower than the average person on undesirable characteristics (Alicke, Klotz, Breitenbecher, Yurak, & Vredenburg, 1995). In the present study, participants rated their own risk of TAA deficiency first followed by the risk of the average student. For the probability estimates, the personal risk estimates may have served as an anchor for rating the risk of the average student. Wanting to be better than average yet having

already rated their own risk as at the population level, participants could only be better than average if they rated the average person at greater risk than the population risk level.

Of course, it is also possible that participants had difficulty translating the 20% population base rate into probability judgments. After all, there is some evidence that people have difficulty understanding and interpreting base-rate information (Bar-Hillel, 1990; Koehler, 1996; Tversky & Kahneman, 1974). Finally, it is possible that the high-risk estimates of the average student stem from our decision to provide participants with limited information about risk factors. It may have been difficult for participants to imagine why their risk would be below average when they do not know the factors affecting risk. In this study, it may have been easier for participants to overestimate the risk of the average person rather than to underestimate their own risk. Clearly, the reason why participants rated the average student's risk as greater than the population risk deserves further research.

The one consistent exception to the better-than-average effect appeared among participants in the test/severe/immediate-feedback condition. These participants not only supplied personal risk estimates that were similar to their risk estimates for the average student, but they also rated their own risk as greater than the 20% population risk level provided by the experimenter. It seems that the prospect of immediate feedback about a deficiency with severe consequences led these participants to be less sanguine in their personal risk estimates.

The Role of Affect in Personal Predictions

We proposed that the bracing process might be driven by negative affect. That is, people may make pessimistic predictions because they are concerned that their expectations might exceed their outcomes. We thus hypothesized that people would report the greatest negative affect, and consequently be least optimistic, when anticipating immediate feedback from a test for a deficiency with severe consequences. Consistent with our theorizing and with past research (Butler & Mathews, 1987; Dewberry, Ing, James, Nixon, & Richardson, 1990; Sheperd et al., 1996), participants' self-reported affect closely paralleled their personal risk estimates. The more positive their affect was, the less inclined participants were to believe that they would test positive for TAA deficiency. Moreover, participants reported the greatest negative affect in the same condition in which they reported that they were at greatest risk of testing positive for TAA deficiency—the severe/test/immediate-feedback condition.

It is noteworthy that the covariance analyses did not provide conclusive evidence that negative affect was the psychological mechanism driving participants' risk esti-

mates. Although the risk estimates corresponded closely to participants' negative affect reports, we were unable to rule out the possibility that participants experienced negative affect in response to having changed their estimates rather than the reverse. Nevertheless, if we were to take a side regarding which model is correct based purely on the data, we would conclude tentatively that negative affect was driving participants' risk estimates rather than the reverse. Our decision is based on two pieces of information. First, participants rated their affect prior to providing their risk estimates. Thus, temporal precedent favors the affect as mediator interpretation. Second, when affect was treated as a covariate and risk estimates were treated as the dependent measure, the relationship between the formally significant Time \times Testing \times Severity interaction was completely eliminated. In contrast, when the risk estimates were treated as a covariate and affect was treated as the dependent variable, the formally significant Time \times Testing \times Severity interaction, although nonsignificant, was still sizable.

LIMITATIONS AND CONCLUSIONS

The optimistic bias is remarkably robust and researchers have found it notoriously impervious to situational manipulations designed to reduce the bias (Weinstein & Klein, 1995). The present study, however, demonstrated that the optimistic bias can be reduced—even eliminated—under certain conditions. Specifically, people abandon their generally optimistic outlook in favor of a pessimistic outlook when they anticipate imminent feedback for an outcome with serious consequences.

Some limitations of the present study should be noted. We created an artificial health problem that was genetically determined, not modifiable, and not treatable. All of these factors influence the perceived controllability of the health condition, and past research indicates less optimism for uncontrollable events than for controllable events. The uncontrollable nature of the health conditions described to participants in the present study may have resulted in less optimism (and more pessimism) in responses than would have occurred had we examined a condition that was more controllable or for which participants had greater information about risk factors. Examining the generalizability of these findings for other events would be an important undertaking for future research.

There are, no doubt, other situational factors that moderate optimism and the bracing process. The most promising candidate for future research is controllability. Prior research reveals that people are more optimistic about future events that are controllable, presumably because people believe that they can and will take actions that will affect the occurrence of the out-

come (thereby increasing the occurrence of positive events and decreasing the occurrence of negative events) (Harris, 1996). Yet, there are many ways to conceptualize controllability (Skinner, 1996). Moreover, past research on controllability has been largely correlational and often has poorly controlled for factors such as the severity or importance of the event. We view the examination of controllability as a potentially fruitful direction for future research.

Although our research focused on estimates for an event that had health consequences (testing positive for an enzyme deficiency), we would anticipate that people would display a similar pattern in their predictions (optimism for outcomes in which feedback is distant or unanticipated; realism or pessimism for outcomes in which feedback is imminent) for any outcome that has important personal implications. Thus, we suspect, for example, that people awaiting a mechanic's bill following extensive repair work on their automobile are inclined to revise their estimates, predicting a higher bill, in the moments just prior to receiving the bill. Moreover, the extent to which people revise their estimates likely varies as a function of personal need, with people who are financially strapped being more inclined to revise their estimates (and to revise their estimates more substantially) than people who are financially comfortable.

The potential generalizability of our findings is demonstrated anecdotally in a brief newspaper article distributed by the Associated Press and appearing in newspapers around the country on August 17, 1995. The article described the disappearance of at least five climbers in an avalanche in Pakistan near the summit of K2, the world's second-highest mountain. The husband of one of the climbers reported that "he hadn't give up hope for his 33-year-old wife's survival, but he was steeling for the worst" ("Mountain Climbers," 1995). Similar to our own investigation, this real-world illustration demonstrates that the prospect of disappointment can lead people to favor pessimism over optimism when the outcome is important.

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