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Optimistic Expectations have Benefits for Effort and Emotion with Little Cost

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Abstract

The present investigation examined the potential benefits and costs of optimistic expectations about future events through the lens of Error Management Theory (EMT). Decades of evidence have shown that optimism about the likelihood of future events is pervasive and difficult to correct. From an EMT perspective, this perpetuation of inaccurate beliefs is possible because optimism offers benefits greater than the costs. The present investigation examined this possibility for controllable important life events with a known time at which they would occur. College students taking their first exam (n = 1,061) and medical students being matched with residency placements (n = 182) reported their expectations and emotions weeks before the event and their responses after they knew the outcome of the event. There was evidence that optimistic expectations predicted the quality of effort investment before an event occurred – students were more satisfied with their studying and medical students were more satisfied with their decision making, and both groups performed better when optimistic. Optimistic expectations also predicted less emotional distress before the event occurred. There was no evidence that optimistic expectations related to longer-term greater distress when participants experienced an unexpected negative outcome; the valence of the outcome itself predicted distress. Consistent with EMT, optimistic expectations appear to have benefits for effort and emotion before an event occurs, with little cost after the outcome occurs.

Keywords:
Optimism
Emotions
Decision Making
Error Management Theory
Likelihood Judgments

Optimistic Expectations have Benefits for Effort and Emotion with Little Cost

The expectations that people hold about what will happen in their futures matter. What people expect to happen (or expect not to happen) determines the goals they choose to pursue, how much effort they invest, and how they respond as events occur (Lench, 2011; Sharot, 2011). People's expectations about what will happen are the foundation for every decision they make, from the momentous, such as what career to pursue and whom to marry, to the mundane, such as where to have dinner or whether to bring an umbrella. Despite the importance of expectations about the future, decades of evidence have shown that expectations are often wrong, and wrong in consistently biased ways. The interesting theoretical question that follows from these findings is why people continue to have wrong expectations, even though their expectations are so important for decision-making and they get feedback about the accuracy of their expectations.

To begin to address this question, the present investigation examined the consequences associated with one form of systematic bias in expectations – people's tendency to hold overly optimistic expectations for future events, including everything from acing a test to avoiding unemployment. We adopt the theoretical frame of Error Management Theory (EMT), which posits that the processes that result in inaccurate beliefs, including optimistic expectations, persist when the beliefs offer more benefit than cost for the organism (McKay & Dennett, 2009). Specifically, applying EMT to optimistic expectations, we examined the relationship of optimistic expectations for controllable, important life events to effort and emotion before the event, to performance during the event, and to reactions after the event. This longitudinal assessment permitted an examination of the potential costs and benefits of optimistic expectations as events unfold.

How People Get Expectations Wrong

One of the most pervasive and robust biases that affect people's decisions is that expectations are too optimistic (Kahneman, 2003; Taylor & Brown, 1988; Weinstein, 1980). This optimistic bias can be defined as the tendency, all else being equal, to expect positive events to occur and negative events not to occur (Lench & Bench, 2012). This bias is known by many names in the literature, including wishful thinking, unrealistic optimism, desirability bias, and comparative optimism, but all of these constructs share the core tenet that, in general, people optimistically expect outcomes to be positive. People anticipate their favorite sports team or favored political candidate will win upcoming competitions (Babad & Katz, 1991; Bar-Hillel, Budescu, & Amar, 2008). People generally expect that they are likely to experience positive life events, such as having healthy children, placing in a job after graduation, or earning a high income, and unlikely to experience negative life events, such as having a heart attack, losing money, or being unemployed (Lench & Ditto, 2008; Perloff & Fetzer, 1986; Weinstein, 1980). Optimistic bias persists even when positive and negative events have exactly the same objective probability of occurring, people know the probabilities, and the outcome is uncontrollable (Lench & Ditto, 2008). This is not to say that everyone has overly optimistic expectations for every event, but rather that, on average, people expect good things to happen and that those expectations are more optimistic than can be justified by reality (Sharot, 2011).

The robustness and pervasiveness of optimistic bias across people and situations suggests that there is some process, a "feature of thinking," that contributes to the maintenance of this bias (McKay & Dennett, 2009). The exact thought processes that contribute to systematically optimistic expectations have not been definitively established, although multiple potential explanations have been proposed and tested. One set of explanations highlights cognitive

processes that contribute to biased judgments. This includes, for example, focalism when predicting the likelihood of future events, which leads people to focus on more salient (typically desirable) outcomes and not consider less salient and less desirable outcomes (Wilson, Wheatley, Meyers, Gilbert, & Axsom, 2000; Windschitl, Kruger, & Simms, 2003). Focalism also appears to contribute to the maintenance of optimistic expectations, as people confronted with evidence that contradicts their optimism tend to focus only on confirming desirable information (Sharot, Korn, & Dolan, 2011). Another set of explanations highlights the contribution of emotional responses to optimistically biased expectations. For example, people tend to use current feelings as a source of information when making judgments. As a result, they estimate positive outcomes as likely when they experience positive emotions (Johnson & Tversky, 1983; Lerner & Keltner, 2001; Loewenstein, Weber, Hsee, & Welch, 2001). Contemplating positive outcomes also serves to elicit positive emotions, and this too has been shown to result in systematically optimistic expectations (Lench, 2009; Lench, Bench, & Davis, 2016; Slovic & Peters, 2006). Thus, available evidence suggests that both cognitive and emotional processes, as well as the interactions between the two, contribute to optimistic bias.

Error Management Theory and Optimistic Expectations

Error Management Theory (EMT) provides an evolutionary framework for understanding the perpetuation of false beliefs (Haselton & Buss, 2000; Haselton, Buss, & DeKay, 1998). According to this theory, false beliefs will persist and be pervasive when those beliefs offer an evolutionary advantage over accuracy. In other words, false beliefs persist when having the belief, even though false, increases fitness within the environment. The theory was initially applied to understand the errors people make when judging whether others find them attractive as potential sexual partners, but the logic can be extended to any persistent false belief. McKay and

Dennett (2009) applied EMT to the specific case of optimistic expectations about future events, arguing that these false beliefs offer two benefits over accurate (and less optimistic) expectations.

The first proposed benefit of optimistic expectations is that they serve to organize goal pursuit before the event occurs, and, as a result, increase the likelihood that a positive outcome will be attained (McNulty & Karney, 2002; McKay & Dennett, 2009). For example, a student who has high expectations for their grade on an upcoming exam is more likely to align their actions, such as studying, with that goal of a high grade. Because they invest effort to study well, they are more likely to receive a high mark than if they had lower expectations. In other words, positive expectations can be motivating for goal pursuits and result in better outcomes in situations where investment improves outcomes (Taylor & Brown, 1994). Within the frame of EMT, optimistic expectations would increase the rate of failure (a cost) as people strive to attain their goals (e.g., signing up for college courses that have a risk of failure), but optimistic expectations would also increase the effort expended to attain the goal and the likelihood of success in achieving that goal (a benefit; Haselton & Nettle, 2006; McKay & Dennett, 2009). If the overall increase in success is more beneficial than the higher failure rate, as people strive to attain challenging goals, then the process that creates optimistic expectations would persist.

Consistent with this proposed benefit, there is evidence that having optimistic expectations inspires effort (Sharot, 2011; Sweeny, Caroll, & Shepperd, 2006). For example, optimism promotes health-sustaining actions, such as people at risk for skin cancer using sunscreen (Friedman, Weinberg, Webb, Cooper, & Bruce, 1995). Further, people who have optimistic expectations engage in behaviors likely to result in positive outcomes, such as working longer hours, remarrying after divorce, and saving more money (Puri & Robinson, 2007). However, because the benefits for outcomes in these situations were not been directly

assessed, this evidence is only suggestive that optimism predicts effort that improves outcomes. In an investigation of people's inaccurate beliefs about optimism and performance, some participants received false feedback to manipulate their expectations about future performance on a task, and then their performance on that task was measured. Positive expectations did not result in better performance on a task where persistence could not affect scores (guessing age from photos), but did lead to greater persistence and somewhat better performance on tasks where it could affect scores but came with an efficiency cost (Tenney, Logg, & Moore, 2015). Together with findings that optimism and approach motivations foster more efficient use of time on performance tasks (e.g., Aspinwall & Richter, 1999; Lench & Levine, 2008), these findings suggest that optimism can increase persistence in ways that are beneficial on tasks where persistence matters. One limitation of these studies is that performance is measured on problems provided by the experimenter, and cannot directly address the relationship between optimism and outcomes on important life tasks where persistence can improve performance. Further, in ways not consistent with the proposed benefit, people who expect positive outcomes sometimes invest less effort. For example, optimistic expectations are implicated in multiple situations in which people fail to take needed action, including vaccination to avoid illness and saving for retirement (Brewer et al., 2007; Jackson & Aiken, 2000; Lench & Bench, 2012; Madrian & Shea, 2001; Weinstein & Klein, 1996). Most of this research has been conducted on actions with implications for long-term outcomes (e.g., health, retirement) rather than short-term goals (e.g., passing a college exam) where the date of an event is known and effort can have an immediate effect on performance.

Capturing effort expended to attain an individual goal is a challenge in most situations, in part because the quantity of time spent in goal pursuit is not sufficient to capture the quality of

effort invested to attain a goal. For example, students could study more hours for an exam because they are motivated to do well, but students must also study more hours if they are not using their time effectively (Fredrickson, 2012; Kuh, 2009). A better indicator of the quality of effort invested toward goal attainment is satisfaction with effort, which reflects the perceived quality of effort. Satisfaction with effort has been shown to reflect whether the effort invested is perceived as a gain toward a goal or a loss (Berger & Janoff-Bulman, 2006; Fredrickson, 2012), and predicts performance in educational settings (Fredrickson, 2012). Thus, based on these previous findings, satisfaction is reflective of the quality of effort rather than only the amount of effort directed towards a goal.

The second benefit proposed to result from optimistic expectations is that they reduce stress before the event occurs. Within the frame of EMT, optimistic expectations benefit the organism by decreasing the physical toll of stressful situations (McNulty & Karney, 2002). Multiple studies have shown that optimism - the general tendency to expect positive outcomes - predicts less stress, as evidenced by lower mortality risk in cancer patients (Schulz, Bookwala, Knapp, Scheier, & Williamson, 1996), reduced distress after failure to become pregnant as desired (Litt, Tennen, Affleck, & Klock, 1992), and adjusting to major life transitions through more effective coping strategies (Aspinwall & Taylor, 1992). Further, optimistic expectations about specific situations, such as completing law school, predict reduced distress and healthier physiological responses during stressors related to those situations (Segerstrom et al., 1998). Critically, these studies have focused on distress during or after the stressful event, whereas the benefit proposed by EMT accrues before the event occurs. One investigation involved an experimental investigation that manipulated people's expectations about the outcome of a completed personality test, and a field study that assessed expectations about a recently

completed exam (Golub, Gilbert, & Wilson, 2009). The results showed that people felt more negative emotion when they expected negative outcomes (Golub, Gilbert, & Wilson, 2009), suggesting that positive expectations might reduce stress responses in ways that are beneficial.

A potential cost associated with optimistic expectations is that, if an unexpected negative outcome occurs, the failure to prepare for the negative event could result in increased stress after the event. Decision affect theory (DAT; Mellers, Schwartz, Ho, & Ritov, 1997) states that how people feel when they experience an outcome depends not just on the actual outcome, but also on what they were expecting the outcome to be (Bell, 1985; Loomes & Sugden, 1986). In other words, unexpected negative outcomes have a greater impact on emotions than expected outcomes. Supporting this proposition, participants who underestimated how painful electrical shocks would be experienced those shocks as more aversive (Arntz, van Eck, de Jong, van den Hout, 1990). Similarly, participants who were the most optimistic that they would not have a medical condition were most discouraged by a test outcome that they did have the condition (Shepperd & McNulty, 2002). People seem to have an intuitive idea that high expectations could result in disappointment. They often reduce their optimistic expectations shortly before an event, appearing to "brace for the worst." This may have benefits in that people can initiate coping in anticipation of a negative outcome (Carroll, Sweeny, & Shepperd, 2006). Recent work has suggested, however, that these benefits are potentially short-lived, lasting less than 24 hours after the outcome is known (Golub, Gilbert, & Wilson, 2009; Sweeny & Shepperd, 2010). Within the framework of EMT that focuses on the costs of optimistic expectations, we were particularly interested in longer-term emotional distress (rather than a brief response right after the outcome).

The Present Investigation

The logic behind Error Management Theory was employed in the present investigation to examine costs and benefits of optimistic expectations that have been proposed to accrue before and after an event occurs. We examined people's expectations in two situations with important implications for their lives - college students taking a first exam in their introductory course and medical students applying for their residency programs. The designs were longitudinal, which cannot directly address causality as is the case in experimental studies, but do permit analysis of the degree to which expectations at one time point predict responses at subsequent time points. Based on EMT, we hypothesized that optimistic expectations would be associated with less distress before an event occurs, with greater quality of effort before the event, and consequently with better performance. The empirical evidence associated with these hypotheses is mixed and, as reviewed above, optimism has sometimes been linked with increased effort and sometimes with decreased effort. But, unlike previous investigations, the present approach offers an opportunity to study the relationship between expectations and responses before an event, in a situation where there is a concrete event with a known time of occurrence, and where indicators of effort can be linked to performance. We did not make hypotheses regarding the relationship between optimistic expectations and distress after outcomes, or whether downward adjustment of expectations would buffer distress because these have not been previously proposed as specific costs to optimistic expectations within the frame of EMT. We examined these relationships because previous theories and studies have suggested that optimistic expectations could affect the degree of distress after negative events occur, and this could be a potential cost.

Study 1: Expectations for Exam Grades

Methods

Participants. The present data set was composed of two samples collected during two fall semesters; we did not anticipate or find any differences between the two samples based on year of data collection. Participants completed the surveys for course credit in their introductory psychology courses. Overall, data collection was planned for approximately 1,000 participants. We invited more participants than the target sample size because we anticipated non-respondents and attrition over multiple time points, resulting in 1,246 participants who completed the first survey. Participants were excluded from analyses if they did not report their expected and received grade.

The final sample consisted of 1,061 undergraduate participants, with 472 enrolled in a public university in Texas and 589 enrolled in a public university in California. This recruitment provided a post hoc power of .98 to detect a .2 *d* effect size. Degrees of freedom vary among analyses due to missing data on some variables. The sample included 76% women, with an average age of 18.90 years (*SD* = 2.06). Participants reported that they were African American/Black (2%), East Asian (20%), Hispanic/Latino (25%), Middle Eastern (3%), South Asian (9%), White (34%), or multi-racial (8%).

Procedures and materials. This study was part of a larger investigation focused on forecasts of emotional responses (see https://osf.io/hskq7/ and Lench et al., 2019); only methods and procedures relevant to the present questions are reported here. Two weeks before their first exam in an introductory psychology course, participants reported their expectations for the upcoming exam and their emotions. One day before the exam, participants reported their

studying behavior and plans, as well as their expectations for the exam. Two days after they found out their grade on the exam, participants reported their grade and emotional responses. All questionnaires were completed online.

Two weeks before exam (Time 1). The link to the survey was distributed two weeks before their first exam, and was open for one week (M_{day} = 3.18, SD = 2.24). They were prompted, "In about two weeks, you will have an exam in [course]. What grade do you expect to receive on your exam?" and responded on a scale from F (1) to A+ (13). They also reported their age, gender, and race/ethnicity.

One day before exam (Time 2). The link to the survey was distributed at 7 am the day before their first exam, with a reminder at 7 pm, and open until midnight. Participants were asked, "How are you currently feeling in general?" and rated Happy and Unhappy on a scale ranging from *not at all* (1) to *extremely* (9). They were then prompted, "Tomorrow, you will have an exam in [course]. What grade do you expect to receive on your exam?" and responded using the same scale as at Time 1. Participants reported their studying behaviors: "So far, how many hours total have you studied for the exam?" using a drop box from 0 to 72 hours. They were further asked, "How satisfied are you that you will have spent enough time studying for this exam" on a scale ranging from *not at all* (1) to *extremely* (9).

Two days after grades posted (Time 3). The link to the online survey was distributed at 7 am two days after the instructor released grades to students and was open until midnight, with a "last chance" to complete offered the next morning. Participants reported their emotions as at Time 1. They were prompted, "You recently took an exam in [course]…What grade did you receive on the exam?" and responded on the scale from Time 1. Participants were asked, "How

satisfied are you with your grade on the exam?" and "How satisfied are you that you spent enough time studying for the exam?" on scales ranging from *not at all* (1) to *extremely* (9).

Results

Preliminary Analyses

The majority (68%) of participants were optimistic and received a worse grade than they expected; 19% received a better grade than they expected; 14% received the grade that they expected. An examination of responses revealed that, two weeks before the exam, the majority (63%) of participants expected to receive an A, and only 2% expected a grade lower than a B. Table 1 presents the descriptive information and intercorrelations among study variables.

Table 1. Descriptive information and inter-correlations among variables.

	M	*SD*	1	2	3	4	5	6	7	8
1. Initial grade expectation	10.61	1.44								
2. Adjustment in grade expected	1.04	1.22	.01							
3. Number of hours studied	6.81	6.42	.07*	-.08**						
4. Satisfaction with studying	5.10	1.80	.27***	-.37***	.14***					
5. Received grade	8.49	3.02	.20***	-.21***	.06*	.15***				
6. Satisfaction with grade	5.73	2.65	.09**	.02	.14***	.07*	.43***			
7. Satisfaction with studying	5.63	2.47	.10**	.02	.19***	.15***	.27***	.67***		
8. Happiness the day before	1.81	3.26	.11**	-.15***	-.07*	.22***	-.01	.00	.01	
9. Happiness after the exam	2.53	3.26	.06	-.04	-.04	.11**	.19***	.15***	.10**	.43***

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

Effort and Emotion before the Exam

Regression analyses were conducted on responses before the exam, including as predictors the grade that students expected two weeks before the exam and the change in their expectations the day before the exam (i.e., the difference of the grade expected two weeks before minus their expected grade the day before the exam). To account for variance in the outcomes

associated with the strength of the student in the particular course, the analyses included received grade as a covariate. Previous GPA was not available for over half the sample (e.g., first term freshmen); in order to retain as much of the sample as possible, primary analyses did not include previous GPA. Inferences remain the same after accounting for previous GPA, except where noted.

We examined two indicators of effort, including the number of hours studied the day before the exam and satisfaction with studying efforts. Based on previous research indicating that satisfaction reflects the perceived quality of effort (Fredrickson, 2012; Kuh, 2009), we focused on satisfaction with studying rather than only amount of time spent. As reported in Table 2, expecting higher grades two weeks before the exam predicted studying more hours by the day before the exam, greater satisfaction with the quality of studying, and better received grades. The degree to which students adjusted their expected grade between initial expectations and expectations the day before the exam also predicted indicators of effort. Greater reduction of expectations was associated with fewer hours studied by the day before the exam, lower satisfaction with the quality of studying, and worse received grades (note that, for this analysis, adjustment and studying measures were taken at the same time point).

Table 2. Relationship of initial grade expectations and adjustments in grade expectations the day before the exam to indicators of effort and emotions before the exam, controlling for the grade received.

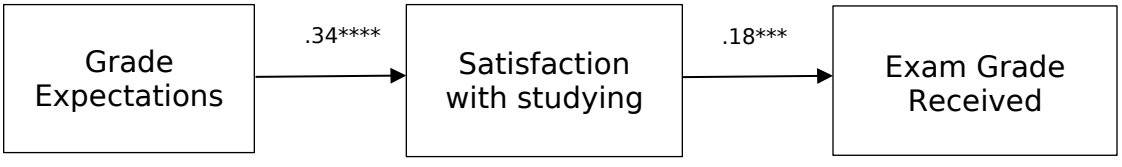
		Initial Grade Expectation β	Adjustment in Grade Expectation β	Grade Received (covariate) β
Effort				
Number of Hours Studied	$R^2 = .01$, $F(3, 1054) = 4.54$, $p = .004$	.07*	-.07*	.03
Satisfaction with Studying	$R^2 = .22$, $F(3, 1057) = 96.36$, $p < .001$	.27***	-.37***	.02

Received Grade	R^2 = .09, F(2, 1058) = 49.95, p < .001	.21***	-.21***	-
Emotion				
Happiness the day before	R^2 = .04, F(3, 982) = 13.71, p < .001	.12***	-.17***	-.07*

Note. * p < .05; ** p < .01; *** p < .001

Effort matters, of course, to the extent that it relates to performance. To further explore whether expectations predicted changes in the quality of effort related to the exam, in ways that affected performance, we conducted a mediation analysis using Process version 3 (Hayes, 2018; bootstrapped 10,000). Figure 2 presents the results of this analysis. The overall model including the indirect effect was significant, R^2 = .05, F(2, 1058) = 25.87, p < .001. As reported above, students' expectations predicted their satisfaction with studying efforts, coefficient = .34 (*SE* = .04), *95% CI*: .27 to .41, t = 9.20, p < .001, such that higher grade expectations predicted greater satisfaction the day before the exam with the quality of studying. Expectations also predicted the grade that students received on the exam, with higher expectations predicting better grades, coefficient = .37 (*SE* = .07), *95% CI*: .24 to .49, t = 5.58, p < .001, and greater satisfaction with studying one day before the exam also predicted better grades, coefficient = 0.18 (*SE* = .05), *95% CI*: .08 to .28, t = 3.44, p = .001. Further, the indirect effect was significant (i.e., did not include zero in the confidence interval), coefficient = .06 (*SE* = .02), *95% CI*: .03 to .10. This indicates that students' expectations about their grade, two weeks before the exam, predicted their satisfaction that they will have studied enough one day before the exam, and this in turn predicted the grade that they actually received.

Figure 2. Exam grade expectations weeks before the exam predicted satisfaction with studying immediately before the exam and the grade students later received.



Following conventions, we subtracted reported unhappiness from happiness to create an overall happiness score (e.g., Diener, Lucas, & Oishi, 2002; inferences remain identical if happiness and unhappiness are examined separately). As reported in Table 2, expecting higher grades two weeks before the exam predicted greater happiness the day before the exam. Further, greater reduction of expectations was associated with less happiness the day before the exam.

Effort and Emotion after the Exam

Similar analyses examined responses after the exam, including as predictors the grade that students expected two weeks before the exam and the change in their expectations the day before the exam (i.e., the difference of the grade expected two weeks before minus their expected grade the day before the exam), as well as the difference between the expected and received grade. The correlation between difference in expected and received grade at the two times points (2 weeks before and the day before) was too high to permit inclusion of both as predictors; therefore, the difference two weeks before the exam was used in analyses.

We examined two indicators of effort, including satisfaction with studying efforts and satisfaction with the grade received. As reported in Table 3, expecting higher grades two weeks before the exam predicted greater satisfaction with studying after knowing the grade received, and greater satisfaction with the grade received. The degree to which students adjusted their expected grade between initial expectations and expectations the day before the exam also predicted indicators of effort. Greater reduction of expectations was associated with greater satisfaction with studying after knowing the grade received, and greater satisfaction with the grade received. These latter two relationships were no longer significant if previous GPA was

included as a covariate. Further, the greater the difference between the grade that students expected and the grade they received, the less satisfied they were with their studying and with their grade. Expecting higher grades two weeks before the exam also predicted greater happiness after the exam. Adjustment in expectations the day before the exam did not significantly predict happiness after the exam. A greater difference between expected and received grade predicted less happiness after the exam.

Table 3. Relationship of initial grade expectations, adjustments in grade expectations the day before the exam, and difference between received and expected grade to indicators of effort and emotions after the exam.

		Initial Grade Expectation β	Adjustment in Grade Expectation β	Difference in Received vs. Expected Grade β
Effort				
Satisfaction with Studying	$R^2 = .08$, $F(3, 1051) = 30.11$, $p < .001$	.17***	.08**	-.28***
Satisfaction with Grade	$R^2 = .19$, $F(3, 1054) = 83.78$, $p < .001$	.21***	.11***	-.46***
Emotion				
Happiness after Exam	$R^2 = .04$, $F(3, 1011) = 13.28$, $p < .001$	.11***	.002	-.19***

Summary. Students' expectations two weeks before about how well they would perform on their exam predicted their effort and emotions before and after the exam, and these relationships could not be accounted for by prior performance or competence in the particular course. Within the framework of EMT, these findings suggest that there were benefits of high expectations for effort and performance, as well as emotional responses. Adjusting grade expectations downward shortly before the exam also predicted greater satisfaction with studying

and satisfaction with the grade, but not experienced happiness, suggesting that any benefits of adjustment for emotional distress are fleeting (see also Sweeny & Shepperd, 2010).

Study 2: Expectations for Match with Medical Residency Programs

Medical students completing their training and applying to match with residency programs reported their expectations and experiences during the match process. In the last year of medical school, students undergo a competitive process known as "the Match," the outcome of which is the culmination of years of training. The result of the Match determines where they will spend their residency training, setting the stage for the remainder of their career as physicians and often impacting their personal lives (as it requires moving with potential ramifications for relationships). After applying to programs and completing interviews, applicants rank order their choices for residency programs; programs also rank order applicants. A centralized matching service processes the lists and matches residents to programs. The Monday before the service releases the specific outcomes of the match, they notify applicants about whether or not they matched to a program at all. If they have not, they must quickly scramble to find a position by contacting any program in any specialty area that might be willing to take them. If they have matched, they find out the specific program on the third Friday of March ("Match Day"), and they are obligated under contract to attend that program. Participants reported their expectations for matching to programs before Match Day, and the decisions they made when ranking programs. On Match Day, students reported the outcome and their emotions.

Methods

Participants. Fourth year medical students at a large public university in California completed surveys regarding their experiences and perception of Match Day. One of the student leaders of the program presented the survey to other students and encouraged participation in order to learn more about this process. Participants received financial compensation for completing the surveys. Data collection was planned for 200 participants, based on estimated enrollment rates across two years in the medical program, acknowledging that the availability of this sample would limit power. The final sample consisted of 182 participants. This recruitment provided a post hoc power of .38 to detect a .2 *d* effect size. Degrees of freedom vary slightly among analyses due to missing data on some variables. The sample included 53% women, with an average age of 28.03 years (*SD* = 2.21). Participants reported that they were African American/Black (2%), East Asian (18%), White (39%), Middle Eastern (9%), South Asian (13%), Pacific Islander (2%), or multi-racial (3%).

Procedures and materials. This study was part of the same larger investigation referenced in Study 1; only methods and procedures relevant to the present research questions are included here. Two weeks before Match Day, shortly after submitting their ranked list of residency programs, participants reported their expectations for Match Day and their emotions. The week after Match Day, participants reported the outcome and their emotions. All questionnaires were online.

Two Weeks Before Match Day (Time 1). After participants submitted their rankings of residency programs but before they learned the outcome, participants were emailed a link to an online questionnaire to be completed by March 7, a week before Match Day (M_{day} = 6.46, *SD* = 5.29). Participants were asked, “In general, how are you currently feeling?” for happy and

stressed, on scales from *not at all* (1) to *most extreme possible* (9). They then listed the specialty, medical facility/hospital, and location for their top four ranked choices of a residency program. Using a sliding scale from *not strong* (0) to *extremely strong* (100), they reported, "How strong is your desire to be a resident in the programs you ranked first, second, third, and fourth?" Participants were also asked, "How satisfied are you with the decisions you made about your Rank Order List?" and responded on a scale from *not at all satisfied* (1) to *most satisfied possible* (9).

Participants were instructed, "Suppose it's an evening during the week after Match Day, and you matched with the program you ranked FIRST: In general, how will you be feeling at this time?" and rated how happy they would be on a scale from *not at all* (1) to *most extreme possible* (9). They completed this question for their second, third, and fourth or lower ranked programs. Participants also responded to, "How satisfied will you be with the decisions you made about your Rank Order List if you match with the program you ranked: 1st, 2nd, 3rd, 4th or lower" on scales from *not at all satisfied* (1) to *most satisfied possible* (9). They then reported, "In your opinion, how likely is it that you will be matched with the program you ranked: 1st, 2nd, 3rd, 4th or lower" on scales from *not at all likely* (1) to *extremely likely* (9).

Finally, participants reported on indicators of their performance in medical school and preparation for residency programs. This included their score on the United States Medical Licensing Examination (USMLE) Step 1, the USMLE Step 2, number of basic science courses that they honored in, and number of outside experiences (e.g., research). They also reported their gender (male, female), age, and race/ethnicity.

Week after Match Day (Time 2). Participants received a link to a second online questionnaire the day after Match Day and completed it during an evening within a week (M_{day} = 2.60, SD = 1.69). They reported their current happiness and stress using the same questions as at Time 1. They also reported program information for the program they matched to. Participants were asked, "How satisfied are you with the decisions you made about your Rank Order List?" on the same scale as at Time 1.

Results

Preliminary Analyses

About 52% of participants matched with their top ranked program and 48% did not match with their top choice. Of those who did not match with their top choice, about 20% matched with their second choice, 10% with their third choice, 7% with their fourth choice, 4% with their fifth choice, 1% with their sixth choice, 4% with their seventh choice, 1% with their tenth choice, and 2% did not match at all. Additional analyses indicated that participants had markedly and qualitatively different views of matching with their top ranked choice versus all other programs. Participants expressed a stronger desire to be in the program that they ranked first (M = 96.05, SD = 7.27) compared to those they ranked lower (M = 79.24, SD = 22.04), $t(154) = 6.84$, $p < .001$. They also anticipated that they would be more satisfied with their decision making about rank ordering if they matched with their top choice (M = 8.60, SD = .93) than if they matched with a program they ranked lower (M = 7.73, SD = 1.66), $t(155) = 4.17$, $p < .001$. Given this pattern, analyses focused on the outcome of matching with the top ranked choice versus not matching with the top ranked choice. Table 4 presents the descriptive information and inter-correlations among study variables.

Table 4. Descriptive information and inter-correlations among variables.

	M	*SD*	1	2	3	4	5	6	7
1. Expectation to Match	0.76	0.43							
2. Satisfaction with rank order before Match	7.73	1.13	.16*						
3. Match with top choice	0.52	0.50	.30***	.14					
4. Happiness before Match Day	6.62	1.25	.18*	.26***	.12				
5. Stress before Match Day	5.10	2.17	-.17*	-.07	-.18*	-.29***			
6. Satisfaction with rank order after Match Day	7.68	1.65	.17*	.35***	.35***	.19*	-.10		
7. Happiness after Match Day	7.30	1.69	.10	.18*	.42***	.26***	-.11	.65***	
8. Stress after Match Day	4.28	2.15	-.04	.02	-.20**	-.11	.27***	-.29***	-.37***

Note. * $p < .05$; ** $p < .01$; *** $p < .001$

We first examined if there were relationships between participants' perceived likelihood of matching with their top choice and the quality of the ranked programs or in the academic preparation of the participants. Contrary to the intuitive hypothesis that participants might choose lesser programs to increase chances of matching, participants perceived they were more likely to match with their top choice for programs with higher rankings, $r(181) = .17$, $p = .021$. There was no indication that past training or preparation was related to expectations of matching with the top choice program. Specifically, perceived likelihood of matching was not related to United States Medical Licensing Examination (USMLE) Step 1 scores, $r(178) = -.035$, $p = .643$, USMLE Step 2 clinical knowledge scores, $r(176) = 0.14$, $p = .855$, the number of basic science courses with honors, $r(179) = 0.82$, $p = .277$, or the number of outside experiences (e.g., research), $r(173) = -.03$, $p = .663$. Because it was possible that differences could be driven by factors related to ability (in ways not captured by indicators of academic preparation) rather than expectations, we also conducted all analyses with accuracy of expectations included. These analyses revealed no main effect or interaction with accuracy in predicting outcomes, and the inferences from analyses remained identical to those reported below.

Effort and Emotion before Match Day

To examine the relationship of expectations to perceived effort during rank order decisions, an independent sample *t*-test was conducted with expectation group (match, no match) as the between subjects factor and satisfaction with decision making as the outcome. Beyond effort invested in studying (which did not differ between groups, as described above), the other determinant of the Match Day Outcome is the effort students invest in making rank order decisions of programs. Thus satisfaction with decision making during the rank order was

examined as an indicator of perceived effort on that critical task. Those who expected to match with their top ranked program were more satisfied, weeks before knowing the outcome, with the decisions they made about ranking programs (M = 7.83, SD = 1.13) than those who did not expect to match with their top ranked program (M = 7.40, SD = 1.09), $t(176) = 2.21$, $p = .028$, $d = .33$. This perception of better decision making appeared to be justified - a chi-square analysis revealed that participants who expected to match were more likely to match with their top choice (61%) than those who did not expect to match (26%), $\chi^2(1) = 16.16$, $p < .001$.

For emotional responses, both happiness and stress were measured. These reports were not highly correlated, $r(180) = -.29$, $p < .001$, and were therefore examined separately. There was a difference in happiness based on expectations for matching, $t(174) = 2.44$, $p = .016$, $d = .37$. Participants were happier weeks before Match Day if they expected to match with their top choice (M = 6.77, SD = 1.24) than if they did not expect to match (M = 6.24, SD = 1.21). Similarly, participants were less stressed weeks before Match Day if they expected to match to their top program (M = 4.87, SD = 2.14) than if they did not expect to match (M = 5.74, SD = 2.18), $t(175) = 2.30$, $p = .023$.

Effort and Emotion after Match Day

About half of participants (46%) accurately expected to match, with 6% underestimating (expecting not to match but they did), 30% overestimating their match (expecting to match and they did not), and 18% accurately expecting not to match. The cell size for underestimation was too small (n = 11) to permit reliable comparisons and was therefore removed from analysis. To examine the relationship of expectations to perceived effort, an ANOVA was conducted with expectation group (overestimated, accurately expect not to match, accurately expect to match) as the between subjects factor and the outcome of satisfaction with ranking decisions after knowing

the outcome of Match Day. This analysis revealed an effect of expectation group, $F(2, 164) = 11.14$, $p < .001$, $\eta_p^2 = .120$. Participants who accurately predicted that they would match ($M = 8.18$, $SD = 1.01$), were more satisfied with their decisions on the rank order list than participants who did not match, regardless of whether they overestimated ($M = 7.38$, $SD = 1.62$), $t(133) = 3.56$, $p = .001$, $d = .62$, or predicted that they would not match ($M = 6.78$, $SD = 2.27$), $t(112) = 4.58$, $p < .001$, $d = .87$. Satisfaction did not differ for the two groups that did not match, $t(83) = 1.41$, $p = .16$, $d = .31$. In other words, participants' satisfaction with their decisions was determined by the outcome of Match Day, with no evident cost to optimistic expectations that were not fulfilled.

A similar analysis for happiness after knowing the outcome of Match Day revealed a main effect of accuracy group, $F(2, 164) = 14.44$, $p < .001$, $\eta_p^2 = .150$. Participants who accurately expected to match were happier ($M = 7.89$, $SD = 1.09$), than those who accurately expected to not match ($M = 6.47$, $SD = 2.26$), $t(112) = 4.53$, $p < .001$, $d = .86$, and those who overestimated their chances of matching ($M = 6.66$, $SD = 1.71$), $t(133) = 5.11$, $p < .001$, $d = .89$. Those who did not match and expected it did not differ from those who expected to match and did not, $t(83) = -0.44$, $p = .659$, $d = .10$. In other words, there seemed to be no emotional cost to expecting the best and not getting it – happiness was related to the outcome itself. There was not a significant main effect of accuracy group for stress, $F(1, 164) = 2.81$, $p = .063$, $\eta_p^2 = .033$. Participants who accurately expected to match had marginally lower stress ($M = 3.94$, $SD = 2.20$) than those who accurately expected not to match (M = 4.78, SD = 1.90), $t(112) = 1.91$, $p = .059$, $d = .36$, and marginally less stressed than those who expected to match and did not ($M = 4.68$, $SD = 2.16$), $t(133) = 1.93$, $p = .056$, $d = .33$. The stress experienced by participants who did not

match and expected it did not differ from that in participants who optimistically expected to match, $t(83) = 0.22$, $p = .826$, $d = .05$.

Summary. There was no evidence that competitiveness of programs ranked or past training/performance differed for medical students who expected to match with their top choice versus those who did not expect to match, but there were differences in perceived effort and emotional responses. Those who had high expectations, expecting to match with their top choice, were more satisfied with the decisions they made about ranking programs than those who did not expect to match, and they were ultimately more likely to match to their top choice. Those who had high expectations that they would match to their top choice were also happier and less stressed in the weeks leading up to Match Day than those who had low expectations.

Students' expectations about whether they would match with their top ranked residency program as well as the outcome itself predicted perceived effort in decision making and emotional responses. Participants who matched were more satisfied with their decision-making than those who did not match shortly after learning the outcome. Further, participants who optimistically expected to match, but did not, were also more satisfied with their decision-making. Emotional responses after Match Day were largely predicted by the outcome of the match. There was no evidence that overly optimistic expectations were related to greater distress after the event.

Discussion

The present investigation examined the potential benefits and costs of optimistic expectations about future events through the lens of Error Management Theory (EMT; McNulty & Karney, 2002; McKay & Dennett, 2009). Decades of evidence have shown that optimism

about the likelihood of future events is pervasive and difficult to correct. From an EMT perspective, this perpetuation of inaccurate beliefs is possible because optimism offers benefits greater than the costs. Two specific benefits have been proposed to result from optimistic beliefs: 1) organization of goal pursuit before an event that increases the likelihood of a positive outcome, and 2) reduced stress before an event. We investigated both of these potential benefits to decision makers using a longitudinal design for people facing important life events – students taking their first university exam and medical students placing for residency. We also investigated a potential cost to optimistic expectations suggested by previous research findings outside of, but informative to, Error Management Theory – that optimistic beliefs could impose a cost through increased longer-term distress when an unexpected negative event occurs.

Effort before an Event

Based on EMT explanations for the perpetuation of optimistic expectations, we hypothesized that participants who expected positive outcomes would demonstrate greater effort investment before the event, as well as evidence of improved performance (Haselton & Nettle, 2006; McKay & Dennett, 2009). The evidence was consistent with this hypothesis in both studies. In students taking their first exam in a college course, higher grade expectations predicted studying more hours for the exam and greater satisfaction with studying. Higher grade expectations also predicted receiving better grades on the exam, and effort mediated the relationship between expectations and received grade. In medical students applying to residency programs, students who expected to match with their top ranked program were more satisfied with the decisions they made during the process than students who did not expect to match with their top choice. Students with high expectations also performed better, in that they were more likely to actually match with their top choice.

These findings support the proposition that optimistic expectations organize goal pursuit through investment of effort before an event occurs, increasing the likelihood of a positive outcome. Prior evidence for this relationship has largely focused on health-related behaviors and the findings have been mixed, showing that optimism sometimes increases health-promoting behaviors (e.g., Friedman et al., 1995) and sometimes increases avoidance of health-promoting behaviors (e.g., Brewer et al., 2007; Jackson & Aiken, 2000; Weinstein & Klein, 1996). One study indicated that optimistic expectations in one domain were associated with behaviors likely to result in positive outcomes in other domains (working longer hours, remarrying, saving money; Puri & Robinson, 2007). The present findings reveal that optimistic expectations for a specific, controllable, important event, with a known timeline, predict indicators of effort to prepare for that event and better outcomes.

Reduced Distress before an Event

Based on the second proposed benefit to optimistic expectations from an EMT framework, we hypothesized that participants positive expectations would predict less distress before the event (McNulty & Karney, 2002). The evidence was consistent with this hypothesis in both studies. Higher expectations for a grade on the first exam in a college course predicted greater happiness shortly before taking the exam. In medical students applying to residency programs, students who expected to match with their top ranked program were happier and less stressed before finding out the outcome of Match Day (when they learn their fate for residency programs) than students who did not expect to match with their top choice.

These findings support the EMT proposition that a benefit of optimistic expectations is that it reduces distress before an event occurs, and previous studies have linked this reduced emotional distress with lower physiological stress (McNulty & Karney, 2002). This finding is

consistent with past work demonstrating that holding generally positive expectations for one's future predicts reduced stress during a number of challenging life events (e.g., cancer, pregnancy loss; Schulz et al., 1996; Litt et al., 1992). It is also consistent with a past study showing that optimistic expectations for a specific experience predicted reduced distress during stressors related to that experience (Segerstrom et al., 1998). However, these past studies have largely focused on distress during or after the event, whereas EMT predicts a benefit of reduced distress before the event. The present investigation revealed that optimistic expectations for a concrete future event, with a known timeline, predict reduced distress as people prepare for the event, consistent with EMT.

Distress after the Event

The present investigation assessed one potential cost that has been prominent in theoretical accounts of optimism. This is the possibility that optimistic expectations leave people unprepared to deal with negative outcomes. As a result, optimism could predict greater distress after a negative event occurs (Mellers et al., 1997; Loomes & Sugden, 1986; Shepperd & McNulty, 2002). In the present investigation, there was no evidence that optimistic expectations predicted greater distress after negative events. Instead, what mattered for emotional responses was the outcome. If the outcome was positive, participants were happier; if the outcome was negative, participants were less happy. This inference is consistent with previous findings that longer-term responses after an outcome are driven by the valence of the outcome, not people's expectations, potentially because the discrepancy between expectations and outcome is most important immediately after receiving feedback (Sweeny & Shepperd, 2010) and then quickly fades from memory (Golub et al., 2009), or because people rapidly cope with even unexpected negative outcomes (Armor & Taylor, 1998). In students taking their first exam in a college

course, we also examined if adjusting expectations downward shortly before an event predicted less distress in the week after the event. There was no evidence of buffering of longer-term distress.

Limitations

Limitations include that measures relied on self-report that may be subject to various biases. Factors such as social desirability bias or selective memory could influence how participants responded, even on questions about facts such as the grade students received on their exam. For measures of expectations, however, self-report is likely to be the best measurement because it is participants' perception of their possible future outcomes that was under investigation. Expectations can be manipulated, but this is frequently done through creating an expectation for high performance based on false feedback (e.g., Tenney et al., 2015). This manipulation thus requires a relatively high amount of deception, and the effectiveness of the manipulation will vary based on participants' level of suspicion and confidence in the feedback provided. As a result, to be confident of detected relationships, even studies that manipulate expectations must take into account individual variation in expectations (Lench, Taylor, & Bench, 2014).

The correlational study design in the present investigation limits the ability to make causal inferences. As a result of this design, it is possible that the observed relationships are influenced by a confound. We made every effort to rule out potential confounds, by addressing differences in past performance that could result in legitimate confidence (i.e., GPA, medical school performance) and ability in the particular course in Study 1. While causality cannot be inferred without total control over potential third variables, the longitudinal method of the study means that the other two criteria for inferring causation—covariation and temporal precedence—

have been met. This permits inferences about the degree to which expectations predict responses at a subsequent time point.

We drew upon findings related to "bracing" for negative events, along with other literature on reactions to unexpected events, to identify a potential cost to optimistic expectations – increased distress to unexpected negative events. However, the studies were not designed to test hypotheses related to bracing specifically. This is important to note because previous studies have demonstrated that the timing of measurement is critical to detect bracing (e.g., Sweeny & Shepperd, 2010). These findings have shown that people adjust their expectations downward shortly before finding out the outcome of the event (e.g., right before test grades are handed back in class) and that the improved emotion from this bracing is limited to shortly after finding out the outcome (e.g., right after they get their test grade). The present investigation was not designed to test this time period relevant to the bracing literature. Instead, within the frame of EMT, we were interested in the relationship of optimistic expectations to periods of time when effort could matter to performance (e.g., before taking the test) and longer-term emotional responses after finding out the outcome (e.g., general happiness the week after finding out the grade). Our finding that downward adjustment of expectations did not relate to these longer-term emotional responses should not be interpreted as counter to the bracing literature and is consistent with previous findings that the benefits of bracing are brief and limited to almost immediately after the outcome.

Conclusions

The pattern of findings suggests that there are multiple benefits for effort, performance, and emotion of holding optimistic expectations for future events, consistent with Error Management Theory. Concerns have been raised that these benefits could be offset by increased

distress when people are surprised by unexpected negative events. However, there was no evidence of an emotional cost after the events – people were distressed about negative outcomes regardless of their expectations. For future events that are specific, controllable, and important, it appears optimism has benefits with very little cost.

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