Positively Biased Appraisals in Everyday Life: When Do They Benefit Mental Health and When Do They Harm It?

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Abstract

To promote optimal mental health, is it best to evaluate negative experiences accurately or in a positively biased manner? In an attempt to reconcile inconsistent prior research addressing this question, we predicted that the tendency to form positively biased appraisals of negative experiences may reduce the motive to address those experiences and thereby lead to poorer mental health in the context of negative experiences that are controllable and severe but lead to better mental health in the context of controllable negative experiences that are less severe by promoting positive feelings without invoking serious consequences from unaddressed problems. In 2 longitudinal studies, individuals in new marriages were interviewed separately about their ongoing stressful experiences, and their own appraisals of those experiences were compared with those of the interviewers. Across studies, spouses' tendencies to form positively biased appraisals of their stressful experiences predicted fewer depressive symptoms over the subsequent 4 years among individuals judged to be facing relatively mild experiences but more depressive symptoms among individuals judged to be facing relatively severe experiences. Furthermore, in Study 2, these effects were mediated by changes in those experiences, such that the interaction between the tendency to form positively biased appraisals of stressful experiences and the objectively rated severity of initial levels of those experiences directly predicted changes in those experiences, which in turn accounted for changes in depressive symptoms. These findings suggest that cognitive biases are not inherently positive or negative; their implications for mental health depend on the context in which they occur.

Keywords

positive illusions; depression; stress; self-enhancement; optimistic bias

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Challenges, hassles, and stressful experiences are a fact of life. Some people may experience financial crises, others may suffer health or interpersonal problems, and still others may face stressors in multiple domains. Not only do people vary in the frequency and severity of their challenges, they also vary in how they respond to those challenges. Whereas some people are resilient and maintain good mental health even in the face of significant problems and stress, others find the same experiences leading to depression and other symptoms of poor mental health.

Given the inevitability of negative or stressful experiences, what is the best way for people to protect their mental health when these challenges arise? Numerous theorists, social psychologists in particular, have argued that mental health is more resilient for people who tend to make positively biased appraisals of their experiences—that is, interpret their experiences more positively than an objective observer would interpret those same experiences (Alloy & Abramson, 1979; Needles & Abramson, 1990; Seligman, Steen, Park, & Peterson, 2005; Taylor & Brown, 1988). These claims for the benefits of unrealistic thinking challenge traditional conceptualizations of mental health that emphasize the importance of perceiving reality accurately (Allport, 1930; Erikson, 1950; Fromm, 1955; Maslow, 1950). Accordingly, they have been the source of ongoing debate and controversy.

Unfortunately, empirical examinations of the link between positively biased appraisals and subsequent mental health have done little to resolve this controversy. Whereas some longitudinal studies have suggested that positively biased appraisals promote mental health (e.g., Alloy & Clements, 1992; Bonanno, Field, Kovacevic, & Kaltman, 2002; Taylor, Helgeson, Reed, & Skokan, 1991; Taylor, Lichtman, & Wood, 1984; Zuckerman & O'Loughlin, 2006), others suggest those less-than-accurate appraisals can threaten mental health (e.g., Bonanno, Rennicke, & Dekel, 2005; Colvin, Block, & Funder, 1995; Paulhus, 1998; Robins & Beer, 2001; Swann, 1983). The overarching goal of the current research was to address this inconsistency by examining a potential moderator of the effects of positively biased appraisals on mental health: the severity of the negative experiences being appraised. To this end, the rest of this introduction is divided into four sections. The first section distinguishes among different types of negative experiences, noting one area of consistency in research on the implications of positively biased appraisals for mental health—positively biased appraisals of uncontrollable negative experiences appear to benefit mental health (e.g., Bonanno et al., 2002; Taylor et al., 1984, 1991). The second section nevertheless reveals that research on the mental health implications of positively biased appraisals of the controllable negative experiences that characterize everyday life has been less consistent, with some studies suggesting that such appraisals benefit mental health (e.g., Zuckerman & O'Loughlin, 2006) and other studies suggesting that such appraisals harm mental health (e.g., Robins & Beer, 2001). The third section attempts to reconcile these inconsistencies by arguing that the mental health implications of positively biased appraisals of controllable negative experiences may depend on the severity of those experiences, such that positively biased appraisals may be adaptive in the face of minor controllable negative experiences but harmful in the face of more severe controllable negative experiences. Finally, the fourth section describes two multiwave, longitudinal studies that directly tested this possibility.

Positively Biased Appraisals of Uncontrollable Negative Experiences

Negative experiences can be minor or severe, chronic or acute, and controllable or uncontrollable. These and other qualities of negative experiences likely play an important role in determining the implications that positively biased appraisals of those experiences have for mental health. Indeed, recognizing such distinctions reveals one area of consistency in research on the implications of positively biased appraisals for mental health. A consistent body of research indicates that positively biased appraisals of negative experiences that are relatively uncontrollable are associated with better mental health over time (e.g., Alloy & Clements, 1992; Bonanno et al., 2002; Taylor et al., 1984, 1991; for a review, see Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000). For example, Bonanno et al. (2002, Study 2) reported that participants who had recently experienced the death of a spouse experienced better mental health over time to the extent that they held positively biased views of their abilities to cope. Likewise, Taylor et al. (1984) reported that women diagnosed with breast cancer experienced better psychological adjustment over time to the extent that they were unrealistically optimistic regarding their chances for survival.

In both of these studies, individuals faced sources of stress that were relatively uncontrollable. The participants in the Bonanno et al. (2002) study, for example, had recently experienced the death of a loved one, an acute event that was impossible to reverse. Likewise, because all the participants in the Taylor et al. (1984) study had already been diagnosed with breast cancer and because most had already been surgically treated, there was little else they could do to control the progression of the disease (see Hayes, Isaacs, & Stearns, 2001). It makes sense that positively biased appraisals should benefit mental health in these situations, given the mechanisms through which positively biased appraisals are expected to influence mental health. Those who describe the benefits of positively biased appraisals argue that such appraisals should promote better mental health by promoting more positive emotions (Taylor & Brown, 1994), whereas those who challenge such benefits argue that positively biased appraisals may weaken the motivation to prevent negative experiences from recurring in the future and thus allow problems to fester and ultimately threaten mental health (e.g., Baumeister, 1989; McNulty, O'Mara, & Karney, 2008; Swann, 1983). Because there is little that can be done behaviorally to prevent or resolve problems that are relatively uncontrollable (for a related discussion, see Rothbaum, Weisz, & Snyder, 1982), interpreting such experiences in a positive light should allow people to capitalize on the emotional benefits of those biases without suffering any negative implications from failing to manage or prevent such experiences from recurring.

Positively Biased Appraisals of Controllable Negative Experiences

Yet what about the more controllable negative experiences that characterize everyday life? In contrast to past acute negative experiences like losing a loved one or relatively uncontrollable negative experiences like having a potentially terminal disease, people frequently have options for managing or enhancing potentially stressful circumstances that occur on a more regular basis, such as having problems at work or school, financial challenges, health problems, or difficult interpersonal relationships. Although positively biased appraisals of such problems may provide emotional benefits, any weakened

motivation to manage such problems could prove costly by precluding resolutions that would otherwise be achieved.

In light of these conflicting possibilities, it is not surprising that research has been less consistent in demonstrating the mental health implications of positively biased views of controllable negative experiences. Consistent with the idea that positively biased appraisals of such experiences should benefit mental health, several longitudinal studies have indicated that, like positively biased appraisals of uncontrollable negative experiences, positively biased appraisals of relatively controllable negative experiences lead to positive outcomes over time (Gramzow & Willard, 2006; Gramzow, Willard, & Mendes, 2008; Zuckerman & O'Loughlin, 2006). Zuckerman and O'Loughlin (2006), for example, reported that participants who believed they were better than similar peers on 21 traits and skills (e.g., cheerfulness, drive to achieve, sensitivity to others) reported being less depressed 6 months later than participants who demonstrated less positive bias. Yet several other longitudinal studies have indicated that positively biased appraisals of relatively controllable negative experiences lead to poorer outcomes over time (e.g., Bonanno et al., 2005; Colvin et al., 1995; Paulhus, 1998; Robins & Beer, 2001; Swann, 1983). Robins and Beer (2001), for example, reported that incoming college students who reported positively biased appraisals of their academic abilities reported declines in well-being over the 4 subsequent years of college compared to participants who were more accurate regarding their academic abilities.

Reconciliation: The Moderating Role of the Severity of People's Negative Experiences

Recognizing the implications that positively biased appraisals have for people's tendencies to engage in preventive and precautionary behaviors suggests one way to reconcile these inconsistent effects. Previous work has linked measures of dispositional and domain-specific optimism to greater tendencies to engage in precautionary behaviors (e.g., Aspinwall & Brunhart, 1996; Aspin-wall & Taylor, 1992). Although that work may give the impression that positively biased appraisals should also be associated with an increased tendency to engage in such behaviors, measures of optimism do not distinguish between positive appraisals that are accurate and positive appraisals that are biased (see Bonanno et al., 2002; Colvin & Block, 1994; Colvin et al., 1995; Klein & Cooper, 2008). In fact, consistent with the idea that positively biased appraisals may reduce people's motivations to address their negative experiences (see Baumeister, 1989; McNulty, O'Mara, & Karney, 2008), several studies that assessed the motivational and behavioral implications of positive appraisals that were biased have suggested that such appraisals actually reduce the frequency with which people are either motivated to engage or do engage in behaviors that could benefit them over time (Burger & Burns, 1988; Radcliffe & Klein, 2002; Robins & Beer, 2001; Swann, Silvera, & Proske, 1995; Wiebe & Black, 1997). Wiebe and Black (1997), for example, reported that participants who were more unrealistically optimistic regarding their chances of contracting a sexually transmitted infection were less interested in learning about the risks of unprotected sex. Likewise, in the Robins and Beer (2001) study described earlier, participant' tendencies to be positively biased regarding their academic abilities at baseline predicted decreased motivation to succeed academically over time.

Given this evidence that positively biased appraisals can reduce the effort people expend managing their negative experiences, the implications of positively biased appraisals for subsequent mental health may depend on the severity of the negative experiences people tend to encounter in their everyday lives. Because relatively minor or infrequent problems (e.g., occasional spats with a loved one, the inability to afford luxury items, a pesky but harmless cough) should have few implications for subsequent mental health, failing to address or prevent such experiences from recurring should have few implications for subsequent mental health. Accordingly, the tendency for individuals to form positively biased appraisals in the context of mostly minor or infrequent chronic and controllable negative experiences should provide the emotional benefits associated with such biases without being costly over time. In contrast, because more severe problems (e.g., experiencing verbal or physical abuse, the inability to pay bills on time, a serious illness) should be more detrimental to subsequent mental health, failing to address and prevent such experiences from recurring should be more detrimental to subsequent mental health. In the context of more severe stress, the negative implications of positively biased appraisals on motivation may eventually override any short-term emotional benefits and thus predict poorer mental health over time.

Although we are aware of no research that has tested the prediction that the severity of people's negative experiences moderates the implications of their tendencies to hold positively biased appraisals on their mental health, at least one line of research is consistent with it. Specifically, McNulty and colleagues (e.g., McNulty & Karney, 2004; McNulty, O'Mara, & Karney, 2008) have shown that the implications of positive cognitions about a relationship/intimate partner for subsequent satisfaction with that relationship depend on the quality of spouses' experiences in that relationship (for a review, see McNulty, 2010). For instance, McNulty and Karney (2004) reported that more optimistic expectations for the success of the relationship predicted greater satisfaction over time for spouses who interacted effectively (e.g., engaged in fewer negative behaviors during videotaped conversations) but predicted declines in satisfaction over time for spouses who were less effective at resolving conflict. Likewise, McNulty, O'Mara, and Karney (2008) reported that positive thoughts about the partner and the relationship predicted greater marital satisfaction over time among partners whose relationships were characterized by infrequent and less severe problems but steeper declines in marital satisfaction over time among partners whose relationships were characterized by more frequent and severe problems. Furthermore, consistent with the current perspective, these effects were mediated by changes in the problems themselves, such that positive appraisals of the partner in the context of a problematic relationship led to declines in satisfaction through the direct effects of positive appraisals on escalating marital problems.

Although suggestive, the implications of these studies for understanding how positively biased appraisals may predict subsequent mental health are limited in two important ways. First, the dependent variable in both prior studies was marital satisfaction, not mental health. Although measures of marital satisfaction tend to be correlated with measures of mental health, such as depressive symptoms (for a review, see Whisman, 2001), mental health is a conceptually and empirically distinct construct. Indeed, whereas husbands' and wives' reports of their marital satisfaction are correlated with one another and both deteriorate over

the first few years of marriage, husbands' and wives' reports of their depressive symptoms tend to be unrelated to one another and do not change systematically over that same period (Davila, Karney, Hall, & Bradbury, 2003). In other words, different factors may explain the development of depressive symptoms than explain the development of marital satisfaction. Second, neither study compared spouses' positive thoughts about their partners or relationships to an objective benchmark. As noted earlier, the idea of bias implies a difference between one perception and a presumably more accurate perception (see Bonanno et al., 2002; Klein & Cooper, 2008). Accordingly, to determine whether the implications of positively biased appraisals of ongoing and controllable negative experiences are moderated by the objective severity of the negative experiences people tend to face in their lives, research needs to (a) assess participants' appraisals of ongoing and controllable experiences that can vary in severity across people, (b) obtain objective estimates of the severity of those experiences, and (c) test whether the difference between self- and objective ratings of those experiences predicts better or worse mental health over time depending on the severity of those objective ratings.

Overview of the Current Studies

The current research made use of two longitudinal data sets that offered such measures. Both studies assessed (a) recently married participants' subjective views of the stressful experiences they tended to encounter in numerous domains of their lives, (b) objective raters' views of those experiences, and (c) participants' reports of a particularly common mental health outcome—depressive symptoms (Kessler et al., 1996, 2003)—every 6 months for the next 4 years. Although the hypotheses tested here do not necessarily require samples of married couples, drawing from longitudinal studies of newlyweds offered the advantage of samples that were relatively homogeneous on notable sources of error variance in mental health, such as age (e.g., Mirowsky & Ross, 1992) and marital status (e.g., Eaton & Kessler, 1981), and ensured equal numbers of men and women.

Study 1 tested the prediction that the longitudinal implications of positively biased appraisals of stressful experiences for depressive symptoms depend on overall severity of the stressful experiences people tend to face, such that positively biased appraisals should be associated with fewer depressive symptoms over time in the context of few and minor stressful experiences, whereas positively biased appraisals should be associated with more depressive symptoms over time in the context of more severe stressful experiences. Study 2 attempted to replicate this effect in an independent sample and to demonstrate its expected mechanism—changes in the stressful experiences themselves, such that associations between positively biased appraisals of negative experiences and subsequent changes in depressive symptoms in the context of more severe stressful experiences should be mediated by the direct associations between positively biased appraisals and escalating stressful experiences. Given recent work by McNulty, O'Mara, & Karney (2008) predicting marital satisfaction in these samples using relationship cognitions that may be related to positively biased appraisals of stressful experiences and given the strong link between depressive symptoms and marital satisfaction (see Whisman, 2001), the primary analyses described later controlled for marital satisfaction at every wave of data collection.

Study 1

Study 1 was a 4-year longitudinal study of newlyweds. Each member of the couple was interviewed separately regarding the ongoing negative experiences in his or her life, and then spouses and interviewers independently rated the stressfulness of those experiences. The tendency to form positively biased appraisals was operationalized as the residualized difference between participants' self-ratings and observers' objective ratings. Participants then reported their depressive symptoms eight times, once every 6 months, for 4 years. We predicted that the tendency to form positively biased appraisals of stressful experiences would be associated with fewer depressive symptoms over time among people facing more minor stressful experiences on average according to the interviewers but with more depressive symptoms over time among people facing more severe stressful experiences on average according to the interviewers.

Method

Participants—Participants were 82 couples participating in a broader study of marital development conducted in Gainesville, a Northern Florida community surrounding the University of Florida.[1] Participants were recruited using two methods. The first was to place advertisements in community newspapers and bridal shops offering payment to couples willing to participate in a study of newlyweds. The second was to send invitations to eligible couples who had completed marriage license applications in counties near study locations. Those responding to either solicitation were screened for eligibility in an initial telephone interview. Inclusion required that (a) this was the first marriage for each partner, (b) the couple had been married less than 6 months, (c) each partner was at least 18 years of age, (d) each partner spoke English and had completed at least 10 years of education (to ensure comprehension of the questionnaires), and (e) couples did not have children and wives were not older than 35 (to allow a similar probability of transitioning to first parenthood for all couples). Eligible couples were scheduled for an initial laboratory session.

At baseline, husbands were 25.1 years old (*SD* = 3.3) and had received 16.3 years (*SD* = 2.4) of education. Forty percent were employed full time, and 54% were full-time students. On average, husbands earned a relatively low income of between $5,000 and $10,000 (*SD* = $4,800), likely due to the high proportion of students. Wives were 23.7 years old (*SD* = 2.8) and had received 16.3 years (*SD* = 1.2) of education. Thirty-nine percent were employed full time, and 50% were full-time students. On average, wives earned between $5,000 and $10,000 (*SD* = $4,400). Fifty-nine percent of husbands and 59% of wives were Christian, and 83% of husbands and 89% of wives were White.

Procedure—Before their laboratory session, participants were mailed a packet of questionnaires to complete at home and bring with them to their appointment. This packet included self-report measures of depressive symptoms, marital satisfaction, and demographics, and a letter instructing participants to complete all questionnaires

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[1]Data describing this sample have been reported elsewhere (Frye & Karney, 2002, 2004, 2006; McNulty & Karney, 2001, 2002, 2004; McNulty, Neff, & Karney, 2008; McNulty, O'Mara, & Karney, 2008; Neff & Karney, 2002, 2003, 2004, 2005b, 2009). Nevertheless, none of those reports examined the variables used to test the current hypothesis.

independently of their spouse and to bring their completed questionnaires to their upcoming laboratory session. Upon arriving at that session, participants completed a consent form approved by the local human subjects review board and a standard Big Five personality measure, and each participant was interviewed by a trained researcher regarding the negative experiences the participant was experiencing in various domains of his or her life. After completing their interviews, couples were paid $50 for participating in this phase of the study.

At approximately 6-month intervals subsequent to the initial assessment, couples were recontacted by phone and again mailed a packet of questionnaires, including the same measures of depressive symptoms and marital satisfaction, along with postage-paid return envelopes and a letter of instruction reminding participants to complete the forms independently of their spouse. This procedure was used at all follow-up procedures except Time 5, which was a laboratory session resembling Time 1. After completing each phase, couples were mailed a $40 check for participating.

Measures

Tendency to form positively biased appraisals of stressful experiences: Previous research has assessed positively biased appraisals using a variety of measures. One common measure asks participants to report their appraisals of the difference between their own qualities and/or experiences and the qualities and/or experiences of an average other or peer. As some authors have pointed out (e.g., Colvin & Block, 1994; Colvin et al., 1995), however, these measures do not distinguish between positive appraisals that are biased and positive appraisals that are accurate—that is, some people may indeed have more positive experiences than the average person. Accordingly, other authors (e.g., Klein & Cooper, 2008) have recommended using measures that compare participants' self-reported qualities and/or experiences to some relatively objective benchmark (e.g., peer or observer ratings).

Following such recommendations, we assessed participants' tendencies to form positively biased appraisals of their stressful experiences by estimating the difference between participants' and researchers' ratings of participants' stressful experiences. Given that people's levels of chronic stress appear to be one source of the daily hassles that most directly affect their well-being (Eckenrode, 1984; Kanner, Coyne, Schaefer, & Lazarus, 1981), researchers individually interviewed each spouse regarding the negative experiences he or she tended to encounter in nine life domains thought to be important to psychological well-being: the marital relationship, relationships with family, relationships with in-laws, relationships with friends, experiences at school, experiences at work/unemployment, finances, own health, and partner's health. Specifically, interviewers followed a modified version of a protocol developed by Hammen, Adrian, Gordon, Burge, and Jaenicke (1987) in which they asked specific questions designed to identify any ongoing stressors that participants had been experiencing in each domain during the past 6 months (e.g., "Have you been able to pay all your bills?", "Do you have any ongoing health problems?") and then probed for concrete indicators of the amount of stress caused by any ongoing stressors that were identified. After answering questions regarding each domain, each participant rated the stressfulness of his or her experiences in that domain by reporting whether he or

she had exceptionally stressful circumstances (1) or exceptionally positive circumstances (9) in that domain. Each interview lasted approximately 45 min.

All interviewers were trained approximately 2 hr per week for approximately 16 weeks to make objective ratings of the stressful experiences participants encountered in each domain using the same 9-point scale. During the first several meetings, interviewers listened to and discussed audio recordings of some of the initial interviews. On the basis of those discussions, the team formed a strict, rule-based system for coding the interviews. During the remaining meetings, the team continued to make and discuss ratings as a group until reliability was established. Once reliability was established, interviewers made their own ratings individually. The interview team was comprised of four males and five females. Although idiosyncratic qualities of each interviewer may add error that could make it difficult to find significant associations involving objective ratings of stressful experiences, the relatively large number of interviewers and the fact that each interviewer coded only $M = 18.22$ ($SD = 8.74$) of the 164 interviews make it unlikely that such idiosyncrasies may account for any such associations that emerged. To determine how well these interviewers agreed on their codes, a portion of the recorded interviews (23%) were randomly chosen to be coded by a second rater, and agreement between coders was assessed by calculating intraclass correlation coefficients (ICCs) between the averages of the ratings provided by each rater. Suggesting any idiosyncratic qualities of coders did not actually add much error to the codes, reliability appeared to be adequate (ICC for husbands = .71, ICC for wives = .80).

We estimated the difference between interviewers' and participants' ratings by forming residualized differences between participants' and interviewers' ratings. Because the tendency to form positively biased appraisals of stressful experiences across a variety of domains should be more strongly associated with mental health than the tendency to form positively biased appraisals of stressful experiences in just one domain (e.g., finances), we created an index of the general tendency to form positively biased appraisals by obtaining standardized residuals formed by regressing the average of participants' self-ratings of the stressfulness of their experiences across domains onto the average of observers' objective ratings of the stressfulness of those experiences. Whereas raw difference scores have been criticized for their unreliability (e.g., Griffin, Murray, & Gonzalez, 1999), residualized differences are reliable statistically (see Cohen, Cohen, West, & Aiken, 2003) and in this case are a conceptually clear operationalization of the variance in self-ratings that is independent of objective ratings.

Severity of negative experiences: The severity of participants' negative experiences was operationalized as the average of observers' ratings of the severity of participants' stressful experiences across domains (the same average that was partialed out of participants' own reports of their stressful experiences to form our operationalization of positively biased appraisals of stress). Lower scores indicated more severe negative experiences.

Depressive symptoms: Depressive symptoms were assessed at each time point using the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The BDI is a widely used measure that assesses depressive symptoms experienced in the past

week using 21 items. Although the BDI was originally designed to assess depressive symptoms among psychiatrically diagnosed populations, subsequent research has validated the measure for assessing depressive symptoms in normal populations (Steer, Beck, & Garrison, 1986) and college-age populations (Bumberry, Oliver, & McClure, 1978). Scores can range from 0 (no depressive symptoms) to 63 (most extreme depression). Coefficient alpha was high across all phases (across all phases, coefficient alpha was at least .71 for males and .81 for females).

Marital satisfaction: Given recent work by McNulty, O'Mara, and Karney (2008) predicting marital satisfaction in this sample and given the strong link between depressive symptoms and marital satisfaction (see Whisman, 2001), we wanted to assess depressive symptoms independent of these participants' satisfaction with their marriages. Thus, we assessed marital satisfaction at every time point using the Quality Marriage Index (QMI; Norton, 1983) and controlled for marital satisfaction in all analyses. The QMI is a six-item scale that asks spouses to report the extent to which they agree or disagree with general statements about their marriage (e.g., "We have a good marriage," and "My relationship with my partner makes me happy"). Five items ask spouses to respond according to a 7-point scale, and one item asks spouses to respond according to a 10-point scale, yielding scores from 6 to 45. High scores reflect more satisfaction with the relationship. Internal consistency of this measure was high across all phases (across all phases of both studies, coefficient alpha was at least .92 for males and .93 for females).

Covariates: To address the possibility that socioeconomic status or personality could account for any interactive effects of bias and severity that emerged, we assessed several covariates at baseline and controlled them in the primary analyses. To minimize the influence of socioeconomic status, we assessed and controlled the number of years of education participants' had received and the $5,000 range of their income (or whether they earned more than $50,000). To minimize the influence of personality, we assessed and controlled the Big Five personality traits using the Big Five Personality Inventory short form developed by Goldberg (1999). This instrument consists of 50 statements (10 items per subscale) with which participants indicate their extent of agreement on a scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Items on each subscale were averaged such that higher scores indicated higher levels of extraversion, agreeableness, conscientiousness, neuroticism, and openness. Coefficient alpha was adequate for all subscales. (For extraversion, husbands' $\alpha= .90$, wives' $\alpha= .83$; for agreeableness, husbands' $\alpha= .84$, wives' $\alpha= .88$; for conscientiousness, husbands' $\alpha= .82$, wives' $\alpha= .88$; for neuroticism, husbands' $\alpha= .90$, wives' $\alpha= .89$; for openness, husbands' $\alpha= .83$, wives' $\alpha= .85$.)

Data analysis: We expected that the tendency to form more positively biased appraisals of stressful experiences would predict fewer depressive symptoms over time among participants who faced stressful experiences that were relatively minor on average according to objective observers but would predict more depressive symptoms over time among participants who faced stressful experiences that were relatively severe on average according to objective observers. In other words, we expected the residualized difference between participants' self-ratings of their experiences and observers' ratings of those experiences to

interact with observers' ratings to predict changes in depressive symptoms over time. We addressed this hypothesis through three-level growth curve modeling (see Bryk & Raudenbush, 1987) using the hierarchical linear modeling 6.08 computer program (Raudenbush, Bryk, & Congdon, 2004), where the autocorrelation due to repeated assessments within individuals was controlled in the second level of the model and the statistical dependence between husbands' and wives' data was controlled in the third level of the model. Specifically, reports of depressive symptoms were regressed onto time of assessment and marital satisfaction in the first level of the analyses, and standardized residualized differences between self- and observer ratings, mean-centered objective ratings, the interaction between the two, and mean-centered versions of the covariates were entered into a second level of the analyses to account for between-subjects differences in initial levels of and changes in depressive symptoms over time. No variables were entered in the third level of the analysis.

Results

Descriptive statistics and preliminary analysis—In general, participants reported that they encountered stressful experiences that were relatively minor on average (for men, $M = 6.98$, $SD = 0.74$; for women, $M = 7.00$, $SD = 0.69$). Likewise, judges reported that participants' encountered stressful experiences that were relatively minor on average (for men, $M = 6.10$, $SD = 0.62$; for women, $M = 6.03$, $SD = 0.71$). Judges' ratings of the severity of the stressful experiences participants encountered in any given domain ranged from 1 (*extremely stressful*) to 9 (*not at all stressful*). Consistent with prior research documenting tendencies toward forming positively biased appraisals (Alicke & Sedikides, 2009), paired-sample t tests revealed that participants rated their experiences more positively (i.e., less stressful) than the objective judges—for men, $t(81) = 10.01$, $p < .001$; for women, $t(81) = 17.16$, $p < .001$—indicating that, on average, they held positively biased appraisals. Nevertheless, eight participants (5%) actually reported their experiences were more stressful than did raters.

Correlations between participants' and judges' ratings indicated that participants and judges tended to agree regarding the relative negativity of participants' experiences, although wives demonstrated more agreement with judges than did husbands (for males, $r = .32$, $p < .01$; for females, $r = .74$, $p < .001$). Notably, given that we operationalized positively biased appraisals of stressful experiences as the residualized difference between participants' and interviewers' ratings of those experiences and given that such residuals partial out the variance in the participants' ratings that is associated with the interviewers' ratings, participants' positively biased appraisals of their stressful experiences were completely uncorrelated with interviewers' ratings. Also, despite considerable overlap in the experiences of these husbands' and wives' lives, spouses reported experiencing relatively unique levels of stress ($r = .20$, $p < .10$), although the two independent judges of those same experiences viewed spouses' experiences more similarly ($r = .58$, $p < .001$).

Describing trajectories of depressive symptoms—The mean depressive symptom scores for husbands and wives at each wave of data collection are presented in Table 1. As can be seen there, both husbands and wives experienced relatively low levels of depressive

symptoms at Time 1 on average. From there, mean levels of depressive symptoms among participants reporting at each wave fluctuated slightly over the 4 years of the study but remained relatively stable. Of course, such trends in mean levels of depressive symptoms offer a misleading picture of within-person change, the key dependent variable of the current research. Thus, within-person change was estimated in the following first-level equation of a three-level growth curve model (e.g., Bryk & Raudenbush, 1987; for similar analyses of trajectories of depressive symptoms, see Davila et al., 2003; Karney, 2001):

$$Y_{ij} \text{ (depressive symptoms)} = \pi_{0j} + \pi_{1j} \text{ (time of assessment)} + e_j, \quad (1)$$

where time of assessment was coded from 0 (baseline) to 7 (Time 8) so that the intercept represented depressive symptoms at baseline (see Bryk & Raudenbush, 2002). Accordingly, Y_{ij} represents the depressive symptoms of Individual j at Time 1, π_{0j} represents the initial depressive symptoms for Individual j, π_{1j} represents rate of linear change in depressive symptoms for Individual j, and e_j is the residual variance in repeated measurements for Individual j. This model can be understood as a within-subjects regression of an individual's depressive symptoms onto time of assessment, where time was defined as wave of data collection, the autocorrelation within individuals was controlled in the second level of the multilevel model, and the dependence between husbands and wives was controlled in the third level of the model. Given that trajectories of depressive symptoms could be computed for all participants who had participated in two or more assessments, these analyses were based on 100% of the original 164 participants.

Fitting the model to the data provided generalized least squares estimates of the average intercept and slope of depressive symptoms for participants and estimated the variances of these parameters using restricted maximum-likelihood estimates. Table 2 reports these estimates, as well as t statistics that tested whether the initial levels of and changes in depressive symptoms differed from zero and estimates of effect size. Regarding the intercepts, participants demonstrated relatively low levels of depressive symptoms in the beginning of their marriages on average, although these average reports were significantly different from zero. Wives reported experiencing higher levels of initial depressive symptoms than did husbands (unstandardized $B = 1.62$, $SE = 0.57$), $t(162) = 2.85$, $p < .01$. Notably, the substantial standard deviation indicates that some participants demonstrated significantly more depressive symptoms than others. Regarding the slopes, the sample did not experience linear changes in depressive symptoms over time on average. These changes did not differ across husbands and wives (unstandardized $B = –0.10$, $SE = 0.09$), $t(336) = –1.10$, *ns.* Nevertheless, the substantial standard deviation of that mean also indicates that some participants experienced different changes in depressive symptoms than others. The goal of the primary analyses was to determine whether participants' tendencies to form positively biased appraisals of their stressful experiences and interviewers' objective ratings of the average severity of those experiences interacted to account for between-subjects differences in these changes.

Did positively biased appraisals of stressful experiences interact with objective ratings of the severity of those experiences to account for changes in depressive symptoms?—We used the following Level 1 and Level 2 equations to

examine the interactive effects of the tendency to form positively biased appraisals of stressful experiences and objective ratings of the severity of those experiences on the trajectory of depressive symptoms.

$$Y_{ij} \text{ (depressive symptoms)} = \pi_{0j} + \pi_{1j} \text{ (time of assessment)} + \pi_{2j} \text{ (marital satisfaction)} + e_{ij}. \quad (2)$$

$$\begin{aligned}
\pi_{0j} = B_{00} + B_{01} \text{ (bias)} + B_{02} \text{ (severity)} \\
+ B_{03} \text{ (Bias} \times \text{Severity)} \\
+ B_{04} \text{ (education)} \\
+ B_{05} \text{ (own income)} \\
+ B_{06} \text{ (partner income)} \\
+ B_{07} \text{ (extraversion)} \\
+ B_{08} \text{ (agreeableness)} \\
+ B_{09} \text{ (conscientiousness)} \\
+ B_{010} \text{ (neuroticism)} \\
+ B_{011} \text{ (openness)} + r_0.
\end{aligned} \quad (2a)$$

$$\begin{aligned}
\pi_{1j} = B_{10} + B_{11} \text{ (bias)} + B_{12} \text{ (severity)} \\
+ B_{13} \text{ (Bias} \times \text{Severity)} \\
+ B_{14} \text{ (education)} \\
+ B_{15} \text{ (own income)} \\
+ B_{16} \text{ (partner income)} \\
+ B_{17} \text{ (extraversion)} \\
+ B_{18} \text{ (agreeableness)} \\
+ B_{19} \text{ (conscientiousness)} \\
+ B_{110} \text{ (neuroticism)} \\
+ B_{111} \text{ (openness)} + r_1.
\end{aligned} \quad (2b)$$

$$\begin{aligned}
\pi_{2j} = B_{20} + B_{21} \text{ (bias)} + B_{22} \text{ (severity)} \\
+ B_{23} \text{ (Bias} \times \text{Severity)} \\
+ B_{24} \text{ (education)} \\
+ B_{25} \text{ (own income)} \\
+ B_{26} \text{ (partner income)} \\
+ B_{27} \text{ (extraversion)} \\
+ B_{28} \text{ (agreeableness)} \\
+ B_{29} \text{ (conscientiousness)} \\
+ B_{210} \text{ (neuroticism)} \\
+ B_{211} \text{ (openness)} + r_2.
\end{aligned} \quad (2c)$$

Specifically, changes in depressive symptoms were again estimated in the first level of a three-level model, but this time, marital satisfaction was entered as a time-varying covariate to partial out changes in depressive symptoms that were due to marital satisfaction. At Level

2, the standardized residuals obtained from a separate analysis that regressed self-ratings of stressful experiences onto objective ratings of the severity of those experiences were entered to account for both the intercepts and slopes of the trajectory of depressive symptoms estimated in Equation 1, as well as the association between depressive symptoms and marital satisfaction, along with mean-centered objective ratings of those stressful experiences, the interaction between the standardized residuals and mean-centered objective ratings of stress, and mean-centered baseline reports of education, own income, partner income, extraversion, agreeableness, conscientiousness, neuroticism, and openness. No variables were entered at Level 3. All Level 2 equations and all equations estimating the intercepts of those equations at Level 3 allowed a randomly varying error term.

Results regarding the association between these variables and the intercepts (i.e., initial depression) are presented in the top half of Table 3. Not surprisingly, objective ratings of the severity of participants' stressful experiences were negatively associated with initial depressive symptoms, suggesting that people judged to be facing more severe negative experiences reported more depressive symptoms at baseline. Controlling for that effect, neither the tendency to form positively biased appraisals of those experiences nor the Bias × Severity interaction was significantly associated with initial levels of depression.

Results regarding the primary prediction that the tendency to form positively biased appraisals of stressful experiences would interact with objective ratings of the severity of those experiences to predict changes in depressive symptoms over time are presented in the bottom half of Table 3. As can be seen there, neither the tendency to form positively biased appraisals of stressful experiences nor objective ratings of the severity of those experiences were associated with changes in depressive symptoms over time on average. Nevertheless, as predicted, a significant negative Bias × Severity interaction emerged. A test of the Sex × Bias × Severity interaction indicated that this effect did not vary by participant sex (unstandardized $B = -0.07$, $SE = 0.19$), $t(148) = -0.35$, ns.

To view the nature of the Bias × Severity interaction, the simple slopes of the tendency to form positively biased appraisals of stressful experiences were plotted for individuals one standard deviation above and below the mean on the tendency to form positively biased appraisals of stressful experiences and the objectively rated severity of those experiences. This plot is depicted in Figure 1. As can be seen there, consistent with predictions, the tendency to form positively biased appraisals was negatively associated with changes in depressive symptoms among people who encountered relatively minor negative experiences on average but positively associated with changes in depressive symptoms among people who encountered relatively severe negative experiences on average.

To determine the statistical significance of each simple slope, we followed the instructions described by Preacher, Curran, and Bauer (2006) for using the Johnson-Neyman method (Johnson & Neyman, 1936) to identify the one-tailed regions of significance of the simple effects of the tendency to form positively biased appraisals—that is, the exact levels of severity at which the tendency to form positively biased appraisals was significantly associated with changes in depressive symptoms. That test indicated that the tendency to form positively biased appraisals was negatively associated with changes in depressive

symptoms among participants facing experiences that were 1.19 standard deviations more positive than the mean but positively associated with changes in depressive symptoms among participants facing experiences that were 0.91 standard deviations more negative than the mean. That is, consistent with predictions, the tendency to form positively biased appraisals of stressful experiences led to steeper declines in depressive symptoms over time among people objectively judged to be facing more minor negative experiences but led to continued depressive symptoms over time among people objectively judged to be facing more severe negative experiences.

Discussion

Consistent with predictions, Study 1 revealed that the long-term implications of the tendency to form positively biased appraisals of stressful experiences for depressive symptoms depend on the severity of the negative experiences people encounter in their everyday lives. Specifically, although the tendency to form positively biased appraisals predicted declines in depressive symptoms over 4 years among participants facing relatively minor negative experiences in the beginning of the study, the same tendency predicted more stable depressive symptoms over 4 years among participants facing more severe negative experiences.

Nevertheless, Study 1 was limited in an important way—it did not identify the mechanism through which the predicted interactive effects emerged. Given our rationale that the tendency to form positively biased appraisals of stressful experiences in the context of more severe negative experiences should lead to worse mental health over time by allowing those experiences to persist or intensify over time, Study 2 explored the role of changes in the severity of people's negative experiences in mediating the interactive effects of the tendency to form positively biased appraisals and the objectively rated severity of initial levels of their negative experiences.

Study 2

The data used in Study 2 were similar to those used in Study 1 with one exception: in addition to being interviewed at baseline as in Study 1, a large number of participants in Study 2 were interviewed again 2 years after baseline, providing information regarding how their negative experiences had changed over the first 2 years of the study. Analyses first attempted to replicate the interactive effect of the tendency to form positively biased appraisals of stressful experiences and objective ratings of the severity of those experiences on changes in depressive symptoms that emerged in Study 1. Additionally, analyses tested the prediction that those interactive effects would be mediated by changes in the quality of the negative experiences people encounter over time by examining (a) whether the implications of tendencies to form positively biased appraisals of stressful experiences for changes in those experiences were moderated by the objectively rated severity of initial levels of those experiences and (b) whether changes in those experiences predicted changes in depressive symptoms over the course of the study, controlling for those interactive effects.

Method

Participants—Participants were 169 couples who participated in a longitudinal study of marital development conducted in Gainesville, Florida.[2] Participants were recruited using the same methods used in Study 1. On average, husbands were 25.6 years old ($SD = 4.1$) and had received 16.3 years ($SD = 2.4$) of education. Fifty-nine percent were employed full time, and 34% were full-time students. On average, husbands earned between $5,000 and $10,000 ($SD = \$7,210$), again likely due to the high proportion of students. On average, wives were 23.4 years old ($SD = 3.6$) and had received 16.2 years ($SD = 2.0$) of education. Forty-five percent were employed full time, and 45% were full-time students. On average, wives earned between $0 and $5,000 ($SD = \$5,410$). Slightly over 65% of the sample were Christian, and 94% of husbands and 86% of wives were White.

Procedure—Procedures were identical to those in Study 1, with two exceptions. First, couples were paid $70 for participating in the first and fifth phases of the study (rather than the $50 paid in Study 1) and $40–$50 for each other follow-up (rather than the $40 paid in Study 1). Second, a large number of participants (105 husbands and 108 wives) were interviewed and evaluated again regarding their chronic experiences at Time 5, approximately 2 years into the 4-year study.

Measures

Tendency to form positively biased appraisals of stressful experiences: The same interview used in Study 1 was used in Study 2, with the exception that an additional life domain, living conditions, was added as part of a broader aim of Study 2. This interview team was comprised of three male and 13 female interviewers at Time 1 and of three male and 10 female interviewers at Time 5. As in Study 1, although idiosyncratic qualities of each interviewer may have added error that could make it difficult to find significant effects, the relatively large number of interviewers and the fact that each interviewer coded only $M = 21.13$ ($SD = 10.80$) of the 338 interviews at Time 1 and $M = 16.85$ ($SD = 9.24$) of the 213 interviews at Time 5 make it unlikely that such idiosyncrasies may account for any effects involving the interview ratings. To determine how well these interviewers agreed on their codes, a portion of the recorded interviews (34%) were randomly chosen to be coded by a second rater, and agreement between coders was assessed by calculating ICCs between the averages of the ratings provided by each rater. Suggesting any idiosyncratic qualities of coders did not actually add much error to the codes, reliability appeared to be adequate (ICC for husbands and wives = .81).

Severity of negative experiences: As in Study 1, the severity of participants' negative experiences was operationalized as the average of interviewers' ratings of the severity of

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participants' stressful experiences across domains, where lower scores indicated more severe negative experiences.

Depressive symptoms: As in Study 1, depressive symptoms were assessed at each time point using the BDI (Beck et al., 1961), where scores could range from 0 (no depressive symptoms) to 63 (most extreme depression). Coefficient alpha was high across all phases (across all phases, coefficient alpha was at least .81 for males and females).

Marital satisfaction: This time, we assessed and controlled for marital satisfaction at each wave of measurement using a semantic differential measure of marital satisfaction (Osgood, Suci, & Tannenbaum, 1957), which asks spouses to rate their perceptions of their relationship on 7-point scales between 15 pairs of opposing adjectives (e.g., *bad–good, dissatisfied–satisfied, unpleasant–pleasant*). Scores on this measure could range from 15 to 105, with higher scores indicating more positive satisfaction with the relationship. Internal consistency of this measure was high across all phases (across all phases, coefficient alpha was at least .90 for both males and females).

Covariates: We again assessed the number of years of education participants had received, the $5,000 range of their income (or whether they earned more than $50,000), and their scores on the same Big Five inventory used in Study 1. Coefficient alpha was adequate for all subscales. (For extraversion, husbands' $\alpha = .86$, wives' $\alpha = .92$; for agreeableness, husbands' $\alpha = .86$, wives' $\alpha = .86$; for conscientiousness, husbands' $\alpha = .82$, wives' $\alpha = .84$; for neuroticism, husbands' $\alpha = .91$, wives' $\alpha = .86$; for openness, husbands' $\alpha = .78$, wives' $\alpha = .81$.)

Results

Descriptive statistics and preliminary analysis—As in Study 1, participants reported that they encountered stressful experiences that were relatively minor on average (for men, $M = 6.84$, $SD = 1.12$; for women, $M = 6.89$, $SD = 0.98$). Likewise, judges reported that participants encountered relatively minor negative experiences on average (for men, $M = 6.31$, $SD = 0.57$; for women, $M = 6.27$, $SD = 0.55$). As in Study 1, judges' ratings of the severity of the stressful experiences participants experienced in any given domain ranged from 1 (*extremely stressful*) to 9 (*not at all stressful*). Also as in Study 1, paired-sample t tests revealed that participants demonstrated tendencies to form positively biased appraisals of their stressful experiences when compared to the interviewers: For men, $t(168) = 7.20$, $p < .001$; for women, $t(168) = 9.62$, $p < .001$. Nevertheless, 80 participants (24%) actually reported that their experiences were more stressful than did raters.

As in Study 1, correlations between participants' and judges' ratings indicated that participants and judges tended to agree regarding the extent to which participants' experiences were more versus less stressful, although this agreement did not differ across men and women this time as it did in Study 1 (for males, $r = .51$; for females, $r = .51$). Also as in Study 1, given the nature of how we formed the measure of positively biased appraisals of stressful experiences, positively biased appraisals of stressful experiences were completely uncorrelated with objective ratings of those experiences. Finally, as in Study 1,

despite the fact that there was considerable overlap in the experiences of these husbands' and wives' lives, males and females reported experiencing relatively unique levels of stress ($r = .23$, $p < .05$), although the two different judges viewed their experiences more similarly ($r = .57$, $p < .001$).

Describing trajectories of depressive symptoms—The mean depressive symptoms scores for males and females reporting at each wave of data collection are presented in Table 4. As can be seen there, as in Study 1, both males and females experienced relatively low levels of depressive symptoms at Time 1 on average. From there, mean levels of depressive symptoms of reporting participants fluctuated slightly over the 4 years of each study but demonstrated modest levels of decline over time. Within-person change was estimated with Equation 1. Given that trajectories of depressive symptoms could be computed for all participants who had participated in two or more assessments, this growth curve analysis was based on 325 (or 96%) of the original 338 participants.

Table 5 reports the estimates of the average intercept and slope of depressive symptoms, the variances of these parameters, t statistics that tested whether the initial levels of and changes in depressive symptoms differed from zero, and estimates of effect size. Regarding the intercept, participants reported relatively low levels of depressive symptoms on average, although these average reports were significantly different from zero. As in Study 1, wives reported experiencing higher levels of initial depressive symptoms than did husbands (unstandardized $B = 0.89$, $SE = 0.43$), $t(336) = 2.05$, $p < .05$. Notably, the relatively large standard deviation reveals that these average initial depressive symptoms scores varied across individuals. Regarding the slopes, participants experienced significant declines in depressive symptoms over the 4 years of the study on average. Also as in Study 1, these changes did not differ across husbands and wives (unstandardized $B = 0.02$, $SE = 0.07$), $t(336) = 0.23$, ns. Nevertheless, the relatively large standard deviation indicates that these average declines varied across individuals. As in Study 1, the primary analyses examined whether residuals of self-ratings and objective ratings of negativity interacted to account for between-subjects differences in these changes.

Did positively biased appraisals of stressful experiences interact with objective ratings of the severity of those experiences to account for changes in depressive symptoms?—We next used Equations 2–2c in the same manner as in Study 1 to estimate the extent to which the tendency to form positively biased appraisals of stressful experiences interacted with the objectively rated severity of those experiences at baseline to predict the trajectory of depressive symptoms. Results regarding the association between these variables and the intercepts are presented in the top half of Table 6. Not surprisingly, as in Study 1, the severity of participants' experiences was negatively associated with initial depressive symptoms, suggesting that people judged to be facing more severe negative experiences on average also reported more initial depressive symptoms on average. In contrast to Study 1, the tendency to form positively biased appraisals of stressful experiences was marginally significantly associated with initial depressive symptoms, indicating that less depressed participants showed a trend toward

forming more positively biased appraisals of their stressful experiences. As in Study 1, the Bias × Severity interaction did not reach significance.

Results regarding the primary prediction that the tendency to form positively biased appraisals of stressful experiences would interact with the objective ratings of the severity of those experiences to predict changes in depressive symptoms are presented in the bottom half of Table 6. As can be seen there, interviewers' ratings of the severity of participants' experiences were positively associated with changes in depressive symptoms, indicating that people judged to be experiencing the most positive experiences at baseline experienced the most stable depressive symptoms over time. Nevertheless, as predicted and as was the case in Study 1, this main effect was qualified by a marginally significant negative Bias × Severity interaction. Notably, as in Study 1, a test of the Sex × Bias × Severity interaction indicated that this effect did not vary by participant sex (unstandardized $B = -0.02$, $SE = 0.13$), $t(322) = -0.14$, ns.

To view the nature of the interaction, the simple slopes of the tendency to form more positively biased appraisals of stressful experiences were plotted for individuals one standard deviation above and below the mean regarding the tendency to form more positively biased appraisals of stressful experiences and the objectively rated severity of those experiences. This plot is depicted in Figure 2. As can be seen there, as in Study 1, the tendency to form more positively biased appraisals appeared to be negatively associated with changes in depressive symptoms among people who encountered relatively minor negative experiences on average but positively associated with changes in depressive symptoms among people who encountered relatively severe negative experiences on average.

To determine the statistical significance of the difference in the associations between the tendency to form positively biased appraisals of stressful experiences and changes in depressive symptoms, we again followed the instructions described by Preacher et al. (2006) to use the Johnson-Neyman method (Johnson & Neyman, 1936) to identify the one-tailed regions of significance of the simple effects of such appraisals. Consistent with predictions and replicating the findings of Study 1, this test indicated that the tendency to form positively biased appraisals was associated with greater decreases in depressive symptoms among participants facing experiences that were more than three standard deviations more positive than the mean but was associated with fewer decreases in depressive symptoms among participants facing experiences that were 0.43 standard deviations more negative than the mean. That is, as in Study 1, the tendency to form positively biased appraisals of stressful experiences led to steeper declines in depressive symptoms over time among people objectively judged to be facing extremely minor negative experiences but led to continued depressive symptoms over time among people objectively judged to be facing more severe negative experiences.

Did positively biased appraisals of stressful experiences and objective ratings of those experiences interact to predict changes in depressive symptoms through their direct effects on changes in those experiences?—Why does the tendency to form more positively biased appraisals of stressful experiences interact with the

objective ratings of those experiences to predict changes in depressive symptoms over time? In addition to replicating the results of Study 1, Study 2 also examined the extent to which the interactions we observed were mediated by changes in objective ratings of the stressful experiences themselves. We tested this hypothesis by computing asymmetric confidence intervals for the mediated effect following the procedures described by MacKinnon, Fritz, Williams, and Lockwood (2007). Those procedures required two additional analyses. First, we estimated the effects of the interaction between the tendency to form positively biased appraisals of stressful experiences and the objectively rated severity of those experiences on the expected mediator—changes in the objectively rated severity of the experiences themselves. Specifically, we regressed interviewers' ratings of the severity of participants' negative experiences at Time 5 onto mean-centered objective ratings of the severity of participants' experiences at Time 1, the standardized measure of the tendency to form positively biased appraisals of those experiences, the Bias × Severity interaction, and mean-centered versions of all covariates in the following first and second levels of a multilevel model:

$$Y_{ij}\,(\text{severity}) = \pi_{0j} + \pi_{1j}\,(\text{time of assessment}) + e_j. \quad (3)$$

$$\begin{aligned}
\pi_{0j} = {} & B_{00} + B_{01}\,(\text{Time 1 bias}) \\
& + B_{02}\,(\text{Time 1 severity}) \\
& + B_{03}\,(\text{Time 1 Bias} \times \text{Severity}) \\
& + B_{04}\,(\text{education}) \\
& + B_{05}\,(\text{own income}) \\
& + B_{06}\,(\text{partner income}) \quad (3a) \\
& + B_{07}\,(\text{extraversion}) \\
& + B_{08}\,(\text{agreeableness}) \\
& + B_{09}\,(\text{conscientiousness}) \\
& + B_{010}\,(\text{neuroticism}) \\
& + B_{011}\,(\text{openness}) + r_0.
\end{aligned}$$

$$\begin{aligned}
\pi_{1j} = {} & B_{10} + B_{11}\,(\text{Time 1 bias}) \\
& + B_{12}\,(\text{Time 1 severity}) \\
& + B_{13}\,(\text{Time 1 Bias} \times \text{Severity}) \\
& + B_{14}\,(\text{education}) \\
& + B_{15}\,(\text{own income}) \\
& + B_{16}\,(\text{partner income}) \quad (3b) \\
& + B_{17}\,(\text{extraversion}) \\
& + B_{18}\,(\text{agreeableness}) \\
& + B_{19}\,(\text{conscientiousness}) \\
& + B_{110}\,(\text{neuroticism}) + B_{111}\,(\text{openness}).
\end{aligned}$$

As in Study 1, time of assessment was coded from 0 (baseline) to 7 (Time 8), the nonindependence of individuals' repeated assessments was controlled in the second level of

the model, and the nonindependence of husbands' and wives' data was controlled for in the third level of the model. Given that objective ratings of marital quality were part of the quality of Time 5 experiences we were attempting to predict, we dropped the control of changes in marital satisfaction from the Level 1 analysis. Objective ratings of stressful experiences at Times 2–4 and 6–8 were treated as missing data. Given that only two waves of data for the objective ratings of the severity of participants' experiences were available, only the Level 2 and Level 3 intercepts were allowed to vary randomly.

Results of that analysis are presented in Table 7. As revealed there, the objectively rated severity of participants' stressful experiences at baseline was negatively associated with changes in ratings of the severity of those experiences over time, whereas the tendency to form positively biased appraisals of those experiences was marginally positively associated with changes in those experiences over time. Nevertheless, consistent with predictions and with the findings regarding changes in depressive symptoms in both studies, these main effects were qualified by a significant Bias × Severity interaction.

Second, we estimated the association between changes in objectively rated experiences and changes in depressive symptoms over time, controlling for the interactive effects of the tendency to hold positively biased appraisals of stressful experiences and the objectively rated severity of those experiences, using the following Level 1 and Level 2 models:

$$Y_{ij} \text{ (depressive symptoms)} = \pi_{0j} + \pi_{1j} \text{ (time of assessment)} + \pi_2 \text{ (severity)} + e_j. \quad (4)$$

$$
\begin{aligned}
\pi_{0j} = &B_{00} + B_{01} \text{ (Time 1 bias)} \\
&+ B_{02} \text{ (Time 1 severity)} \\
&+ B_{03} \text{ (Time 1 Bias × Severity)} \\
&+ B_{04} \text{ (education)} \\
&+ B_{05} \text{ (own income)} \\
&+ B_{06} \text{ (partner income)} \quad (4a) \\
&+ B_{07} \text{ (extraversion)} \\
&+ B_{08} \text{ (agreeableness)} \\
&+ B_{09} \text{ (conscientiousness)} \\
&+ B_{010} \text{ (neuroticism)} \\
&+ B_{011} \text{ (openness)} + r_0.
\end{aligned}
$$

$$\pi_{1j} = B_{10} + B_{11} \, (\text{Time } 1 \text{ bias})$$
$$+ B_{12} \, (\text{Time } 1 \text{ severity})$$
$$+ B_{13} \, (\text{Time } 1 \text{ Bias} \times \text{Severity})$$
$$+ B_{14} \, (\text{education})$$
$$+ B_{15} \, (\text{own income})$$
$$+ B_{16} \, (\text{partner income}) \qquad \text{(4b)}$$
$$+ B_{17} \, (\text{extraversion})$$
$$+ B_{18} \, (\text{agreeableness})$$
$$+ B_{19} \, (\text{conscientiousness})$$
$$+ B_{110} \, (\text{neuroticism}) + B_{111} \, (\text{openness}).$$

$$\pi_{2j} = B_{20}. \quad \text{(4c)}$$

Results of that analysis revealed that, even after controlling for the main and interactive effects that emerged on changes in the objectively rated severity of negative experiences, changes in those experiences were negatively associated with changes in depressive symptoms (unstandardized $B = -2.35$, $SE = 0.80$), $t(520) = -2.95$, $p < .01$, $r = .13$, indicating that, not surprisingly, people who experienced worsening experiences over time demonstrated more depressive symptoms over time.

Finally, we multiplied these two effects together to obtain an estimate of the mediated effect ($B = -0.08$) and estimated the corresponding 95% confidence interval ([-0.16, -0.01]) that indicated the mediated effect was significant. In other words, the interaction between the tendency to form positively biased appraisals of stressful experiences and the objectively rated severity of initial levels of those experiences was associated with change in depressive symptoms over time through its direct association with changes in the objectively rated severity of those experiences.

General Discussion

Prior research has offered inconsistent descriptions of the mental health implications of positively biased appraisals of everyday life stressors. Some studies have shown that positively biased appraisals are positively associated with subsequent mental health (e.g., Zuckerman & O'Loughlin, 2006), but other studies have shown that such inaccurate appraisals are negatively associated with subsequent mental health (e.g., Robins & Beer, 2001). The two studies described here suggest one way to reconcile these discrepant effects: The benefits versus costs of positively biased appraisals depend on the severity of the controllable negative experiences people face in their lives. Across two studies, whereas the tendency to view important ongoing life experiences more positively than did objective observers was associated with declines in depressive symptoms among individuals objectively rated to be experiencing less stressful experiences, that same tendency was associated with continued depressive symptoms among individuals objectively rated to be experiencing more stressful experiences. Furthermore, Study 2 demonstrated the mechanism

through which these effects emerged—change in the experiences themselves. That is, the tendency to hold positively biased appraisals of stressful experiences in the context of more severe stressful experiences was associated with more depressive symptoms over time because it predicted worse experiences.

At first glance, these findings may appear to support Baumeister's (1989) hypothesis that there is an "optimal margin of illusion" that is beneficial for mental health. According to that hypothesis, appraisals that deviate only somewhat from reality should benefit well-being, whereas appraisals that deviate substantially from reality should harm well-being. A deeper comparison of those ideas with the ideas and findings described here reveals an important distinction between them, however. Rather than suggesting that it is the size of a positively biased appraisal that determines the implications that perception has for mental health, the simple linear effects that emerged here suggest the same-size bias can have positive or negative implications depending on the context in which it is held. That is, even large biases in the context of relatively minor ongoing problems should be adaptive for mental health, whereas even small biases in the context of severe ongoing problems should be somewhat harmful for mental health.

Theoretical Implications

These findings have several important theoretical implications. First, they help resolve the ongoing debate regarding the implications of inaccurate appraisals for mental health by suggesting that the consequences of cognitive biases are not necessarily inherent in those biases themselves; rather, they are a product of the interaction between the evaluative process and the nature of what is being evaluated. Although positively biased appraisals can be adaptive in the context of relatively minor negative experiences on average, those same appraisals can be harmful in the context of more significant negative experiences. In other words, the appropriate question is not whether positively biased appraisals demonstrate benefits or costs but under what circumstances positively biased appraisals demonstrate benefits versus costs (see Chang, 2008; Sedikides & Luke, 2008).

Several areas of research may benefit from incorporating these ideas. Regarding self-enhancement, for example, these findings suggest that people may benefit from believing their relatively harmless negative qualities are more positive than they actually are (e.g., believing they are more humorous than they are) but may be harmed by believing their more harmful negative qualities are more positive than they actually are (e.g., believing their alcoholism is not a problem). Likewise, people may benefit from being optimistically biased regarding the likelihood that they will encounter minor negative experiences they may otherwise avoid (e.g., being overly optimistic that they will not contract a cold) but may be harmed by being optimistically biased regarding the likelihood that they will encounter severe negative experiences they may otherwise avoid (e.g., being overly optimistic that they will not contract a sexually transmitted infection). Even the mental health implications of illusions of control may depend on the severity of the outcome people think they can control. People may benefit by believing they have more control than they actually do in situations that have no or relatively few serious consequences (e.g., thinking they have more control than they do in a friendly, low-stakes game of poker with friends) but may be

harmed by thinking they have more control than they actually do in potentially serious situations they would otherwise avoid (e.g., thinking they have more control than they do while driving under the influence of alcohol). In all cases, forming positively biased appraisals may be associated with positive emotions in the moment, but what determines whether or not they will be adaptive over time is whether they make people vulnerable to serious negative consequences that could eventually overwhelm those initially positive emotions.

Second, more broadly, these findings join others to raise questions about whether psychological processes in general can be labeled positive or negative, as the implications of such processes may inevitably depend on the context in which they occur. For example, although forgiveness is frequently described as a positive process (Fenell, 1993; Toussaint, Williams, Musick, & Everson, 2001), recent research has demonstrated that forgiveness has both positive and negative effects, depending on the context in which it is granted (Luchies, Finkel, McNulty, & Kumashiro, 2010; Mc-Nulty, 2008). Likewise, although interpersonal behaviors such as blaming and demanding tend to be described as negative processes, recent research has indicated that such behaviors may yield positive interpersonal outcomes in some situations (e.g., McNulty & Russell, 2010; Overall, Fletcher, Simpson, & Sibley, 2009). Accordingly, theoretical descriptions of the implications of psychological processes may be most accurate to the extent that they move beyond labeling processes as positive versus negative to instead identifying the conditions under which the same processes have positive versus negative implications.

Finally, the current findings join others in emphasizing the importance of appraisals to the mental health implications of stressful experiences (e.g., Hill, 1949; Lazarus & Folkman, 1984; McCubbin & Patterson, 1983). However, in contrast to focusing on the important role played by the content of those appraisals, these studies demonstrated that whether or not people's appraisals of stress deviate from an objective standard also affects well-being. Consistent with contextual views of stress (e.g., Lazarus & Folk-man, 1984), the current studies demonstrated that whether it is best to have biased versus accurate appraisals of stressful experiences depends on the circumstances of people's lives. In other words, the current studies indicate that (a) the severity of stressful experiences, (b) people's subjective appraisals of those experiences, and (c) the accuracy of those appraisals all interact to determine how those experiences affect well-being.

Practical Implications

The current findings also have important practical implications. Recently, psychology has experienced a movement toward the study and promotion of psychological processes believed to promote positive outcomes, such as depressive symptoms. In light of this movement and of the consistent positive cross-sectional associations thus far documented between positively biased appraisals and several measures of mental health, it might be tempting to prescribe positively biased appraisals in interventions designed to promote mental health and well-being (e.g., see Taylor et al., 2000). Although such biases may indeed benefit people coping with uncontrollable negative events, the current findings challenge whether such interventions should be universally applied. Clients may instead

benefit from interventions that make finer distinctions, teaching them to process negative experiences that do not need to be or cannot be resolved in ways that lead to more positively biased appraisals but to process severe experiences that need to be resolved in ways that lead to accurate appraisals (for ways to promote accurate appraisals, see Sedikides, Herbst, Hardin, & Dardis, 2002; Sedikides, Horton, & Gregg, 2007).

Strengths and Limitations

Our confidence in the reported results is bolstered by a number of strengths of the method and design. First, the findings replicated across two independent longitudinal studies that assessed depressive symptoms every 6 months for 4 years. Second, changes in depressive symptoms were analyzed using growth curve analyses, providing a more reliable and valid estimate of within-person change than traditional two-wave longitudinal designs (Bryk & Raudenbush, 1987). Third, the analyses in the current study were based on 100% of the original 164 participants in Study 1 and 96% of the original 338 participants in Study 2, reducing the likelihood that the current findings were influenced by differential attrition. Fourth, the current findings used a strong assessment of positively biased appraisals—self-reported ratings that removed the variance shared with objective ratings of the same experiences (see Bonanno et al., 2002; Klein & Cooper, 2008). Finally, Study 2 demonstrated the mechanism through which the interactive effects of positive bias and objective ratings predicted changes in depressive symptoms—changes in actual life experiences.

Despite these strengths, several factors limit interpretations until these effects can be extended. First, the current findings are correlational and thus cannot support strong causal conclusions. Although the longitudinal nature of the current data lends confidence to the idea that the interactive effects of positively biased appraisals of stressful experiences and objective ratings of the severity of those experiences caused changes in depressive symptoms, although the control of several demographic factors and the Big Five personality factors helped rule out the possibility that some third variables accounted for those effects, and although one recent experimental study has suggested that self-enhancement can exert causal effects on psychological well-being (O'Mara, Gaertner, Sedikides, Zhou, & Liu, 2011), firm causal conclusions regarding the findings reported here ultimately require an experimental replication. Notably, it remains possible that the association between the interaction of positively biased appraisals of stressful experiences and objective ratings of the severity of those experiences and depressive symptoms is bidirectional, such that changes in depressive symptoms also shape positively biased appraisals. Future research may benefit by addressing this possibility. Second, given that participants in these studies were relatively unique, primarily White newlywed couples, about half of whom were in college or graduate school, it is unclear whether these effects would generalize to other populations. For example, if the effects of positively biased appraisals are uniquely moderated by the challenges associated with making the transition to marriage (see Cherlin, 1992), then people in different stages of their lives may not demonstrate similar effects. Also, although the implications of positive bias may not vary across different socioeconomic or racial groups (e.g., Sedikides, Gaertner, & Toguchi, 2003; for a different perspective, see Heine, 2005), the severity of the stressors faced by different groups may indeed vary. If so,

the effects obtained in other samples may be stronger or weaker than the effects obtained here. Third, the present studies examined only one aspect of mental health, depressive symptoms. It is possible that positively biased appraisals may demonstrate different effects on other aspects of mental health. Fourth, both studies used a specific measure of positive bias—residualized differences between participants' and more objective observers' views of participants stressful experiences. It is possible that other measures of positive bias may demonstrate different effects on depressive symptoms or other aspects of mental health.

Additional Directions for Future Research

In addition to addressing these limitations, future research may benefit by examining several other issues not addressed here. First, although Study 2 provided evidence that changes in objective ratings of the severity of people's stressful experiences mediated the interactive effects of objective ratings of the initial severity of those experiences and positively biased appraisals of those experiences, we did not assess the mechanism through which that interaction emerged. On the basis of other work (Burger & Burns, 1988; Radcliffe & Klein, 2002; Robins & Beer, 2001; Swann et al., 1995; Wiebe & Black, 1997), we expect that holding positively biased appraisals in the context of severe negative experiences leads to continued or worsening experiences because we expect positively biased appraisals to lead people to be less motivated to resolve their problems and thus to be less likely to engage in the types of behaviors necessary to resolve those problems. However, research may benefit by directly examining whether holding positively biased appraisals in the context of more severe negative experiences does indeed lead to increased severity of negative experiences and depressive symptoms (or other measures of poor mental health) because it leads to fewer active attempts to resolve problems.

Second, neither study addressed whether the positively biased appraisals assessed here were driven by the motivation to avoid negative outcomes or the motivation to approach positive outcomes. Prior research has suggested those different motivations may explain the results that emerged here. Specifically, several studies suggest that whereas the motive to protect the self is negatively associated with well-being, the motive to enhance the self is positively associated with well-being (e.g., Agostinelli, Sherman, Presson, & Chain, 1992; Aspinwall & Taylor, 1997; but see Norem & Cantor, 1986). Accordingly, the participants who demonstrated positively biased appraisals of stressful experiences in the context of rather severe negative experiences may have demonstrated more stable depressive symptoms over time because they were engaging in positive biases that were driven by self-protection motives. Nevertheless, other perspectives question whether self-protection and self-enhancement motives can be distinguished from one another by suggesting that motives to protect the self may ultimately lead to motives enhance the self (Kwang & Swann, 2010; Sedikides & Gregg, 2008). Future research may benefit by examining whether the interactive effects of biased appraisals and stressful circumstances that emerged in these two studies depended on whether those biases were driven by the desire to approach positive outcomes or the desire to avoid negative outcomes.

Finally, although the current predictions were based on the idea that whether or not negative experiences are severe and controllable should determine the implications of positive biased

appraisals for mental health, the current studies demonstrated only that positively biased appraisals of negative experiences that tended to be relatively controllable were moderated the severity of those experiences. Future research may benefit by directly examining whether the controllability of ongoing negative experiences actually moderates the mental health implications of positively biased appraisals of those experiences.

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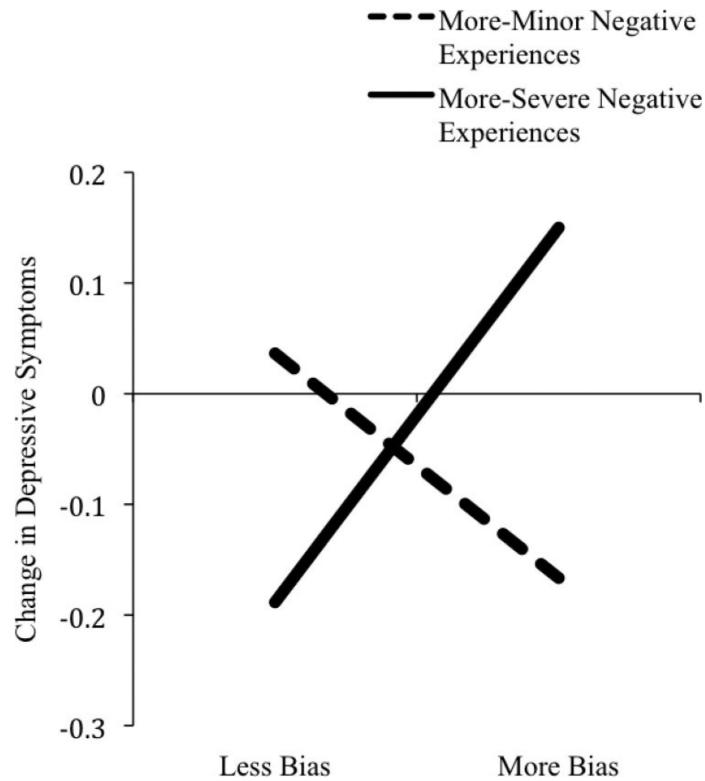
Figure 1.
Objective ratings of stressful experiences moderated the association between positively biased appraisals of those experiences and changes in depressive symptoms in Study 1.
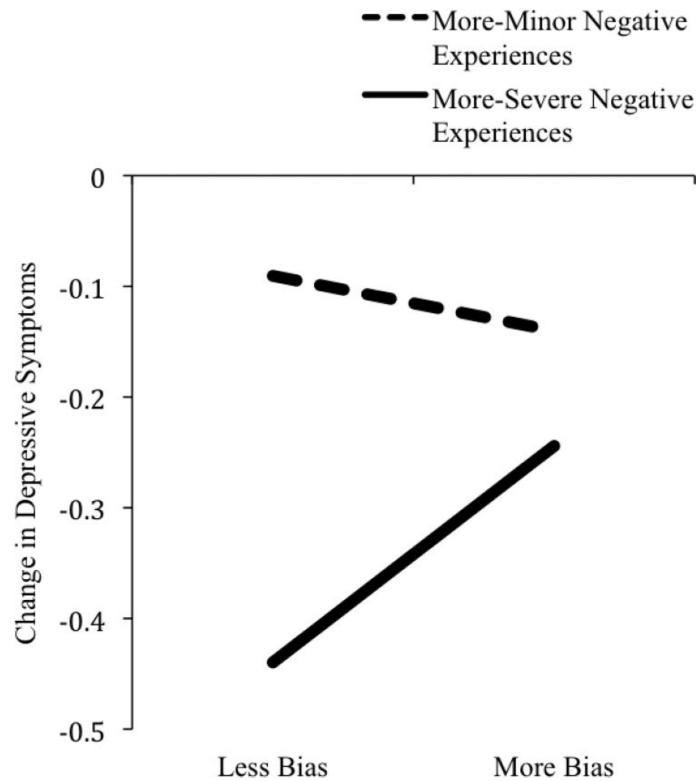
Figure 2.
Objective ratings of stressful experiences moderated the association between positively biased appraisals of those experiences and changes in depressive symptoms in Study 2.

Table 1

Mean Depressive Symptoms Scores Across Eight Waves of Measurement in Study 1

	Time							
Participants	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Males								
M	3.80	3.53	3.43	3.74	2.63	4.68	4.18	3.56
SD	4.12	3.75	3.92	8.44	2.89	5.77	5.21	3.66
N	82	77	64	58	58	55	57	53
Females								
M	5.50	4.82	4.83	5.02	4.52	4.68	5.09	4.85
SD	5.11	5.76	5.97	9.42	7.80	5.77	4.75	6.23
N	82	77	64	62	61	55	55	55

Table 2

Trajectory of Depressive Symptoms in Study 1

Parameter	*B*	*SD*	*t*(81)	*r*
Intercept	4.34	2.67	11.20***	.78
Slope	0.22^{-1}	0.37^{-1}	0.37	.04

Note. $r = \sqrt{\frac{t^2}{t^2 + df}}$.

***$p < .001$.

Table 3

Interactions Between Positively Biased Appraisals of Stressful Experiences and Objective Ratings of Those Experiences Accounting for Initial Depressive Symptoms and Changes in Depressive Symptoms in Study 1

Effect	β	SE	t	r
Intercept				
Constant	4.35	0.27	15.83***	.87
Education	−0.06	0.11	−0.51	.04
Own income	0.36	0.27	1.35	.11
Partner income	−0.16	0.27	−0.59	.05
Extraversion	0.00	0.04	0.04	.00
Agreeableness	0.04	0.05	0.80	.06
Conscientiousness	−0.01	0.05	−0.29	.02
Neuroticism	0.26	0.04	6.66***	.47
Openness	0.03	0.05	0.53	.04
Bias	0.28	0.29	0.99	.08
Severity	−1.19	0.35	−3.42**	.27
Bias × Severity	0.66	0.43	1.54	.12
Slope				
Constant	$−0.42^{-1}$	0.64^{-1}	−0.66	.07
Education	0.20^{-1}	0.23^{-1}	0.90	.07
Own income	0.98^{-1}	0.57^{-1}	1.74†	.14
Partner income	$−1.00^{-1}$	0.58^{-1}	−1.72†	.14
Extraversion	0.04^{-1}	0.10^{-1}	0.39	.03
Agreeableness	$−0.04^{-1}$	0.09^{-1}	−0.43	.03
Conscientiousness	0.17^{-1}	0.08^{-1}	2.23*	.18
Neuroticism	$−0.12^{-1}$	0.09^{-1}	−1.23	.10
Openness	0.01^{-1}	0.11^{-1}	0.07	.01
Bias	0.34^{-1}	0.61^{-1}	0.55	.04
Severity	$−0.35^{-1}$	0.81^{-1}	−0.43	.03
Bias × Severity	$−2.05^{-1}$	0.91^{-1}	−2.26*	.18

Note. For constants, $df = 81$; for all other effects, $df = 152$.

$$r = \sqrt{\frac{t^2}{t^2 + df}}.$$

†$p < .10$.

*$p < .05$.

**$p < .01$.

***$p < .001$.

Table 4

Mean Depressive Symptoms Scores Across Eight Waves of Measurement in Study 2

Participants	Time							
	1	2	3	4	5	6	7	8
Males								
M	4.30	3.88	3.17	3.08	3.52	3.30	4.02	2.08
SD	5.13	4.66	3.94	3.91	5.00	4.96	5.79	3.90
N	169	154	146	133	138	111	107	123
Females								
M	4.74	5.00	4.67	4.54	4.83	3.89	4.61	3.22
SD	4.93	5.02	4.60	5.45	5.65	4.11	5.28	4.48
N	169	154	147	135	140	114	115	125

Table 5

Trajectory of Depressive Symptoms in Study 2

Parameter	*M*	*SD*	*t*(168)	*r*
Intercept	4.47	3.39	17.13***	.79
Slope	-1.43^{-1}	-2.75^{-1}	-3.88***	$-.29$

Note. $r = \sqrt{\frac{t^2}{t^2 + df}}$.

***
$p < .001$.

Table 6

Interactions Between Positively Biased Appraisals of Stressful Experiences and Objective Ratings of Those Experiences Accounting for Initial Depressive Symptoms and Changes in Depressive Symptoms in Study 2

Effect	β	SE	t	r
Intercept				
Constant	4.61	0.19	23.89***	.88
Education	0.02	0.08	0.24	.01
Own income	0.10	0.13	0.73	.04
Partner income	0.03	0.15	0.23	.01
Extraversion	−0.03	0.03	−1.26	.07
Agreeableness	0.03	0.03	0.89	.05
Conscientiousness	−0.06	0.03	−2.36*	.13
Neuroticism	0.17	0.02	6.98***	.36
Openness	−0.04	0.04	−1.10	.06
Bias	−0.33	0.19	−1.76†	.10
Severity	−1.97	0.58	−3.40**	.18
Bias × Severity	0.66	0.41	1.64	.09
Slope				
Constant	−2.29^{-1}	0.35^{-1}	−6.61***	.45
Education	0.15^{-1}	0.19^{-1}	0.80	.04
Own income	−0.40^{-1}	0.23^{-1}	−1.77†	.10
Partner income	−0.08^{-1}	0.28^{-1}	−0.28	.02
Extraversion	0.03^{-1}	0.05^{-1}	0.53	.03
Agreeableness	0.05^{-1}	0.06^{-1}	0.78	.04
Conscientiousness	−0.01^{-1}	0.05^{-1}	−0.26	.01
Neuroticism	−0.05^{-1}	0.05^{-1}	−1.12	.06
Openness	0.04^{-1}	0.07^{-1}	0.59	.03
Bias	0.37^{-1}	0.35^{-1}	1.04	.06
Severity	2.04^{-1}	0.80^{-1}	2.54*	.14
Bias × Severity	−1.11^{-1}	0.65^{-1}	−1.72†	.09

Note. For constants, $df = 168$; for all other effects, $df = 326$.

$$r = \sqrt{\frac{t^2}{t^2 + df}}.$$

$^\dagger p < .10.$

$^* p < .05.$

$^{**} p < .01.$

$^{***} p < .001.$

Table 7

Interactions Between Positively Biased Appraisals of Stressful Experiences and Objective Ratings of Those Experiences Accounting for Initial Objective Ratings of Stress and Changes in Objective Ratings of Stress in Study 2

Effect	β	SE	t [a]	r
Intercept				
Constant	6.29	0.02	—	—
Education	0.02^{-2}	0.78^{-2}	0.02	.00
Own income	-0.01^{-2}	1.23^{-2}	−0.01	.00
Partner income	0.02^{-2}	1.25^{-2}	0.02	.00
Extraversion	-0.00^{-2}	0.21^{-2}	−0.00	.00
Agreeableness	-0.01^{-2}	0.32^{-2}	−0.03	.00
Conscientiousness	-0.01^{-2}	0.26^{-2}	−0.04	.00
Neuroticism	-0.01^{-2}	0.22^{-2}	−0.05	.00
Openness	0.02^{-2}	0.31^{-2}	0.06	.00
Bias	0.00^{-2}	1.62^{-2}	0.00	.00
Severity	99.56^{-2}	3.13^{-2}	31.78***	.87
Bias × Severity	-0.11^{-2}	2.96^{-2}	−0.04	.00
Slope				
Constant	-4.89^{-2}	0.62^{-2}	−7.95***	.33
Education	-0.06^{-2}	0.31^{-2}	−0.20	.01
Own income	1.22^{-2}	0.48^{-2}	2.55*	.11
Partner income	-0.15^{-2}	0.49^{-2}	−0.31	.01
Extraversion	-0.00^{-2}	0.08^{-2}	−0.01	.00
Agreeableness	-0.08^{-2}	0.13^{-2}	−0.60	.03
Conscientiousness	0.08^{-2}	0.10^{-2}	0.79	.03
Neuroticism	-0.24^{-2}	0.09^{-2}	−2.72**	.12
Openness	-0.39^{-2}	0.12^{-2}	−3.18**	.14
Bias	1.18^{-2}	0.65^{-2}	1.82†	.08
Severity	-9.24^{-2}	1.32^{-2}	−7.01***	.29
Bias × Severity	3.26^{-2}	1.28^{-2}	2.54**	.11

Note. For intercept constant, $df = 168$; for all other intercept effects, $df = 326$; for all slope effects, $df = 527$. $r = \sqrt{\frac{t^2}{t^2 + df}}$.

[a] The t test of the constant of the intercept addresses the hypothesis that the intercept differs significantly from zero. Because the lowest possible score on the severity ratings is greater than zero, this test is not meaningful and hence is not reported.

† $p < .10$.

* $p < .05$.

** $p < .01$.

***
$p < .001$.