

Rethinking Stress: The Role of Mindsets in Determining the Stress Response

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This article describes 3 studies that explore the role of mindsets in the context of stress. In Study 1, we present data supporting the reliability and validity of an 8-item instrument, the Stress Mindset Measure (SMM), designed to assess the extent to which an individual believes that the effects of stress are either enhancing or debilitating. In Study 2, we demonstrate that stress mindsets can be altered by watching short, multimedia film clips presenting factual information biased toward defining the nature of stress in 1 of 2 ways (stress-is-enhancing vs. stress-is-debilitating). In Study 3, we demonstrate the effect of stress mindset on physiological and behavioral outcomes, showing that a stress-is-enhancing mindset is associated with moderate cortisol reactivity and high desire for feedback under stress. Together, these 3 studies suggest that stress mindset is a distinct and meaningful variable in determining the stress response.

Keywords: mindset, stress, stress-related growth, resilience, coping

Stress is portrayed in a negative light in the news, in health classes, in entertainment media, and in the workplace. Over the years, stress has been cited as a “growing plague” (Blythe, 1973, p. 14) and an “epidemic” (Wallis, Thompson, & Galvin, 1983, p. 1). Stress has been linked to the six leading causes of death (heart disease, accidents, cancer, liver disease, lung ailments, suicide; e.g., Sapolsky, 1996; Schneiderman, Ironson, & Siegel, 2005); absenteeism from work, increased medical expenses, and loss of productivity (e.g., Atkinson, 2004; Schneiderman et al., 2005); cognitive impairment, depression, and other mental illness (e.g., Hammen, 2005; McEwen & Seeman, 1999; Schwabe & Wolf, 2010; Wang, 2005); and aggression and relational conflict (e.g., Bodenmann, Meuwly, Bradbury, Gmelch, & Ledermann, 2010). As such, few would argue against the assertion that stress is pervasive and debilitating. But the line of research reported here is designed to question whether this focus on the destructiveness of stress—this “stress about stress”—is a mindset that, paradoxically,

may be contributing to its negative impact. Our research suggests that improving one’s response to stress may be a matter of shifting one’s mindset.

In the context of stress, one’s *stress mindset* can be conceptualized as the extent to which one holds the belief that stress has enhancing consequences for various stress-related outcomes such as performance and productivity, health and wellbeing, and learning and growth (referred to as a “stress-is-enhancing mindset”) or holds the belief that stress has debilitating consequences for those outcomes (referred to as a “stress-is-debilitating mindset”). Two propositions are offered. First, we propose that stress mindset is a *distinct* variable that influences the stress response and is different from other influential variables, such as the amount and severity of stress one is experiencing and the manner in which one copes with that stress. Second, we propose that stress mindset is a *meaningful* variable that influences outcomes such as health and performance under stress.

The Enhancing Nature of Stress

Although there are numerous definitions of stress (e.g., Lazarus & Folkman, 1984), stress can generally be considered as the experience of anticipating or encountering adversity in one’s goal-related efforts (Carver & Connor-Smith, 2010). The “stress response,” comprised of activation of the sympathetic nervous system (SNS), a parasympathetic withdrawal, and increased activity of the hypothalamic-pituitary-adrenal (HPA) axis, is the body’s general reaction to demands made on it (Kunz-Ebrecht, Mohamed-Ali, Feldman, Kirschbaum, & Steptoe, 2003; Selye, 1975). From an evolutionary standpoint, the stress response improves physiological and mental functioning to meet imminent demands and enable survival (Sapolsky, 1996). This occurrence is referred to as

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eustress: “good” stress that yields a benefit (Alpert & Haber, 1960; Lazarus, 1974; Le Fevre, Matheny, & Kolt, 2003; Selye, 1975). When the body encounters adversity, physiological arousal is raised and attention is narrowed, leading it to focus resources on dealing with the task at hand. According to Fay and Sonnentag (2002), stress at work leads to initiative-taking, by which employees take action to acquire the necessary skills needed to meet pressing demands. Literature on defensive pessimism (Norem & Cantor, 1986) suggests that individuals can effectively employ stress as a motivator for proactive problem solving by anticipating and planning for all possible situational outcomes. To be sure, this anticipatory action process can go awry, leading to performance anxiety and panic, but when channeled correctly, the stress response can be beneficial, putting the brain and body in an optimal position to perform. Narrowing of perspective, another byproduct of stress, recruits attentional resources and can increase the speed with which the brain processes information (Hancock & Weaver, 2005). Further, the hormones released in the stress response can boost memory and performance on cognitive tasks (Cahill, Gorski, & Le, 2003).

Typically, it is assumed that even if this response is positive in the moment, experiencing chronic stress ultimately is negative. Although several accounts posit that this is true in some cases (e.g., Sapolsky, 1996; Schneiderman et al., 2005), the opposite response is possible. Stress can instead fuel physiological thriving by positively influencing the underlying biological processes implicated in physical recovery and immunity. Specifically, the experience of stress elicits anabolic hormones that rebuild cells, synthesize proteins, and enhance immunity, leaving the body stronger and healthier than it was prior to the stressful experience (e.g., Dienstbier, 1989; Epel, McEwen, & Ickovics, 1998). Similarly, although stress is often linked to depression and relationship troubles (e.g., Hammen, 2005; McEwen & Seeman, 1999; Schwabe & Wolf, 2010; Wang, 2005), investigators have documented a phenomenon referred to as *stress-related growth*, in which stressful experiences fundamentally change individuals for the better: The experience of stress can enhance the development of mental toughness, heightened awareness, new perspectives, a sense of mastery, strengthened priorities, deeper relationships, greater appreciation for life, and an increased sense of meaningfulness (e.g., Park & Helgeson, 2006; Tedeschi & Calhoun, 2004).

This review is not to say that positive outcomes always occur or that stress does not also have fundamentally destructive qualities. Rather, this perspective highlights that research on the enhancing nature of stress exists and is often ignored. Together, these conflicting findings suggest the value of a nuanced view of stress that recognizes that while experiencing stress can *debilitate* health and performance, stress can also fundamentally *enhance* health and performance. These contradictions constitute the stress paradox.

Mindset Matters

A long tradition of research suggests that to function in the midst of complex and conflicting information, individuals often rely on simplifying systems through which they can organize and make sense of the world (e.g., Gollwitzer, 1999; Taylor & Crocker, 1981; Williams, Huang, & Bargh, 2009). Because it is impossible to attend to every detail in the environment, there is a tremendous amount of selectivity in this process. A *mindset* is defined as a

mental frame or lens that selectively organizes and encodes information, thereby orienting an individual toward a unique way of understanding an experience and guiding one toward corresponding actions and responses (adapted from Dweck, 2008). Although mindsets are a necessary and familiar aspect of human cognition, they are not inconsequential. The mindsets people adopt have downstream effects on judgment (e.g., Taylor & Gollwitzer, 1995), evaluations (e.g., Gollwitzer, 1999), health (e.g., Crum & Langer, 2007), and behavior (e.g., Liberman, Samuels, & Ross, 2004). In the case of aging, Levy and her colleagues have found that individuals who have a negative mindset about aging are less likely to engage in proactive measures such as eating well, engaging in physical exercise, and visiting a physician (B. R. Levy & Myers, 2004). These individuals have a diminished will to live (B. R. Levy, Slade, Kunkel, & Kasl, 2002), show a reduction in cardiovascular function when exposed to negative stereotypes about aging (B. R. Levy, Hausdorff, Hencke, & Wei, 2000) and, most critically, die sooner than those who have a more positive mindset (B. R. Levy et al., 2002). In the domain of intelligence, students who acquire a mindset that intelligence is a malleable trait (as opposed to a fixed trait; i.e., “I can improve my intelligence” versus “I was born with a fixed IQ”) demonstrated improvements in both behavior and attitude (e.g., greater appreciation of academics, increased effort and motivation, improved GPAs, and enhanced enjoyment of learning; Aronson, Fried, & Good, 2002; Blackwell, Trzesniewski, & Dweck, 2007). In research on physical exercise, hotel room attendants who adopted the mindset that their work is good exercise showed significant reductions in weight, body mass index (BMI), and systolic blood pressure (Crum & Langer, 2007). In research on mindsets and food consumption, individuals who held the mindset that they were drinking an indulgent, high-calorie milkshake showed steeper declines in ghrelin, a hunger-inducing hormone, than when they held the mindset that the same shake was a sensible, low-calorie milkshake (Crum, Corbin, Brownell, & Salovey, 2011). Together, these examples support the phenomenon that adopting one mindset or another can profoundly influence psychological, behavioral, and physiological outcomes in several life and health domains.

Given the impact of mindset in domains such as intelligence, emotions, and health, it seems reasonable to presume that mindset could have a similarly influential effect in the domain of stress. Specifically, we predict that having a stress-is-enhancing mindset will engender enhancing effects in health and performance and that having a stress-is-debilitating mindset will be more likely to engender debilitating effects in health and performance.

The Role of Mindset in the Context of Existing Stress Management Theory

Historically, the stress paradox has been resolved with the idea that it is the *amount* (frequency, intensity, and duration) of the external stressor that determines whether stress is debilitating or enhancing (Holmes & Rahe, 1967). Investigators asserted that stress might be beneficial, at least up to a certain point. But once stress hits a critical point or allostatic load, it becomes debilitating (distress), represented as an inverted-U-shaped curve (e.g., Alpert & Haber, 1960) that is reminiscent of the Yerkes-Dodson (Yerkes & Dodson, 1908) law describing the relationship between arousal and performance. The assumption that an objective level of stress

predicts physical and psychological outcomes largely has been eclipsed by the notion that responses to stress are driven by how people manage or prevent the negative effects of stress; in effect, how—and how well—they cope. Coping refers to the process of appraising threat and mobilizing cognitive and behavioral resources to combat stress (Billings & Moos, 1981; Carver, Scheier, & Weintraub, 1989; Folkman & Lazarus, 1980; Penley, Tomaka, & Wiebe, 2002). Unfortunately, this initially promising body of literature has yielded several critical reviews. The June 2000 issue of *American Psychologist* was devoted entirely to the gravity of these concerns and proclaimed that “the explosion of interest in coping has yielded little and the field is in crisis” (Somerfield & McCrae, 2000, p. 620).

In our view, there are three key limitations to the current approach to understanding coping and stress. First, avoiding or reducing stress is difficult and can even be counterindicated. Individuals may not have the ability or luxury to reduce the amount of stress they face, and trying to reduce stress (e.g., avoiding the stress of paying bills) may cause more stress later. Second, coping processes are variable, complicated, and can induce stress themselves. For example, problem-focused coping is useful in controllable stressful events but is maladaptive when facing uncontrollable stressors or when there is no problem to solve (e.g., Cheng, 2003). As a result of the complexity and variability of coping, most current stress management programs propose the need to acquire and effectively implement the amalgam of coping techniques (reframe it as a challenge, communicate effectively, know when to problem solve and when to express, exercise regularly and eat healthily, etc.)—a prospect that in and of itself adds additional strain on the individual in an already stressful situation.

The third limitation of avoidance or coping approaches is more fundamental: These approaches advocate and perpetuate the mindset that *stress-is-debilitating*, a mindset that not only is partly inaccurate but may also be countereffective. Even hardiness and resilience approaches to stress, while acknowledging the enhancing outcomes, still ultimately affirm the mindset that the debilitating effects of stress must be managed or avoided. We theorize that the mindset one adopts when approaching stress is a critical factor in determining whether stress will have debilitating or enhancing effects for individuals.

Stress mindset is proposed to be an additional variable that influences the stress response (distinct from other stress-influencing variables such as the amount and severity of stress one is experiencing and one’s coping style). Stress mindset refers to the attributes and expectations ascribed to stress whether one is stressed or not; coping refers to the process of appraising threat and mobilizing cognitive and behavioral resources to combat that stress when it does occur. In other words, while stress mindset may inform the coping strategy that one utilizes, serving as the mental and motivational context in which coping actions are chosen and employed, it is not itself a coping strategy. Furthermore, stress mindset is not appraisal: Whereas appraisal of stress refers to the evaluation of a particular stressor as more or less stressful, stress mindset refers to the evaluation of the *nature of stress itself* as enhancing or debilitating. For example, one may view a particular stressor (e.g., an impending deadline) as highly stressful but have a stress-is-enhancing mindset (i.e., believe that experiencing that stress will ultimately result in enhancing outcomes). Conversely, one may also appraise the impending deadline as highly stressful but may have a stress-is-debilitating mindset (i.e., expect the stressor to debilitate health and vitality).

Proposed Mechanisms

The theoretical underpinning of the proposition that stress mindset alters health and performance is that different stress mindsets will be associated with differential motivational and physiological processes. Specifically, we propose that stress mindset has a significant impact on the manner in which stress is behaviorally approached as well as the manner in which stress is psychologically experienced and that these short-term effects on physiology and motivation have long-term effects on health and performance outcomes. More specifically, if one holds a stress-is-debilitating mindset, it follows that one’s primary motivation is to avoid or manage the stress to prevent debilitating outcomes. On the other hand, when one holds a stress-is-enhancing mindset, it follows that the primary motivation is to accept and utilize stress toward achieving those enhancing outcomes. As such, if one has a stress-is-debilitating mindset, one will be more likely to engage in actions and coping behaviors that serve to avoid or manage the stress itself (in an effort to prevent debilitating outcomes from happening). Contrarily, if one holds a stress-is-enhancing mindset, then one will be more likely to engage in actions that help meet the demand, value, or goal underlying the stressful situation (such that the stress is actively utilized toward enhancing ends). This logic mirrors the results of established research on mindsets in the domain of intelligence. For example, Dweck and her colleagues have shown that mindsets about intelligence predict goals, beliefs about effort, and reactions to setbacks, which in turn predict outcomes (Blackwell, Trzesniewski, & Dweck, 2007).

It is proposed that, when one has a stress-is-debilitating mindset, one’s arousal levels are likely to be hypo- or hyperactivated. Arousal levels may be hypoactive under stress as a result of successful avoidance or denial of the stressor or the use of counteractive coping mechanisms such as medications or substance use. Alternatively, arousal levels may be hyperactivated directly as a result of the additional stress that comes from having a stress-is-debilitating mindset or indirectly through countereffective reactions of emotional suppression, experiential avoidance, or ruminative thought (e.g., Hayes et al., 2004; Mennin & Fresco, 2009). Conversely, if one holds a stress-is-enhancing mindset, then one will be more likely to achieve an optimal level of arousal when under stress, defined as having enough arousal needed to meet goals and demands but not so much as to compromise action toward those ends or to debilitate physiological health in the long run. Our assertion that one’s stress mindset alters health-related outcomes follows research demonstrating that changes in mindsets can affect health through indirect changes in behavior as well as direct changes in physiology (e.g., Crum, Corbin, Brownell, & Salovey, 2011; Crum & Langer, 2007; Lovallo, 1997).

Present Research

To test the proposition that stress mindset is a distinct and meaningful construct in determining health and performance outcomes under stress, we conducted three studies. Study 1 sought to determine the reliability and validity of an eight-item measure developed to assess stress mindset. Study 2 was designed to test the extent to which one’s stress mindset could be altered via a priming intervention. Study 3 tested the proposed mechanisms linking stress mindset with health and performance outcomes,

specifically by measuring the effect of stress mindset on cortisol reactivity and drive for feedback under acute stress.

Study 1

Overview

The purpose of the Study 1 was the development and validation of a Stress Mindset Measure (SMM). We first evaluated the proposition that stress mindset is a distinct construct and tested whether it factors separately from traditional stress-influencing variables including the amount of stress (severity and duration of stressor) and coping abilities (e.g., hardiness, optimism, and other coping strategies). In addition, we evaluated the extent to which stress mindset (as measured by the SMM) is significantly related to self-reported stress-relevant outcomes (e.g., health, performance, and wellbeing), controlling for the amount of stress (severity and duration of stressor) and one's coping abilities (hardiness, optimism, and other coping strategies).

Method

Item generation and pilot studies. In order to generate items for a measure that would capture stress mindset, we conducted a focus group with faculty, graduate students, and postdoctoral fellows from the Health, Emotion, and Behavioral Laboratory. The group generated items to evaluate a participant's general stress mindset (e.g., "The effects of stress are negative and should be avoided"), as well as signs and symptoms related to the enhancing and debilitating consequences of stress in the realms of health and vitality, learning and growth, performance and productivity, and uncertainty and change (e.g., "Experiencing stress improves health and vitality"). Two versions of the scale were created: One referring to beliefs about the nature of stress in *general* (SMM-G) and one referring to beliefs about the nature of stress in the context of a *specific* stressor (SMM-S).

To test the internal consistency and robustness of the initial items, we administered the scales to three separate pilot samples. In the first sample, we asked 20 people attending a workshop on parenting to comment on the language of the items and the ease of completing them. We had included visual analogue and Likert scales, and participants made suggestions to help simplify the language of the items. In the second sample, we administered the refined scale to 26 participants attending a training seminar on conflict management. From this sample, we determined that the internal consistency of this refined scales was adequate but that it would be improved were we to drop two items reflecting uncertainty related outcomes. Finally, we administered the questionnaire to a larger sample of 40 employees at a government institution (*mean* age 48, 42% male, 77.8% white, 13.9% African American, 5.6% Hispanic, 2.8% Asian). In this sample, the internal consistency suggested that the scale was appropriate for broader dissemination. The final scales, including all instructions and items, appear in [Appendix A](#). SMM scores were obtained by reverse scoring the four negative items and then taking the mean of all eight items. Higher scores on the SMM represent the mindset that the effects of stress are enhancing.

Participants. Respondents were 388 employees of a large international financial institution at offices in the northeast region

of the United States. This sample was chosen because the company was undergoing dramatic downsizing and restructuring in response to the recession. This process resulted in an assortment of potentially stressful conditions including financial and job insecurity and increased pressure and workload due to changes in job criteria and a reduced number of employees. Participants were recruited into the study through an e-mailed invitation from the company's Human Resources department offering the opportunity to participate in a "stress management training program." Consistent with training protocol, this invitation was sent to employees across several divisions (e.g., wealth management, investment banking, and asset management). Participants were then enrolled in a workshop designed specifically to address stress management and completed a series of measures in an online screening as a prerequisite to attending the program. The mean age of the sample was 38.49 years ($SD = 8.40$). Most participants were White/Caucasian (71.7%), followed by Asian (15.8%), Hispanic (6.4%), Black/African American (2.4%), and other (3.7%). Consistent with the company's composition, 54% of the participants were male.

Traditional stress-influencing variables. To measure the amount of stress participants were experiencing, the Social Readjustment Rating Scale (SRRS; [Holmes & Rahe, 1967](#)) was used to assess the accumulated number of stressful life events participants had experienced in their lives to date. Furthermore, a single-item measure asking participants "How much stress are you experiencing in your life right now?" was used to assess the amount of stress participants were experiencing currently (scale: 1 = *none* to 7 = *an extreme amount*) and a single item asking participants, "How stressful do you perceive [a primary source of stress] to be?" (scale: 1 = *not stressful at all* to 7 = *extremely stressful*) was used to capture the severity of stress they were experiencing currently.

To measure coping strategies, we utilized the Brief COPE ([Carver et al., 1989](#)) inventory. The measure consists of 14 subscales of two items each, addressing particular coping responses. The subscales include self-distraction (SD), active coping (AC), denial (D), substance use (SU), use of emotional support (ES), use of instrumental support (IS), behavioral disengagement (BD), venting (V), positive reframing (PR), planning (P), humor (H), acceptance (A), religion (R), and self-blame (SB). Questions pertaining to substance use and religion were not used per request of the employer. Each scale consists of two items rated from 0 = *I haven't been doing this at all* to 3 = *I've been doing this a lot*. As recommended by [Carver et al. \(1989\)](#), the composition of higher order factors was determined by subjecting each scale to an exploratory principal components analysis. The scree plot and the Kaiser-Guttman criterion of eigenvalues >1 were used as guidance to determine factors, with both methods suggesting retaining four factors. The four factors together accounted for 61.8% of the total variance. Factor 1 emphasized "approach coping" behaviors with active coping (AC), positive reframing (PR), planning (P), and acceptance (A) loading on the first factor (all loadings $>.63$). Factor 2 included "social coping" variables such as use of emotional support (ES), use of instrumental support (IS), and venting (V; all loadings $>.52$). Factor 3 included "distractive coping" items such as humor (H) and self-distraction (SD; all loadings $>.62$). The final factor included the "avoidance coping" items of behavioral disengagement (BD), self-blame (SB), and denial (D; all loadings $>.55$). Based on Carver et al.'s recommendation,

aggregate scores were then created by taking the mean value of all items within each factor.

To measure participants' appraisal of the stress they were experiencing, we utilized the Perceived Stress Scale (PSS; S. Cohen, Kamarck, & Mermelstein, 1983). Items ask participants to reflect on the past month and include questions such as "Have you been upset by something that happened unexpectedly?" and "Have you felt that you could not cope with all the things you had to do?" (scale: 0 = *never* to 4 = *very often*). In addition to the PSS, the Dispositional Resilience Scale (DRS15-R; Bartone, 2007) was used to measure participants' hardiness, a moderating factor in stress and health. Items assess factors composing hardiness, namely, commitment, control, and challenge. Theory and research suggests that all three components must be present to denote hardiness (cf. Maddi, 2002), and therefore, analyses were performed using the mean of all items as opposed to analyzing the three factors separately. The Life Orientation Test (LOT-R; Scheier, Carver, & Bridges, 1994) was used to assess participants' dispositional optimism. The Intolerance of Uncertainty Scale (IUS; English translation: Buhr & Dugas, 2002) was used to assess participants' negative beliefs about uncertainty and its consequences (higher scores on the IUS indicate less tolerance of uncertainty). And the Freiburg Mindfulness Inventory (FMI; Walach, Buchheld, Buttenmüller, Kleinknecht, & Schmidt, 2006) was used to assess participants' experience of mindfulness, or virtue of present consciousness, combined with nonjudgment of those perceptions.

Measures of health, performance, and quality of life. The Mood and Anxiety Symptom Questionnaire (MASQ; Watson et al., 1995) was used to assess respondents' symptoms of anxiety and depression. This 77-item measure includes subscales pertaining to anxious symptoms (GA), depressive symptoms (GD), anxious arousal (AA), and anhedonic depression (AD). One item regarding thoughts of suicide was removed. Participants rated how much they experienced a given symptom during the past month (scale: 1 = *not at all* to 5 = *extremely*) with the total score calculated by summing the mean of the four subscales (producing a range of 4–20). Furthermore, we used the Healthy Days Measures (HD; Center for Disease Control and Prevention, 2000). This instrument is part of the CDC's Health Related Quality of Life measurements (HRQOL), which are used for tracking health status and quality of life in communities. Questions assessed how many days a respondent's physical health was not good (HD-physical), how many days a respondent's mental health was not good (HD-mental), and how many days a respondent has felt healthy and full of energy (HD-energy).

The *Work Performance Scale* (WPS) was adapted from the Role-Based Performance Scale (Welbourne, Johnson, & Erez, 1998) to assess participants' self-ratings of their performance at work. The scale includes eight questions addressing characteristics of work output: quality, quantity, accuracy, efficiency, ability to generate new ideas, ability to sustain focus, communication, and contribution to work environment. Exploratory factor analysis revealed two factors with eigenvalues >1. Based on these loadings, the scale was separated into two factors. Questions regarding quality, quantity, accuracy, and efficiency represented hard performance measures (WPS-hard; all items loading >.63). Questions regarding ability to generate new ideas, ability to sustain focus,

communication, and contribution to work environment represented soft performance measures (WPS-soft; all items loading >.68).

To measure participants' general satisfaction with their lives, we utilized a subset of items from the Quality of Life Inventory (QOLI; Frisch et al., 2005) assessing satisfaction in 13 domains, including health, self-esteem, goals and values, money, work, play, learning, creativity, helping, love, friends, and home. Respondents rated importance (scale: 0 = *not at all*, 1 = *important*, 2 = *very important*) and satisfaction (scale: -3 = *very dissatisfied* to 3 = *very satisfied*) in each domain. Scoring reflects the idea that quality of life is weighted by a participant's satisfaction in a domain with the corresponding importance of that domain to each participant. Internal consistency was adequate for all scales. Cronbach's coefficient alphas (all >.75) are listed in the diagonals of Table 1 and Table 2.

Results

Psychometric properties of the SMM: Means, variance, and internal consistency. Table 1 presents descriptive data on the SMM. The mean score of all items combined was 1.60 ($SD = 0.67$) for the SMM-G and 1.50 ($SD = 0.64$) for the SMM-S, which is on the debilitating side of the 4-point scale. Both versions of the SMM have high internal consistency (Cronbach's alpha was .80 for the SMM-S and .86 for the SMM-G), and responses on both scales follow a normal distribution. Age and sex were both unrelated to SMM scores. The SMM-G and the SMM-S were significantly correlated with one another, $r(335) = .61, p < .001$. Confirmatory factor analyses confirmed a simple structure of the SMM, suggesting that it is appropriately described as unifactorial. Factor loadings and residuals of each item are presented in Figure 1.

Discriminant validity: Is stress mindset a distinct variable? Pearson correlations revealed that, while the SMM was significantly correlated in the expected direction with all measures related to stress, these correlations were small to moderate, suggesting that the SMM is not a redundant construct. A complete set of correlations appears in Table 2. In order to evaluate more stringently the proposition that stress mindset is distinct from amount, appraisal, and coping, all scales were subjected to Structural Equation Modeling comparing models in which stress mindset was projected to be its own construct as compared to alternative models in which stress mindset was simply another measure reflecting a preexisting construct such as "amount," "appraisal," or "coping." These analyses demonstrated that a model depicting stress mindset

Table 1
Descriptive Data for the Stress Mindset Measure

	SMM-G	SMM-S
<i>N</i>	335	352
<i>M</i> (8 items)	1.62	1.47
<i>SD</i>	0.67	0.64
Kurtosis	-.21	-.07
Skewness	.05	.16
Cronbach's α	.86	.80
Mean item intercorrelation	.43	.31

Note. SMM-G = Stress Mindset Measure-General; SMM-S = Stress Mindset Measure-Specific.

Table 2
Convergent Validity of the SMM-G and SMM-S With Measures of Amount, Appraisal, and Coping

Variable	1a	1b	2	3	4	5	6	7	8	9	10	11	12	13
Mindset														
1a. SMM-G	(.86)													
1b. SMM-S	.61**	(.80)												
Amount														
2. Amount	-.12**	-.33**	—											
3. Severity	-.13*	-.34**	.73**	—										
4. SRRS	-.12*	-.34	-.06	-.01	(.86)									
Appraisal														
5. PSS	-.34**	-.49**	.45**	.46**	.06	(.86)								
6. LOT-R	.23**	.25**	-.20**	-.21**	-.04	-.54**	(.86)							
7. DRS	.31**	.35**	-.18**	-.17**	.00	-.52**	.53**	(.77)						
8. IUS	-.16**	-.16**	.21**	.22**	-.01	.46**	-.35**	-.30**	(.94)					
9. FMI	.21**	.23**	-.18**	-.17**	-.09	-.52**	.50**	.51**	-.41**	(.86)				
Coping														
10. Approach	.27**	.31**	-.04	-.01	-.06	-.41**	.36**	.49**	-.24**	.46**	(.79)			
11. Avoid	-.17**	-.27**	.23**	.23**	.05	.49**	-.32**	-.32**	.37**	-.44**	-.26**	(.83)		
12. Social	.07	-.02	.03	.08	-.15**	-.01	.14*	.10	-.05	.01	.26**	.05	(.60)	
13. Distract	.05	-.03	.01	.01	-.04	.06	.02	-.01	-.01	.10	.14**	.22	.22**	(.66)
<i>N</i>	335	364	367	367	327	348	338	346	338	334	358	358	358	358
<i>M</i>	1.61	1.46	4.84	4.87	32.01	1.82	2.64	1.86	1.04	2.54	2.85	1.68	2.40	2.45
<i>SD</i>	0.67	0.64	1.13	1.20	5.13	0.55	0.90	0.36	0.66	0.49	0.51	0.45	0.64	0.63

Note. Coefficient alphas are in parenthesis along the diagonal. SMM-G = Stress Mindset Measure-General; SMM-S = Stress Mindset Measure-Specific; SRRS = Social Readjustment Rating Scale; PSS = Perceived Stress Scale; LOT-R = Revised Life Orientation Test; DRS = Dispositional Resilience; IUS = Intolerance of Uncertainty Scale; FMI = Freidburg Mindfulness Inventory; Approach = approach coping; Avoid = avoidance coping; Social = social coping; Distract = distractive coping.

* $p < .05$. ** $p < .01$.

as its own construct was better fitting on all indices of fit, CMIN(14) = 38.07, $p < .01$, CFI (.97), RMSEA (.06), and AIC (98.07), than models that included stress mindset with other measures such as optimism and perceived stress, falling under the umbrella of “appraisal,” CMIN(17) = 141.57, $p < .01$, CFI (.87), RMSEA (.14) and AIC (195.57). or than models that included stress mindset as part of other measures such as approach coping and avoidance coping, falling under the umbrella of “coping,” CMIN(17) = 125.03, $p < .01$, CFI (.88), RMSEA (.13), and AIC (179.03).¹ This model is illustrated in Figure 2.

Evidence for criterion validity. In order to evaluate the influence of stress mindset on health, performance, and well-being, correlations were computed between the SMM and other variables affected by one’s reaction to stress. All correlations appear in Table 3. In an effort to understand the extent to which stress mindset predicts unique variance in the effects of stressful situations, three separate stepwise multiple regression models predicting self-reported symptoms related to mood and anxiety (MASQ), performance (WPS), and life satisfaction (QOLI) were conducted with amount, active coping, social coping, distractive coping, and avoidance coping entered as predictors in Step 1 and stress mindset (the mean of SMM-G and SMM-S) entered in Step 2. Shown in Table 4, stress mindset was a significant predictor of the variability in health and life satisfaction over and above variables pertaining to amount of stress, social coping, adaptive internal coping, and aversive internal coping. Stress mindset was not a significant predictor of performance (WPS) in these analyses.

Discussion

This study described the development and validation of an eight-item instrument (SMM) used to measure one’s stress mind-

set. The data supported both hypotheses: first, that one’s stress mindset is a distinct variable from traditional stress-influencing variables (amount, appraisal, and coping) and second, that stress mindset is meaningfully related to stress-relevant outcomes (health, performance, and well-being).

The SMM was weakly to moderately associated with other measures related to stress including the amount of stress, appraisal of stress, and ability to handle stress. These low correlations supported the proposition that one’s stress mindset is related to but meaningfully different from these traditional variables. Particularly notable is the finding that stress mindset was related to but distinct from variables that, on the surface, may seem as though they are related to a stress-is-enhancing mindset: hardiness and optimism. Although a stress-is-enhancing mindset was positively correlated with both hardiness and optimism, these correlations were modest ($r_s = .23$ to $.31$). More importantly, structural equation analyses supported that stress mindset is distinct from measures such as perceived stress and optimism (appraisal) and from measures such as approach coping and avoidance coping.

Individuals who endorse a stress-is-enhancing mindset reported having better health than those who endorse a stress-is-debilitating mindset: specifically, respondents reported fewer symptoms of depression and anxiety while also reporting higher levels of energy. Both workplace performance and overall satisfaction with life were positively correlated with an enhancing stress mindset. Furthermore, regression analyses supported the notion that the SMM is related to self-reported symptoms of mood and anxiety and life satisfaction over and above measures of amount of stress,

¹ The DRS, IUS, FMI, social coping, and distractive coping did not converge onto the model so they were excluded in the analyses.

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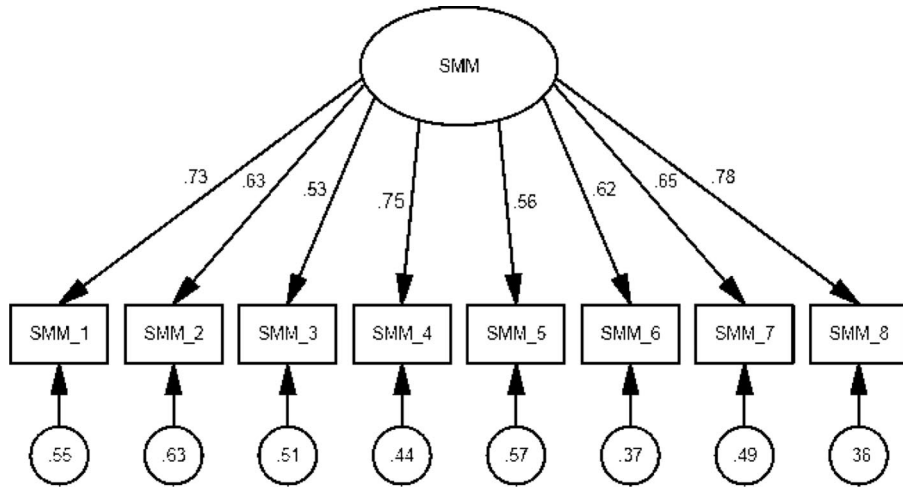


Figure 1. Confirmatory factor analysis model depicting the Stress Mindset Measure (SMM) as one construct with factor loadings and residuals.

active coping, social coping, distractive coping, and avoidance coping. Importantly, this does not mean that these traditional variables are not influential; variables pertaining to amount of stress and coping ability do not lose their significance after stress mindset is incorporated into the model. Rather, stress mindset is an

additional variable that appears to meaningfully influence the stress response.

It is important to point out that the incremental validity found in these regression models, although significant, was small, accounting for an additional 2% to 3% of the variance in health and life

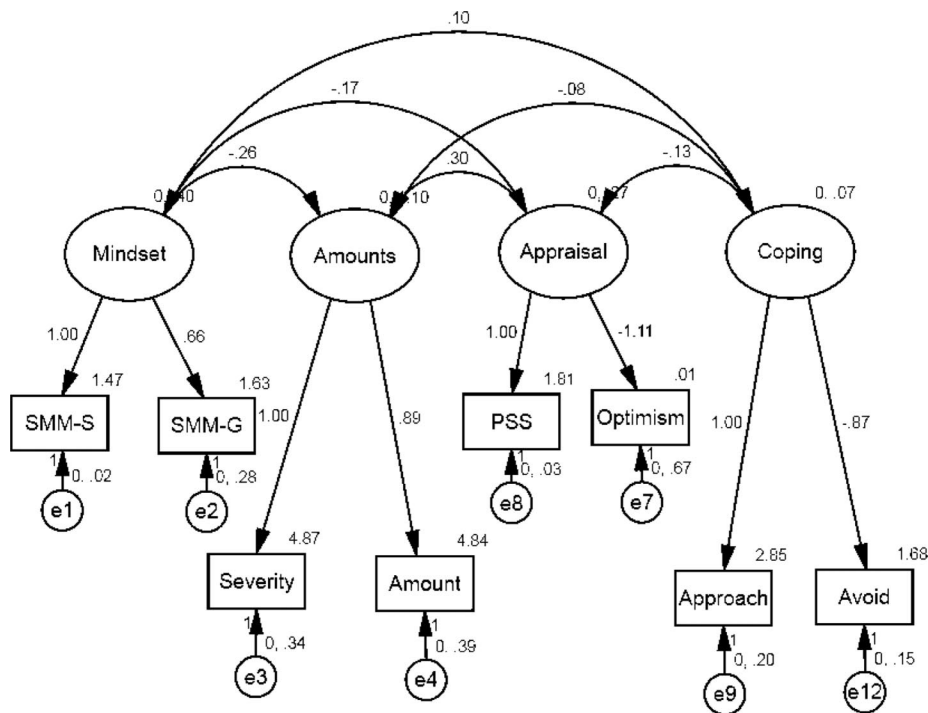


Figure 2. Model depicting General Stress Mindset (SMM-G) and Specific Stress Mindset (SMM-S) as a separate factor, “Mindset.” This model is better on all indices of fit than models including SMM-S and SMM-G as part of other measures such as optimism, hardiness, or perceived threat, which fall under the umbrella of “appraisal,” or than models which include stress mindset as part of other measures such as approach coping, social coping, and avoidance coping, which fall under the umbrella of “coping.” PSS = Perceived Stress Scale; e = error.

Table 3
Criterion Validity of the SMM-G and SMM-S With Measures of Health, Performance, and Quality of Life

Variable	1a	1b	2	3	4	5	6	7	8	9
Mindset										
1a. SMM-G	(.86)									
1b. SMM-S	.61**	(.80)								
Health										
2. MASQ	-.25**	-.45**	(.96)							
3. HD (mental)	-.25**	-.43**	.66**	(.77)						
4. HD (physical)	-.15**	-.24**	.28**	.38**	(.81)					
5. HD (energy)	.20**	.34**	-.50**	-.47**	-.25**	—				
Performance										
6. WPS	.15**	.27**	-.46**	-.27**	-.12*	.31**	(.89)			
7. WPS (hard)	.14*	.22**	-.39**	-.20**	-.08	.26**	.90**	(.87)		
8. WPS (soft)	.12*	.28**	-.45**	-.27**	-.13*	.30**	.88**	.63**	(.86)	
Wellbeing										
9. QOLI	.20**	.35**	-.59**	-.43**	-.31**	.42**	.49**	.44**	.45**	(.82)
<i>N</i>	335	364	335	334	334	329	333	333	333	335
<i>M</i>	1.45	1.47	7.76	9.82	3.49	11.07	2.65	2.89	2.45	1.46
<i>SD</i>	0.65	0.64	1.94	6.47	4.12	8.09	0.71	0.75	0.82	1.69

Note. Coefficient alphas are in parenthesis along the diagonal. SMM-G = Stress Mindset Measure-General; SMM-S = Stress Mindset Measure-Specific; MASQ = Mood and Anxiety Symptom Questionnaire; HD = Healthy Days Measures; WPS = Work Performance Scale; QOLI = Quality of Life Inventory.

* $p < .05$. ** $p < .01$.

satisfaction measures. Furthermore, counter to our predictions, the SMM did not explain a statistically significant portion of additional variance in work performance. In these analyses, only “approach coping” accounted for significant variability in work performance (whereas in health and life satisfaction, other metrics such as social coping, avoidance coping, and amount of stress were significant in addition to stress mindset). This may suggest that performance is so dependent on day-to-day engagement with work (e.g., active coping) that dispositional metrics such as the SMM may not be as influential. The results found in this study rely on cross-sectional data, and thus, the direct impact of mindset on health and performance could not be explored. For these reasons, Study 2 was designed to determine whether active changes in mindset might engender significant changes in health and work performance.

Study 2

Overview

One of the benefits of focusing on mindset is that it can be altered via intervention. In her research on mindset and intelligence, Dweck (2008) demonstrated that an intelligence-is-malleable mindset can be assimilated into one’s view of intelligence by informing individuals of the facts supporting the malleability of intelligence over the course of an 8-week (Chiu, Hong, & Dweck, 1997). Other studies have demonstrated that a change in mindset may not require such extensive interventions. Chiu and colleagues (Chiu et al., 1997) induced college students to adopt either an intelligence-is-fixed mindset or an intelligence-is-malleable mindset by presenting them with a “scientific article”

Table 4
Stepwise Regression of Stress Measures on Health, Performance and Life Satisfaction

	Psychological symptoms (MASQ)			Work performance (WPS)			Life satisfaction (QOLI)		
	β	R^2	ΔR^2	β	R^2	ΔR^2	β	R^2	ΔR^2
Step 1		.37**	.37**		.22**	.22**		.25**	.25**
Amount	.36**			-.07			-.20**		
Approach coping	-.20**			.31**			.26**		
Social coping	.03			.09			.17*		
Distractive coping	.01			.04			-.01		
Avoidance coping	.33**			-.24**			-.23**		
Step 2		.40**	.03**		.23**	.01		.27**	.02*
Amount	.32**			-.06			-.17**		
Approach coping	-.15**			.29**			.24**		
Social coping	.02			.09			.17**		
Distractive coping	.01			.04			-.01		
Avoidance coping	.31**			-.23			-.21**		
Stress mindset	-.19**			.08			.13**		

Note. MASQ = Mood and Anxiety Symptom Questionnaire; WPS = Work Performance Scale; QOLI = Quality of Life Inventory.

* $p < .05$. ** $p < .01$.

that argued compellingly for either a “fixed” or a “malleable” view of intelligence. More recently, video media have been used to engender different mindsets. Aronson et al. (2002) successfully elicited either a “malleable” or a “fixed” mindset of intelligence by showing participants a film clip that endorsed one or the other of these two views. In the current study, we tested whether we could produce changes in stress mindset in a similar manner: watching short, multimedia film clips with factual information biased toward presenting the enhancing nature of stress (as compared to the debilitating nature of stress or a control condition). In addition to testing whether or not stress mindset can be altered through a priming intervention, Study 2 explored whether proposed changes in stress mindset would be accompanied by corresponding changes in participants’ psychological symptoms and work performance (akin to changes in mindset producing corresponding changes in health and performance in other domains such as exercise and intelligence).

Method

Respondents in this study were the same employees of the large international financial institution recruited in Study 1. After completing the baseline questionnaire described in Study 1, participants were randomized into a “stress-is-enhancing” ($N = 163$), a “stress-is-debilitating” ($N = 164$), or a “control” condition ($N = 61$).²

Participants in the enhancing and debilitating conditions were shown three different videos over the course of 1 week presenting the effects of stress in three different domains: health, performance, and learning/growth. These videos were approximately 3 min in length and were composed of words, music, and corresponding images. Detailed contents of these videos and the distinctions between the conditions are presented in Appendix B.³ The control condition participants did not view any videos or receive any additional material.

The three videos were delivered via e-mail in 2- to 3-day intervals. The videos were embedded in a Qualtrics survey to ensure that each participant had viewed each video. Two to 3e days after the third stress mindset video, participants were invited to complete a set of follow-up measures consisting of the general Stress Mindset Measure (SMM)⁴ and the primary outcome measures (MASQ, WPS, described in Study 1).

Results

To examine the effect of the stress mindset training on psychological symptoms and work performance of the participants, 3 (group: enhancing, debilitating, control) \times 2 (time: pre-, post-) repeated measures general linear models (GLM) were conducted. Where significant two-way interactions occurred, simple effects test were used to determine the nature of these changes within each group.

Repeated measures GLM yielded a reliable condition by time effect for SMM, $F(1, 261) = 27.39, p < .001, \eta^2 = .17$.⁵ Specifically, simple effects tests indicated that while the SMM increased over time for those in the enhancing condition, $t(110) = 3.13, p < .01$, it decreased over time for those in the debilitating condition, $t(106) = 7.45, p < .001$, and did not change for those in the control condition, $t(45) = 0.43, p = .67$. These findings

suggest that participants were appropriately sensitive to the stress mindset condition.⁶ Figure 3 illustrates these changes.

Repeated measures GLM yielded a reliable condition by time effect for MASQ, $F(1, 269) = 3.20, p = .04, \eta^2 = .02$. Simple effects tests indicated that while scores on the MASQ decreased over time in the enhancing condition, $t(112) = 4.86, p < .001$, the control and debilitating condition showed no significant change in the number of symptoms reported, $t(43) = 0.84, p = .40$ and $t(115) = 0.92, p = .36$, respectively. Figure 3 illustrates these changes.

Repeated measures GLM yielded a reliable condition by time effect for the scale as a whole, $F(1, 293) = 5.10, p < .01, \eta^2 = .04$. Simple effects tests indicated that the WPS increased over time for the enhancing condition, $t(128) = 3.24, p < .001$; the control and debilitating condition showed no significant change before and after the intervention in their self-reported performance, $t(125) = 1.57, p = .12$ and $t(41) = 0.93, p = .37$, respectively. Similar trends were found with respect to both “hard” skills (quality, quantity, efficiency, accuracy) and “soft” skills (new ideas, focus, engagement, collaboration). Figure 3 illustrates these changes.

Discussion

Over the course of 1 week, participants viewed three short video clips presenting images, research, and examples that were designed to demonstrate either the enhancing nature of stress or the debilitating nature of stress. Participants seemed to change their mindsets about stress quite readily. Whereas those in the enhancing condition developed more of a stress-is-enhancing mindset as a result of watching clips biased in that direction, those in the debilitating condition showed just the opposite by developing more of a stress-is-debilitating mindset.

Furthermore, participants in the enhancing condition reported improved psychological symptoms and better work performance, whereas their counterparts in the control or debilitating conditions did not. The results suggest that stress mindsets can be changed, and that eliciting a stress-is-enhancing mindset is accompanied by corresponding positive changes in participants’ self-reported psychological symptoms and work performance.

It is interesting to note that, although participants in the debilitating condition did show movement in their stress mindsets, these negative changes in mindset were not accompanied by corresponding decrements in psychological symptoms and performance. This is likely because the stress-is-debilitating mindset is already the predominant mindset, and thus, reinforcing this mindset is not as

² The unequal assignment of participants to the control group was to ensure adequate power for detection of the differences between the two active mindset groups.

³ Complete videos are available for viewing at http://pantheon.yale.edu/~ajc84/videos/all_e.html (enhancing videos) and http://pantheon.yale.edu/~ajc84/videos/all_d.html (debilitating videos).

⁴ Test–retest reliability of the SMM for participants in the control condition was .66.

⁵ According to J. Cohen (1988), effect sizes, measured by eta squared (η^2), are small at .01, medium at .09, and large at .25.

⁶ The correlation between pre- and posttest SMM scores for the control condition was .66 reflecting adequate test–retest validity for the SMM. The correlation between pre- and post-test SMM scores was .34 in the enhancing condition and .49 in the debilitating condition.

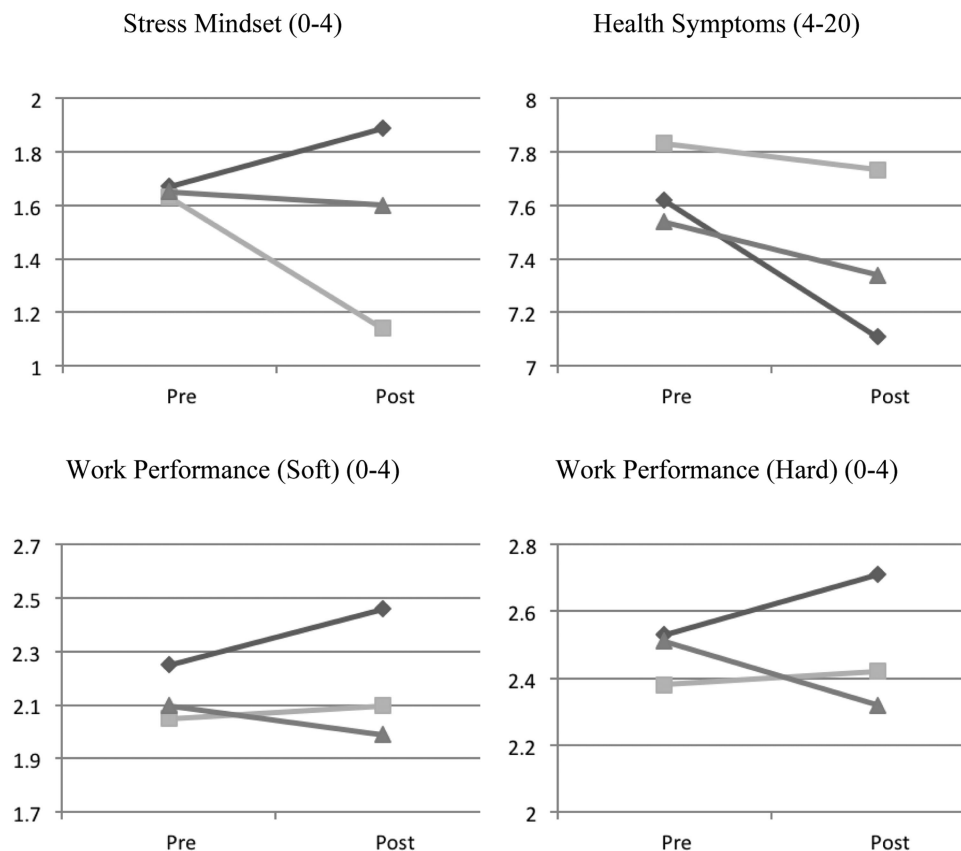


Figure 3. Changes in stress mindset, health symptoms, and work performance over time as a function of condition. Dark gray lines with diamond points represent participants in enhancing condition. Medium gray lines with triangle points represent participants in the control condition. Light gray lines with square points represent participants in the debilitating condition.

meaningful as a shift toward a more qualitatively different mindset (from debilitating to enhancing).

The findings support previous research suggesting that mindset can be changed through exposure to selective information (Williams et al., 2009). It appears that mindset can be altered through a limited intervention—less than 10 min total of video exposure and that such a change is related to changes in self-reported work and performance. The study did not assess how long the stress mindset effects lasted beyond 2 weeks. Future research should focus on determining the time needed and the reinforcements necessary to introduce stable changes in beliefs about stress. Furthermore, a primary limitation in Studies 1 and 2 was that all of the measures used were obtained via self-report, which may be biased by a number of methodological artifacts (e.g., participants may report self-enhancing scores, or common-method variance may have inflated relationships between variables; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Therefore, to address these shortcomings and begin the process of understanding possible mechanisms through which stress mindset influences health and performance, Study 3 was designed to investigate how stress mindset influences more objective markers of performance.

Study 3

Overview

In Studies 1 and 2, “stress mindset” was proposed as a new variable that influences an individual’s response to stress. These studies provided support for the propositions (a) that stress mindset is conceptually distinct from variables that are traditionally proposed to influence the stress response, and (b) that stress mindset can be changed, and (c) that a change toward a stress-is-enhancing mindset is accompanied by improvements in self-reported health and work-performance. A necessary next step is to begin the process of investigating the mechanisms that link stress mindset with health and performance outcomes. In Study 3, we examine how stress is behaviorally approached (e.g., desire for feedback) and how stress is physiologically experienced (e.g., cortisol response).

An important variable underpinning how stress is behaviorally approached is the extent to which an individual has a desire for feedback. Positive and/or negative feedback makes individuals aware of the quality of their performance and aspects of performance that may need improvement (Waldersee & Luthans, 1994). As such, the use of feedback can help to set new goals and adjust

strategies and methods to ensure positive growth. The problem with feedback is that the very act of receiving it can be stressful. Negative feedback can threaten self-esteem, leading to anxiety and stress (P. E. Levy, Albright, Cawley, & Williams, 1995). Therefore, one must be motivated to endure the stress of receiving feedback in exchange for the learning opportunity of receiving it. If an individual holds a stress-is-debilitating mindset, it follows that he or she will be likely to engage in actions that serve to avoid or manage the stress in order to prevent debilitating consequences. Alternatively, if one holds a stress-is-enhancing mindset, it follows that he or she will be motivated to engage in actions that serve to help meet the goal or demand underlying the stress and thereby engender those enhancing outcomes. Based on this logic, we propose that those individuals with a stress-is-enhancing mindset will be more likely to seek out feedback under stress.

An important physiological variable underpinning how stress is experienced and therefore influencing the health effects of stress is cortisol response. When faced with a stressful situation, the physiological stress response consists of an activation of the sympathetic nervous system (SNS), a parasympathetic withdrawal, and increased activity of the hypothalamic-pituitary-adrenal (HPA) axis. This "fight or flight" response, essentially initiated through this secretion of cortisol, acts as an adaptive defensive mechanism to life-threatening situations. Despite the lack of true life-threatening stimuli, this response is still elicited frequently (over 50 times per day). A hyperactivation of the HPA axis results in high levels of cortisol secretion, which can result in potentially damaging effects to the physiological and psychological health of an individual. Some effects of excessive cortisol circulation include increased cravings for calorie-dense foods, decreased energy expenditure (Torres & Nowson, 2007), increased propensity to store fat viscerally (Björntorp, 2001), and compromised immunologic health (Lovallo, 1997). On the other hand, blunted cortisol responses to stress are related to a down-regulation of the immune system and the development of autoimmune disorders (e.g., Cahill & McGaugh, 1998; de Kloet, Oitzl, & Joels, 1999; Meewisse, Reitsma, De Vries, Gersons, & Olf, 2007; Sternberg, 2001). Therefore, an appropriate level of arousal for engendering positive health outcomes under stress seems to be marked by a moderate level of cortisol activity under acute stress as opposed to high or low levels of cortisol activity (e.g., Kunz-Ebrecht et al., 2003).

We propose that if an individual holds a stress-is-debilitating mindset, subsequent arousal levels are likely to be hyper- or hypoactivated directly as a result of the additional stress that comes from having a stress-is-debilitating mindset, or indirectly through countereffective reactions of emotional suppression, experiential avoidance, or ruminative thought (e.g., Hayes et al., 2004; Mennin & Fresco, 2009). Conversely, if one holds a stress-is-enhancing mindset, then one will be more likely to achieve an optimal level of arousal when under stress, defined as having enough arousal to meet goals and demands but not so much as to compromise action toward those ends or to debilitate physiological health in the long run. Based on this logic, we hypothesize that a stress-is-enhancing mindset will be associated with a moderate cortisol reactivity to stress. In other words, we propose that stress mindset will interact with cortisol reactivity such that a stress-is-enhancing mindset will buffer cortisol reactivity for high cortisol responders and will boost cortisol reactivity for low cortisol responders.

Method

Participants were students in an undergraduate personality psychology course in the Northeastern United States. The mean age was 19, and 62% were women. Only participants who completed all sets of measures evaluated ($n = 63$) were included in the analyses.⁷

Early in the semester, participants completed the SMM as part of a battery of personality assessments. Later in the semester, participants were told that salivary hormone measurements would be collected for research investigating the link between personality variables and health. Participants were given three salivettes and verbal instructions for collection. They were told that samples would be taken at three time points during the two class sessions. The first three cortisol samples were administered at the beginning (0 min), middle (30 min) and end (60 min) of a normal class day ("baseline day"). On the "stress day," participants underwent a modified Trier Social Stress Test (TSST; Kirschbaum, Pirke, & Hellhammer, 1993). The TSST was imbedded in a lecture on the components of charisma (confidence, emotional intelligence, persuasion, and presence/authenticity). Students were asked to rate themselves on these components and then to spend 10 min preparing a speech that they could deliver to the class in a charismatic manner. They learned that five of them would be randomly selected to give their speech to the class and were told that their peers would evaluate them on their levels of charisma. Furthermore, they were informed that they would be videotaped and that a team of experts from the business school would assess their ability. Participants were told that they would have the opportunity to receive feedback from their peers and the management professionals on their speeches (if they were chosen) or at another time (if they were not) and were given several questions to assess the extent to which they desired this feedback. These questions addressed their comfort with feedback from 1 = *not comfortable* to 9 = *very comfortable* and their willingness to receive feedback from 1 = *not willing* to 9 = *very willing*, whether they wanted to receive feedback if they were to be chosen as a speaker (only five students were to be randomly chosen; Y or N), and whether they wanted to take advantage of the opportunity to receive personalized feedback at the business school (Y or N). An aggregate variable was created from the mean z -scores of each of the four items. Internal consistency of this aggregate measure was adequate (Cronbach's $\alpha = .75$).

The stress induction is based on past research that supports the use of public speaking as a stressful and realistic task (e.g., Al'Absi et al., 1997; Epel et al., 2000; Salovey, Stroud, Woolery, & Epel, 2002). Salivary cortisol was collected using Sarstedt salivettes, which were assayed by the Yale Center for Clinical Investigation (YCCI) in a coated tube RIA (TKCO1) with intra-assay variability of 5.9%–9.6%, and interassay variability of 5.6–8.7%, (Vendor: Diagnostic Products Corporation, Los Angeles, CA).

In order to assess the impact of the stress task on cortisol, data were analyzed using an area under the curve (AUC) analysis. An

⁷ There were a total of 109 students in the class, of which 63 completed all sets of measures (meaning they were present on all 3 days in which data were collected). Only subjects who did not complete all the measures were excluded from analyses.

AUC analysis is conducted based on the trapezoid formula, a frequently used method in endocrinological research to characterize information that is contained in repeated measurements (Pruessner, Kirschbaum, Meinlschmid, & Hellhammer, 2003). The AUC of the baseline day (AUC baseline) was calculated as the total area over the 60-min period on baseline day $\{[(\text{Cortisol.1.00} + \text{Cortisol.2.00}) * 30]/2\} + \{[(\text{Cortisol.2.00} + \text{Cortisol.3.00}) * 30]/2\}$. The AUC of the stress day (AUC Stress) was calculated as the total area over the 60-min period on "stress day" $\{[(\text{Cortisol.4.A} + \text{Cortisol.5.A}) * 30]/2\} + \{[(\text{Cortisol.5.A} + \text{Cortisol.6.A}) * 30]/2\}$.⁸ Cortisol Reactivity was calculated as the difference between the 2 days (AUC Stress – AUC Base).

In addition to cortisol and feedback measures, we also assessed perceived stress through a single item question asking participants to rate how stressful they perceived the experience to be from 1 (*not stressful at all*) to 9 (*extremely stressful*). Furthermore, dispositional tendencies toward suppression and reappraisal was assessed using the Gross and John Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). Specifically, the ERQ captures individual differences in the habitual use of two emotional regulation strategies: cognitive reappraisal and suppression. In the current sample, internal consistency (Cronbach's alpha) was .81 for the reappraisal subscale of the ERQ and .71 for the suppression subscale of the ERQ.

Results

Manipulation check. Paired *t* tests indicated that the AUC Base was significantly less than the AUC Stress, $t(63) = 3.71, p < .001$, suggesting that more cortisol was secreted over the 60 min on "stress day" as compared to the baseline day.

Influence of stress mindset, cortisol, and perceived stress on desire for feedback. In total, 75% of participants in the stressful speaking task chose to receive feedback if they were to be selected as a speaker; however, regarding the opportunity to receive advanced feedback at a later date, only 25% of participants chose to take advantage of an opportunity to receive personalized feedback at the business school. On a scale of 1–9 (1 = *not comfortable/not willing* to 9 = *very comfortable/very willing*), participants rated their willingness to receive feedback as a 6.00 ($SD = 2.12$) and their comfort receiving feedback as a 5.14 ($SD = 2.18$).

A regression model was calculated predicting desire for feedback in which perceived stress, emotion regulation and suppression, and cortisol reactivity on "stress day" were entered in at Step 1 and SMM was entered in at Step 2. This regression analysis revealed SMM as the strongest predictor of desire for feedback.⁹ Beta weights and other statistics for the impact of stress mindset on drive for feedback over and above perceived stress, dispositional reappraisal and suppression, and cortisol response to stress are shown in Table 5.

Moderating effect of stress mindset on cortisol response under acute stress. To test for the influence of stress mindset as a moderator in the model, a hierarchical regression model predicting AUC Stress was conducted with standardized scores of Cortisol Reactivity and SMM entered as predictors in Step 1 and their interaction entered in Step 2. In these analyses, there is no main effect of stress mindset on the amount of cortisol secreted under acute stress ($\beta = -.03$), $t(58) = -2.4, p = .81$, and of course

there is a main effect when comparing high cortisol responders with low responders ($\beta = -.42$), $t(58) = -3.49, p < .01$, however, there is a marginally significant interaction between stress mindset and cortisol reactivity such that a stress-enhancing mindset boosts cortisol response to stress for low cortisol responders and buffers cortisol response to stress for high cortisol responders ($\beta = .21$), $t(58) = 1.80, p = .07$.

Discussion

In Study 3, individuals who endorsed a stress-is-enhancing mindset had a stronger desire to receive feedback than those who endorsed a stress-is-debilitating mindset, over and above other variables including cortisol response and perceived stress. This finding supports the logic that if one holds a stress-is-enhancing mindset, then one will be more likely to choose behaviors that help meet the demand, value, or goal underlying the stressful situation such that the stress is actively utilized toward enhancing ends. Desire for feedback was chosen as a variable in this study because it presents an individual with the opportunity to grow as a result of experiencing stress, thereby facilitating future growth and performance enhancement. Although performance effects of seeking feedback were not directly measured in this study, proactive feedback-seeking stimulates this personal enhancement because it enables employees to become aware of role expectations, assess their work behavior, and set goals for future development and performance (London & Smither, 2002; VandeWalle, Ganesan, Challagalla, & Brown, 2000).

A stress-is-enhancing mindset was also related to more adaptive cortisol profiles under acute stress. For individuals with high cortisol reactivity to stress, having a stress-is-enhancing mindset lowered the cortisol response, whereas for those who had low cortisol reactivity to stress, having a stress-is-enhancing mindset increased the cortisol response. This supports the hypothesis that one's stress mindset is related to different physiological responses under stress. Although the typical approach to stress is to reduce one's arousal and "stay calm" under stress, the interaction between SMM and cortisol reactivity supports the hypothesis that stress mindset influences cortisol function in a more nuanced fashion. It supports the notion that a stress-is-enhancing mindset is associated with reduced activity in high cortisol responders and increased activity in low cortisol responders to achieve an appropriate or moderate level of arousal. These findings fall in line with research suggesting that performance is at its peak at a moderate level of arousal (e.g., Yerkes & Dodson, 1908) and suggest that having a stress-is-enhancing mindset may assist in achieving that level. More research is needed to determine whether or not this moderate level of cortisol was indeed the most optimal with regard to enhancing performance and/or mitigating negative health conse-

⁸ "A" indicates that the value was adjusted for (subtracted from) Cortisol 1. Each measure adjusted for the first value on baseline day (Cortisol 1) to account for any stress effects of merely administering the salivettes for the first time.

⁹ Of note is that neither reappraisal nor suppression was significantly correlated with stress mindset, $r(55) = -.09, p = .27$, between SMM and the reappraisal subscale of the ERQ; $r(55) = .05, p = .36$, between SMM and the suppression subscale of the ERO. This is consistent with our theoretical proposition that stress mindset is distinct from reappraisal.

Table 5
Stepwise Regression of Perceived Stress, Cortisol and SMM on Desire for Feedback

Step and variable	<i>B</i>	<i>SE</i>	β	<i>R</i> ²	ΔR^2
Step 1				.08	
Age	-.02	.08	-.04		
Gender	-.34	.23	-.21		
Perceived Stress	-.01	.07	-.01		
AUC_Stress	.01	.01	.07		
ERQ_Reappraisal	.15	.12	.18		
ERQ_Suppression	.03	.08	.06		
Step 2				.17*	.09*
Age	-.02	.08	-.03		
Gender	-.32	.22	-.20		
Perceived Stress	.00	.07	.00		
AUC_Stress	.01	.01	.08		
ERQ_Reappraisal	.17	.11	.20		
ERQ_Suppression	.02	.07	.05		
SMM	.420	.19	.23*		

Note. ERQ = Emotion Regulation Questionnaire; AUC_Stress = Total Cortisol secreted on Stress Day; SMM = Stress Mindset Measure.

* $p < .05$.

quences, although several studies support this assertion (Hayes et al., 2004; Kunz-Ebrecht et al., 2003).

General Discussion

Taken together, these studies suggest that stress mindset is a distinct and influential variable in determining the stress response. Study 1 described the development of a measure (the Stress Mindset Measure, SMM) to assess individuals' beliefs about stress and demonstrated that stress mindset is conceptually distinct from variables that are traditionally proposed to influence the stress response, such as the amount of stress, one's appraisal of stress, and one's coping mechanisms. Further, Study 1 presented data suggesting that SMM is related to individuals' self-reported psychological symptoms and life satisfaction, over and above traditional stress-influencing variables such as the amount of stress and ability to cope with stress. Study 2 extended the findings of Study 1 by moving beyond a cross-sectional design to demonstrate that watching short film clips with factual information selectively oriented toward defining the nature of stress in one of two ways (stress-is-enhancing vs. stress-is-debilitating) could elicit corresponding changes in one's stress mindset. Changes toward a more enhancing mindset were associated with corresponding changes in self-reported psychological symptoms and work performance over time.

Study 3 provided a preliminary look at potential mechanisms behind the connection between mindset and psychological symptoms and work performance outcomes. Specifically, Study 3 demonstrated that stress mindset influences both the extent to which stress is psychologically experienced (cortisol response) and one manner in which stress is behaviorally approached (desire for feedback), two variables important in determining health and performance outcomes under stress. Taken together, these three studies, using an array of tools from social, clinical, and health psychology, support the general proposition that stress mindset may be an important variable in determining psychological symptoms and performance in the midst of stress.

Limitations and Questions of External Validity

It is important to note, however, that the measures included in our studies are only a small subset of a very large pool of measures pertaining to coping and stress. More research is needed to reliably determine the role of mindset in the mix of a long history of stress and coping research. Further research should address questions of external validity, such as for whom and for what types of stress are interventions directed toward stress mindset most effective. In Study 3, participants were given a stressful class assignment within the context of a university course. It may be the case that having to give a speech may be particularly amenable to enhancing outcomes. That said, Studies 1 and 2 found effects of stress mindset across a wide variety of stressors, suggesting that mindset may matter regardless of the nature and severity of the stress. This is theoretically important because it is distinct from the threat/challenge hypothesis and amount hypothesis, which hinge on the nature and severity of the stress in determining the stress response. Nevertheless, future studies should explore whether stress functions differently between different types of stressors (e.g., controllable vs. uncontrollable stressors, high vs. low intensity stressors, chronic vs. acute stressors; e.g., Penley et al., 2002). Furthermore, it may be important to note that Studies 1 and 2 consisted of participants who actively chose to be part of a stress management program, thereby suggesting that they wanted to change how they view or experienced stress. Future research is needed to determine whether stress mindset interventions would be effective in participants who were not actively seeking to change their response to stress.

Finally, although Study 3 began the process of investigating potential mechanisms through which stress mindset influences health and behavioral outcomes (e.g., by influencing desire for feedback and cortisol response to stress), it did not measure multiple outcomes and processes simultaneously. Therefore, it is essential that future research include multiple measures along the mechanistic pathway to more thoroughly understand the mediating forces linking mindset with health and performance outcomes.

Implications and Future Directions

This study expands the literature on mindsets by demonstrating that the mindset may also matter in the domain of stress. Stress is portrayed in a negative light in the news, the popular press, and the workplace. The intention of these depictions is to help prevent or stem the negative effects of stress: however, if the self-fulfilling nature of mindset exists, the result of such prophecy may be countereffective. Repetitive portrayals of stress in a negative light not only increase the possibility that we form the mindset that stress-is-debilitating but may also make it more likely that stress will trigger an automatic response that can result in harmful consequences.

That stress mindset may have simultaneous effects on behavior and health has important implications for stress management interventions. The traditional approach has been to intervene at each of the relevant variables, for example: relaxation techniques to change the biological responses to stress, cognitive restructuring techniques to change one's emotional or cognitive responses to stress, and social skills to increase the likelihood of social support in times of stress. The implications of these studies may lead to a more efficient approach—intervening at the level of mindset to provoke a chain of physiological and behavioral reactions, which will, in turn, improve health and performance outcomes.

Of prime importance, given these results, is the investigation of how individuals can change their stress mindsets to a more enhancing perspective. Two questions are important to consider. The first question is the degree of consciousness with which mindsets operate. In these studies, it is clear that participants were at least somewhat aware of the mindset elicitation because the SMM is a self-reported instrument. However, future research investigating implicit stress mindsets may be particularly illuminating, as it is likely to be the case that mindsets operate both within and without conscious awareness. A second question that is essential to consider is the extent to which mindsets must be strongly endorsed in order for them to be impactful. In Study 2, individuals in the “stress-is-enhancing” condition came to hold a more positive mindset about stress after watching selectively oriented film clips. It is possible that rather than subscribing to this mindset, they may have been motivated by demand to write what they thought was the appropriate answer or what they thought the experimenter was asking for. Future research should focus on how conflicting and paradoxical information will influence stress mindset and how stress mindset, at varying strengths of endorsement, differentially impacts stress-related outcomes.

It is important to restate here that the effects of stress can be debilitating or they can be enhancing: research supports both of these assertions. The intention of the current research is not to make the case that stress is fundamentally enhancing or to try to debunk the literature that demonstrates the debilitating effects of stress. Moreover, these findings do not suggest that coping with or reducing stress are necessarily ineffective strategies. Rather, what this research does suggest is that the mindset under which these strategies are adopted serves as an additional variable in determining the stress response and that different stress mindsets may render a constant level of stress more or less advantageous.

Final Words

For many years, the spotlight has been on stress's negative aspects, including detrimental health effects, loss of productivity, and depression. This interpretation may be well intended, but the result of such perspective may be countereffective. The findings of these studies indicate that people can be primed to adopt a stress-is-enhancing mindset, which can have positive consequences relating to improved health and work performance. This does not mean that people should seek out more stress. But, it does mean is that people may not need to focus single-mindedly on reducing their stress. The message of this research is ultimately a positive one: eliciting the enhancing aspects of stress (as opposed to merely preventing the debilitating ones) may be, in part, a matter of changing one's mindset.

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(Appendices follow)

Appendix A

Items and Instructions for the Stress Mindset Measure

Stress Mindset Measure–General (SMM-G)

Please rate the extent to which you agree or disagree with the following statements. For each question choose from the following alternatives:

- 0 = Strongly Disagree
- 1 = Disagree
- 2 = Neither Agree nor Disagree
- 3 = Agree
- 4 = Strongly Agree

1. The effects of stress are negative and should be avoided.
2. Experiencing stress facilitates my learning and growth.
3. Experiencing stress depletes my health and vitality.
4. Experiencing stress enhances my performance and productivity.
5. Experiencing stress inhibits my learning and growth.
6. Experiencing stress improves my health and vitality.
7. Experiencing stress debilitates my performance and productivity.
8. The effects of stress are positive and should be utilized.

Stress Mindset Measure–Specific (SMM-S)

What is the primary source of stress in your life right now?

In considering this particular stressor, please rate the extent to which you agree or disagree with the following statements. For each question choose from the following alternatives:

- 0 = Strongly Disagree
- 1 = Disagree
- 2 = Neither Agree nor Disagree
- 3 = Agree
- 4 = Strongly Agree

1. The effects of this stress are negative and should be avoided.
2. Experiencing this stress facilitates my learning and growth.
3. Experiencing this stress depletes my health and vitality.
4. Experiencing this stress enhances my performance and productivity.
5. Experiencing this stress inhibits my learning and growth.
6. Experiencing this stress improves my health and vitality.
7. Experiencing this stress debilitates my performance and productivity.
8. The effects of this stress are positive and should be utilized.

(Appendices continue)

Appendix B
Videos

Mindset	Debilitating	Enhancing
	Health and vitality	
Research Examples	<p>Herbert & Cohen, 1993; Sapolsky, 1996</p> <p>Stress as America’s number one health issue and cause of death</p> <p>Examples of stress being related to: heart disease, cancer, liver disease, diabetes, obesity, headaches/migraines, sleep disorders, drugs and alcohol abuse</p>	<p>Dienstbier, 1989; Epel et al., 1998</p> <p>Stress as a way to make people stronger</p> <p>Examples of benefits of stress on health and the body: building muscles, vaccinations and improved immunity (“physiological thriving”)</p>
	Learning and growth	
Research Examples	<p>Shapiro et al., 2000, 2007; Schneiderman et al., 2005</p> <p>Stress can lead to: irritability, emotional exhaustion, low morale/ self-esteem, loss of enjoyment, memory loss, fears</p> <p>Examples of high number of psychiatric visits and anti-depressants/anxiety medicine prescriptions in America due to stress, high percentage of worker burnout</p>	<p>Park & Hegelson, 2006; Park et al., 1996; Tedeschi & Calhoun, 2004</p> <p>Stress can enhance creativity, give new perspective, improve relationships, strengthen priorities, lead to post-traumatic growth</p> <p>Examples of people achieving in the face of adversity: John D. Rockefeller, Hewlett & Packard, Lance Armstrong</p>
	Performance and productivity	
Research Examples	<p>McEwen & Sapolsky, 1999; Schwabe & Wolf, 2010</p> <p>Stress can cause athletes to crumble at critical sports moments, doctors to make medical errors, high percentage of worker accidents on the job</p> <p>Examples of people failing to perform under stress: Kenneth Lay with Enron, George Bush with Hurricane Katrina</p>	<p>Cahill et al., 2003; Hancock & Weaver, 2005</p> <p>Stress can lead to skilled performance at risky moments: athletes succeeding at “clutch” moments, doctors performing life-saving surgery, fighter pilots</p> <p>Examples of historical leaders making remarkable decisions and actions in the face of stress: Lincoln, Gandhi, Churchill, pilot landing on the Hudson, bystander saving stranger on the subway</p>

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