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Improving Acute Stress Responses: The Power of Reappraisal

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Abstract

Contrary to lay beliefs, physiological changes that co-occur with stress are not necessarily bad. Much can be done during stressful experiences to promote adaptive responses. In this article, we review recent research on one method for improving acute stress responses: reappraising arousal. A growing body of research suggests that cognitive appraisals are powerful tools that help shift negative stress states to more positive ones. Arousal reappraisal instructs individuals to think of stress arousal as a tool that helps maximize performance. By reframing the meaning of the physiological signals that accompany stress, arousal reappraisal breaks the link between negative affective experiences and malignant physiological responses. We demonstrate how this approach can benefit physiological reactivity, attention, and performance and explore its potential applications.

Keywords

stress, reappraisal, emotion regulation, psychophysiology

Stress is ubiquitous in daily life and typically is a negative experience. Indeed, people devote considerable time and resources to reducing stress levels via regulatory behaviors, such as vacationing, exercising, or having some cocktails at the local pub. These efforts, however, do not change stressful experiences but rather provide an escape from day-to-day stressors. What are the options for coping with acute stress when escape is not possible? What can people do in the moment to modify the stressful experience? Research indicates that cognitive processes, particularly reappraisal, can shift negative stress to positive stress.

Background

Scientists have long believed that the mind and body are tightly linked, with changes in one directly affecting the other. Seminal work by Schachter and Singer (1962), for example, specified that cognitive processes, physiological signals, and situational cues interact to determine emotions. The idea that the mind and body operate in concert to produce psychological states is evident in current models of emotion. For instance, Conceptual Act Theory argues that appraisal transforms internal states into emotions by integrating bodily changes with external sensory information and knowledge of the situation (Barrett, 2006).

To understand how the body and mind work together, imagine you are a skier staring down a steep, icy slope with no other way off the mountain than plunging down this trail. Regardless of your affinity for skiing, this situation would likely elicit an increase in physiological arousal. Avid skiers might experience excitement, believing that they could handle the difficult trail, whereas novices would be more likely to experience fear if the difficulty of the trail were perceived to exceed their skill level. Thus, arousal is semantically and psychologically fuzzy (Blascovich, 1992). Our responses depend in large part on how a situation and our body's responses are construed.

The biopsychosocial model of challenge and threat offers an explanation of how appraisals and situations interact to shape stress responses (see Blascovich & Mendes, 2010, for a review). Both *challenge* and *threat* states are experienced during acute stress but differ in antecedent appraisal processes and downstream physiological responses. Individuals experience challenge when appraisals of personal resources exceed situational demands—like the expert skiers in the example above. Alternatively, threat manifests itself when perceived demands exceed resources. Although both states are accompanied by sympathetic activation, challenge is characterized by improved cardiac efficiency and dilation of the peripheral

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vasculature, whereas threat decreases cardiac efficiency and constricts the vasculature in anticipation of damage or defeat. Commonly held beliefs suggest that arousal experienced during stress is bad, but sympathetic activation may actually be greater during approach-motivated challenge states than during threat states. This notion is consistent with the idea of *physiological toughness*, which suggests that activation of the sympathetic nervous system (SNS) facilitates effective coping and improves performance in situations of acute stress (Dienstbier, 1989).

Using the biopsychosocial model of challenge and threat as a framework, recent studies have sought to improve acute stress responses by altering appraisals of arousal (e.g., Jamieson, Mendes, Blackstock, & Schmader, 2010; Jamieson, Nock, & Mendes, 2012a, 2012b). In this line of research, research participants are told that the physiological arousal experienced during stressful situations can be thought of as a resource that aids performance. Participants who reframe the meaning of the physiological signals that accompany stress as beneficial experience more positive outcomes than those who do not (Fig. 1).

Research on reappraising arousal has extended work on emotion regulation (Gross, 1998, 2002) and cognitive behavioral therapy (CBT; Hofmann & Smits, 2008). The underlying theme of these approaches is that changing cognitions produces downstream benefits. Reappraisal, as specified by emotion-regulation models, typically involves the reinterpretation of the affective meaning of contextual cues. In other words, emotionally charged stimuli are presented, and participants are instructed to reinterpret the stimuli (e.g., "The images are fake") or distance themselves from the stimuli (e.g., by adopting a third-person perspective; Kross & Ayduk, 2011; Ochsner & Gross, 2008). Clinical researchers developed CBT to help improve patient outcomes by modifying faulty affective responses and cognitions (Barlow, 2004). For instance, depressive patients are taught to identify errors in thinking (e.g., "Everyone hates me and always will") and replace them with more rational thoughts.

In the "classic" emotion-regulation literature, reappraisal has often (but not always) centered on decreasing sympathetic activation during passive tasks (e.g., Gross, 2002). Likewise, reappraisal in clinical research typically either decreases arousal (e.g., mindfulness meditation; Cincotta, Gehrman, Gooneratne, & Baime, 2011) or teaches individuals to accept arousal (e.g., interoceptive exposure; Levitt, Brown, Orsillo, & Barlow, 2004). Decreased SNS arousal might be adaptive

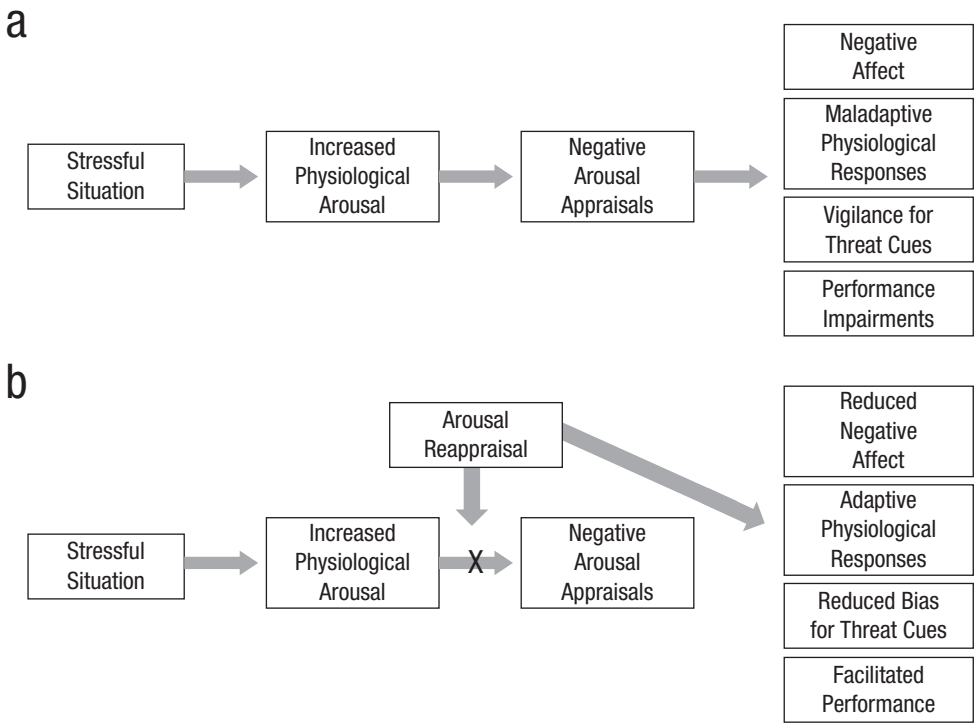

Fig. 1. The impact of stress on downstream outcomes and the effects of arousal reappraisal. As shown in panel (a), stressful situations are accompanied by increased physiological arousal, which is typically construed in a negative manner. These negative appraisals of arousal feed forward to produce myriad negative outcomes, including negative affect, maladaptive patterns of physiological reactivity, increased vigilance for threat cues, and impaired performance. As shown in panel (b), arousal-reappraisal manipulations break the association between stress-based arousal and negative appraisals. By severing this link, arousal-reappraisal techniques help shift negative stress states to more positive ones, leading to a reduction in negative affect, more adaptive patterns of physiological reactivity, reduced attentional bias for threat cues, and improved performance.

when no instrumental cognitive or physical responses are required, but during active tasks, increased SNS arousal can facilitate mobilization of oxygenated blood to the brain and periphery, thereby improving performance. Arousal reappraisal narrows in on acutely stressful events that require active responding *and* identifies bodily responses, specifically sympathetic arousal, as a coping tool. That is, arousal reappraisal seeks to alter cardiovascular responses so as to promote adaptive responding during acute stress (cf. Dienstbier, 1989; Mendes & Jamieson, 2011). It is not aimed at eliminating or dampening stress arousal but instead focuses on changing the *type* of stress response.

Psychophysiological Studies of Arousal Reappraisal

Initial examinations of arousal reappraisal have suggested that it can positively affect physiology, attention, and performance. In one study, we examined how reappraising arousal might alter cardiovascular functioning and attention during and after a stressful evaluative task (Jamieson et al., 2012a). After a resting baseline, participants were instructed that they were going to complete a public-speaking task (the Trier Social Stress Test; Kirschbaum, Pirke, & Hellhammer, 1993). Just prior to the task, we assigned one third of the participants to an arousal-reappraisal condition that consisted of instructions educating them on the functionality of stress responses and encouraged them to interpret arousal as a tool that aids performance; another third received a "placebo" intervention that described the best way to cope with stress was to ignore the source of that stress; and the remaining third were given no instructions. During the stressful task, reappraisal participants exhibited an approach-oriented physiological profile, indexed by less vasoconstriction and greater cardiac output, compared with participants assigned to the other conditions. Immediately after the public-speaking task, we assessed attentional bias (using an emotional Stroop task; Williams, Mathews, & MacLeod, 1996). Reappraisal participants exhibited less vigilance for threat cues than did participants in the other two groups.

Extending this study, we recently examined how arousal reappraisal facilitates recovery from stress (Jamieson et al., 2012b). Participants instructed to reappraise arousal not only exhibited more adaptive physiological responses during stress but also had their physiological responses return to baseline more quickly after the stressful situation, compared with no-instruction controls.

The benefits of arousal reappraisal also extend to high-stakes testing situations (Jamieson et al., 2010). We recruited students preparing to take the GRE to come to the laboratory for a practice GRE study. Half of the prospective test takers were informed that signs of physiological arousal (e.g., increased heart rate) that accompany testing situations predict better, not worse, performance. Before beginning the practice test, participants provided a saliva sample that was analyzed for alpha amylase, a nonspecific measure of sympathetic activation (Nater & Rohleder, 2009) that tends to covary with catecholamines (e.g., dopamine, epinephrine [adrenaline], and norepinephrine; Rohleder, Nater, Wolf, Ehlert, & Kirschbaum, 2004). Participants assigned to reappraise arousal exhibited an increase in alpha amylase and improvements in their performance on the quantitative section of the practice GRE, relative to no-instruction controls. One to three months after the laboratory session, participants returned to the lab with their score reports from the actual GRE. Compared with controls, reappraisal participants scored higher on the quantitative section of the actual GRE and reported that arousal on the day of the test had aided their performance. These findings demonstrate that a brief laboratory-based reappraisal manipulation may have sustained effects on stress appraisals and performance.

Taken together, the aforementioned research demonstrates that reappraising arousal as a coping tool during acutely stressful episodes that require instrumental responses can promote adaptive physiological responses, reduce attentional bias, and improve performance. However, the literature has yet to pin down the exact mechanisms of change. For example, in the GRE study, reappraisal participants exhibited long-term benefits, but we are uncertain of why the effects persisted. Reappraisal participants may have engaged in the same reappraisal they learned in the lab during the actual test, or their success in the lab may have reinforced studying and improved performance through learning. Future research should attempt to uncover when and why reappraisal might "stick."

Mechanisms and Moderators

Emotion regulation research has examined the neurological underpinnings of reappraisal processes, with the research suggesting a componential view (Ochsner & Gross, 2008). That is, specific brain regions map onto subprocesses of reappraisal. For example, areas of the medial prefrontal cortex allow individuals to consider what reappraisal instructions mean to them (Mitchell, Banaji, & Macrae, 2005). Additional areas of the prefrontal cortex then help develop a strategy to modulate activity (Ochsner, Bunge, Gross, & Gabrieli, 2002), and subsequent changes in the hippocampus and amygdala attenuate the release of corticotropin-releasing hormone (which stimulates the synthesis of adrenal hormones such a cortisol; Dedovic, Duchesne, Andrews, Engert, & Pruessner, 2009).

Further back in the temporal sequence, examining perceived resources and demands provides a look into how arousal reappraisal shifts perceptions of stress on an experiential level. Participants instructed to reappraise arousal reported that they possessed more resources to cope with a stressful public-speaking task than did participants given no instruction, but reappraisal did not influence appraisals of situational demands (Jamieson et al., 2012b).

In addition to identifying mechanisms, future research should consider moderators. For example, individual differences could determine the effectiveness of arousal reappraisal. Along these lines, individuals who are better able to reappraise situations so as to decrease their emotional impact exhibit

more adaptive responses to anger provocation compared with individuals low in reappraisal tendencies (Mauss, Cook, Cheng, & Gross, 2007; Schmader, Forbes, Zhang, & Mendes, 2009). Thus, some people might simply be better than others at applying reappraisal instructions.

Another variable to consider is *interoceptive accuracy*—the ability to perceive one's bodily changes (Critchley, Wiens, Rotshtein, Ohman, & Dolan, 2004). It is unclear whether individuals with high interoceptive accuracy would benefit more or less from arousal reappraisal. If sympathetic activation produces the improvements seen in our work (cf. Dienstbier, 1989), then accurate interoceptors may exhibit greater improvements than poor interoceptors because of their ability to perceive increases in sympathetic arousal (Werner, Duschek, Mattern, & Schandry, 2009). Conversely, stress and arousal tend to be negatively perceived, so good interoceptors may exhibit more rigid negative-arousal appraisals and be less inclined to "believe" reappraisal instructions. Alternatively, interoception may be unrelated to reappraisal, given that research has yet to show whether good interoceptors can differentiate types of stress.

Studying moderators will also help specify the conditions necessary for reappraisal effects to manifest themselves while highlighting limitations. One likely necessary condition is motivation. If individuals are disengaged, then altering arousal appraisals will not influence outcomes. To illustrate this point, in the GRE study (Jamieson et al., 2010), if we had recruited college freshmen for whom this particular test was not currently self-relevant, reappraisal may not have affected performance. In other words, the stakes must be high. Another limitation evident in the GRE study is that arousal reappraisal instructions benefited only quantitative performance; verbal performance was unaffected. Compared with verbal problems, math problems generally require more active processing. Thus, reappraisal may benefit performance only when active-processing demands are high.

Applications of Arousal Reappraisal

Reappraisal is a centerpiece of CBT. Some CBT methods even include giving individuals information about the evolutionary antecedents and adaptive functions of biological responses, as is evident in patient workbooks for anxiety and panic (e.g., Barlow & Craske, 2000). Arousal reappraisal can add to such approaches by including components that not only educate people about the functionality of biological responses to stress but also encourage the maintenance of adaptive levels of SNS activation during acute stress. As such, arousal reappraisal is best applied to psychopathology that is directly tied to stressful experiences for which sympathetic activation is needed for optimal performance, such as experiences associated with social anxiety disorder (SAD).

Individuals diagnosed with SAD exhibit chronic, debilitating impairments in stressful evaluative situations (e.g., dates, meetings at work, talks with strangers; Stein & Kean, 2000). Notably, people with SAD display a strong attentional bias for emotionally negative information and interpret ambiguous social situations as threatening (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007). As we have shown, arousal reappraisal attenuates threat vigilance, which may lessen the likelihood that anxious individuals will experience future situations as threatening. In fact, recently completed research (Jamieson et al., 2012b) has provided initial evidence that reappraisal can improve socially anxious individuals' responses to evaluative stress. Of course, additional work is needed to further explore potential clinical applications, but these initial results are promising.

More broadly, research on psychological treatments has primarily focused on improving patient outcomes rather than identifying mechanisms of change (Kazdin, 2011; Kazdin & Nock, 2003). That is, clinical trials typically test packages of techniques, not individual components, with careful measurement of immediate outcomes. So, although reappraisal is a primary component of CBT, we do not necessarily know how effective reappraisal is itself or, if reappraisal is effective, how it works. The paradigms and experimental procedures reviewed here can help researchers test putative mechanisms.

Finally, the translational implications of reappraisal have yet to be explored. The medical literature suggests that prevention is more effective than curative treatments (Leaf, 1993). Forestalling disease development is preferred to treating symptoms. In the work described here, reappraisal instructions were sufficient to alter affective, physiological, and cognitive processes. Given that adaptive responses to acute stress improve people's ability to cope with future stressors (Dienstbier, 1989), health education might seek to incorporate information about the functionality of stress. The potential for such an approach can be seen in research showing that a brief self-affirmation intervention at the outset of a semester improved students' classroom performance and reduced racial achievement gaps months and even years later (Yeager & Walton, 2011).

In sum, recent research on arousal reappraisal has taken seriously the idea that the body and mind interact reciprocally and that embodiment effects are situated in a broader context. Taking this work into a translational arena may have myriad benefits, including assisting clinical psychologists in identifying mechanisms of change in CBT, providing guidance to organizational and sports psychologists on improving performance, helping educational psychologists facilitate learning, and more.

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Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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