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Rethinking Butterflies: The Affective, Physiological, and Performance Effects of Reappraising Arousal During Social Evaluation

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This study examined the effects of reappraising stress arousal on affective displays, physiological responses, and social performance during an evaluative situation. Participants were sampled from across the social anxiety spectrum and instructed to reappraise arousal as beneficial or received no instructions. Independent raters coded affective displays, nonverbal signaling, and speech performance. Saliva samples collected at baseline and after evaluation were assayed for salivary alpha-amylase (sAA), a protein that indexes sympathetic activation. Arousal reappraisal participants exhibited less shame and anxiety, less avoidant nonverbal signaling, and performed marginally better than no instruction controls. Reappraisal participants also exhibited increased levels of sAA and increased appraisals of coping resources compared with controls. Furthermore, stress appraisals mediated relationships between reappraisal and affective displays. This research indicates that reframing stress arousal can improve behavioral displays of affect during evaluative situations via altering cognitive appraisals.

Keywords: stress, arousal, reappraisal, psychophysiology, social anxiety

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Succeeding in social evaluative situations is important for success in many aspects of a person's life. For instance, giving a presentation at work can impact performance reviews, promotions, and client satisfaction. Even asking a potential romantic partner out on a date involves presenting information about oneself and being subject to evaluation. Although self-presentational, evaluative situations are ubiquitous, people generally do not enjoy them. To illustrate, in public speaking situations people commonly report being unable to mask anxious feelings, stop their hands from shaking, or control their voice (Clark & Wells, 1995; Makkar & Grisham, 2011; Lundh et al., 2002). The research presented here examined affective responses to a stressful social evaluative situation in three domains: behavioral displays, physiological responses, and social performance.

Arousal and Emotion

Social evaluative pressures create acute task demands that targets must actively cope with. Thus, evaluation is frequently accompanied by increases in arousal as targets marshal coping resources. Arousal, however, can be a "fuzzy" term both psychologically (Blascovich, 1992) and physiologically (Jamieson, Koslov, Nock, & Mendes, 2013). Psychologically, elevations in arousal levels do not necessarily correspond to negative emotions, contrary to common beliefs (cf., Keller et al., 2012); rather, increases co-occur with a wide range of affective states (see Barrett, 2006 for a review). Physiologically, arousal is associated with activation of the sympathetic nervous system (SNS), and SNS arousal can accompany both adaptive and maladaptive response patterns (see Blascovich & Mendes, 2010 for a review). One means to assess SNS activation noninvasively is to measure levels of salivary alpha amylase (sAA), a protein that indexes sympathetic arousal (Rohleder & Nater, 2009) and tends to covary with catecholamine levels, particularly norepinephrine (Rohleder, Nater, Wolf, Ehlert, & Kirschbaum, 2004; Thoma, Kirschbaum, Wolf, & Rohleder, 2012).

Arousal, or activation, is a central component of most theoretical models of emotion, particularly psychological construction models and the process model of emotion regulation (e.g., Barrett, 2006; Gross, 1998). Both models posit that experienced emotions can be altered by changing the underlying "ingredients" occurring upstream that give rise to emotional experiences, and arousal is a primary ingredient. Conceptual act theory, specifically, argues that cognitive appraisal processes transform internal states into meaningful emotional experiences by integrating bodily signals (e.g., signs of arousal) with situational factors (e.g., evaluative pressure; Barrett, 2006). So, increases in arousal can lead to negative (e.g., anxiety or shame) or positive (e.g., excitement or joy) affective states depending on knowledge of the situation, contextual factors, and experience. Thus, improving cognitive appraisals of arousal has the potential to improve affective experiences, and individuals

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performing in social evaluative situations can be at an advantage if they appraise stress arousal positively instead of negatively.

Arousal Reappraisal

A growing body of research indicates that encouraging people to reinterpret stress arousal as functional can improve outcomes (Crum, Salovey, & Achor, 2013; Jamieson, Mendes, Blackstock, & Schmader, 2010; Jamieson, Mendes, & Nock, 2013; Jamieson, Nock, & Mendes, 2012, 2013). Specifically, *arousal reappraisal* instructs individuals that the physiological arousal experienced during stress is not harmful, but rather can be conceived of as a coping resource that aids performance. This perspective builds directly on reappraisal research from the emotion regulation literature (Gross, 1998, 2002).

Reappraisal as conceptualized in classic emotion regulation research typically involves reinterpreting the meaning of situational cues or self-distancing (e.g., adopting a third-person perspective; Kross & Ayduk, 2011; Ochsner & Gross, 2008). That is, reappraisal processes commonly focus on reinterpreting the situation or one's place in it, not internal bodily states. This often (but not always: Mauss, Cook, Cheng, & Gross, 2007) decreases SNS arousal (Gross, 2002). However, rather than seeking to downregulate arousal or emotional intensity to improve affective outcomes, arousal reappraisal focuses on changing cognitive appraisals of stress arousal so as to promote adaptive high-arousal affective states.

The distinction between arousal reappraisal and other reappraisal techniques is rooted in situational factors. In contexts that do not require motivated or instrumental responding, SNS arousal serves little function. There is no need to marshal resources to actively cope with demands. For example, viewing images or videos does not require individuals to engage in active responding, and reappraising situational cues or one's placement in the situation is advantageous (e.g., Dillon, Ritchey, Johnson, & LaBar, 2007; Gross, 2002; Hajcak & Nieuwenhuis, 2006). In fact, research that has examined the effects of situational reappraisal and self-distancing frequently (but not always: Ayduk & Kross, 2010, Study 3) asks participants to view images/videos, consider hypothetical scenarios, or recall emotionally relevant events (e.g., Dillon et al., 2007; Goldin, McRae, Ramel, & Gross, 2008; Ochsner, Bunge, Gross, & Gabrieli, 2002). Arousal reappraisal, on the other hand, would not be advantageous in such situations because SNS activation is not functional. Instead, arousal reappraisal focuses on situations of acute stress, such as public speaking, interviewing for a job, or taking a high-stakes exam. In these contexts, SNS arousal can be beneficial because the individual must engage in motivated behavior to actively cope with task demands.

The extant literature suggests that reinterpreting signs of arousal can improve physiological and cognitive responses to acute stress (see Jamieson, Mendes, et al., 2013, for a review). For instance, during a stressful task, participants instructed to reinterpret arousal as a coping tool exhibited decreased vasoconstriction and increased cardiac efficiency—indicative of more adaptive stress responses—compared with placebo controls; and after stress, arousal reappraisal participants were less vigilant for emotionally negative cues than controls (Jamieson et al., 2012). Other research highlights the potential benefits of reframing stress arousal for academic performance. Compared with no instruction controls, arousal reappraisal participants performed better on the quantitative section of the GRE in the laboratory. Then, 1 to 3 months later, participants provided their actual score reports from the Graduate Record Examinations (GRE) exam. Again, arousal reappraisal participants outperformed controls on the quantitative section (Jamieson et al., 2010). However, the effects of arousal reappraisal on social performance and the visible bases of evaluations—affective displays and nonverbal signaling—remain unclear. The research presented here sought to address this gap in the literature.

The Current Study

The primary goal of this research was to test the efficacy of reappraising arousal to improve affective displays and social performance during evaluative stress. Affective displays play an integral role in shaping interpersonal communication, evaluations of others, and social performance (e.g., Hall et al., 2005; Keltner & Haidt, 1999; Keltner & Kring, 1998; Tangney et al., 2013). For instance, negative affect has been found to mediate relationships between dysfunctional group behavior and worse social performance outcomes (Cole, Walter, & Bruch, 2008) and is associated with impaired job performance (Janssen, Lam, & Huang, 2010). Moreover, the affective signals conveyed by business leaders predict future firm performance (Mayew & Venkatachalam, 2012). Thus, it is important to delineate how emotion regulation strategies such as arousal reappraisal impact behavioral displays of affect.

To assess the effectiveness of the arousal reappraisal manipulation, we examined physiological and behavioral responses to a social evaluative task with a public speaking component: the Trier Social Stress Test (TSST; Kirschbaum, Pirke, & Hellhammer, 1993). We expected participants assigned to reappraise stress arousal as functional and adaptive would perform better on their speeches, display less negative affect (particularly anxiety and shame), and exhibit increased levels of sAA (indicative of high SNS arousal; Thoma et al., 2012) compared with no instruction controls.

A secondary aim of this research examined the effects of social anxiety on outcomes. Research has yielded mixed social performance findings across anxiety level. For example, general deficits have been observed during evaluative situations in socially anxious versus less anxious samples (e.g., Cody & Teachman, 2011; Levitan et al., 2012). However, other studies found deficits only during one-on-one conversations (Voncken & Bögels, 2008). Here, we tested the effects of anxiety across multiple indexes of social performance: affective displays and speech performance in an evaluative setting that required participants to present material to an audience. Additionally, we tested the efficacy of arousal reappraisal in a highly socially anxious sample (cf., Jamieson et al., 2013). Highly anxious participants were expected to perform more poorly on the speech and display more negative affect compared with less anxious individuals. We did not expect the effectiveness of the reappraisal manipulation to differ as a function of anxiety. All participants were hypothesized to benefit from reappraisal instructions.

Method

Sample Size Estimation

A power analysis was conducted to estimate the number of participants needed to test hypotheses. Effect sizes were calculated from published arousal reappraisal data focusing on physiological (autonomic) and performance effects. Using an average of these effect sizes ($d = .76$) and a target power level of .80, we required a minimum of 21 participants per cell in the 2 × 2 design (minimum total $N = 84$).

Participants

Eighty-five community members (56 female; 57 White, seven Black, 12 Asian, seven Hispanic, two "Mixed/Other") were recruited from the Cambridge, MA area ($M_{age} = 25.06$ years) via Harvard University's online study pool system (SONA), advertisements on Craigslist.org, and flyers posted in the area.[1] Participants were prescreened and excluded for physician-diagnosed hypertension, medications impacting neuroendocrine functioning, body mass index scores > 33, or pregnancy/breast-feeding. Sessions were completed with start times from 12 p.m.–6 p.m. Participants were compensated $25.

The socially anxious group ($n = 42$) consisted of individuals meeting the criteria for social anxiety disorder (SAD) as determined by the Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998). Nonanxious controls ($n = 43$) also completed the MINI and did not meet criteria for anxiety/mood disorders. There were no differences between anxiety or intervention groups on age, sex, or race/ethnicity, Fs < 1.

Procedures

Upon arrival, participants provided consent and a baseline saliva sample, followed by initial questionnaires. Participants were then randomly assigned to receive reappraisal instructions or no instructions. Reappraisal instructions informed participants about the functionality of stress arousal. Participants were first told:

> In stressful situations, like public speaking, our bodies react in very specific ways. The increase in arousal you may feel during stress is not harmful. Instead, these responses evolved to help our ancestors survive by delivering oxygen to where it is needed in the body. We encourage you to reinterpret your bodily signals during the upcoming public speaking task as beneficial.

After verbal instructions, participants read summaries (via MediaLab software) of three scientific articles (all real, but modified to closely match the message conveyed) outlining the adaptive benefits of stress during performance situations. Each summary was followed by two questions that required participants to endorse the information before moving on. Reappraisal instructions were designed to increase perceptions of coping resources. So as not to disrupt timing of saliva samples, no instruction participants completed a driving game (Mather, Gorlick, & Lighthall, 2009) to control for time. Research shows that this driving game does not significantly impact stress appraisals, physiological responses, or cognitive control compared with placebo control instructions (Jamieson et al., 2012). After instructions/the game, participants were given 3 min to prepare for their speech.

As specified by the TSST paradigm, participants delivered a 5-min videotaped speech about their strengths and weaknesses to two evaluators who provided negative nonverbal feedback (e.g., furrowed brow, frowning, etc.). After the speech, participants performed an impromptu 5-min mental arithmetic task (counting backward in steps of seven from 996), while the evaluators again provided negative nonverbal feedback.

Self-Report Measures

Anxiety. To assess trait social anxiety, participants completed the Interaction Anxiousness Scale (IAS; Leary & Kowalski, 1993) prior to TSST instructions. Participants also completed a general anxiety scale, the Beck Anxiety Inventory (BAI; Steer & Beck, 1997). Scales were analyzed separately.

Stress appraisals. Before beginning the TSST, participants completed a resource/demand appraisal questionnaire (Mendes, Gray, Mendoza-Denton, Major, & Epel, 2007). We computed a ratio of coping resources and task demands such that higher scores indicate greater resources relative to demands.

Behavioral Measures

Three raters blind to anxiety level and instruction condition coded videotaped speeches for affective displays, nonverbal signaling, and overall speech performance. We focused on displays of shame and anxiety because these high-arousal negative affective states are frequently observed during tasks involving public speaking (e.g., Egloff, Schmukle, Burns, & Schwerdtfeger, 2006; Jamieson, Koslov, et al., 2013).

Interrater reliabilities were good to excellent. Individual items were scored on scales ranging from 1–5, except for self-handicapping statements, which were dummy-coded as 5 if participants made any and 1 if participants made none. For individual items, intraclass correlations (two-way mixed model, absolute agreement) ranged from 0.71 to 0.94 (M intraclass correlation coefficient (ICC) = 0.85). One item, how "defensive" participants appeared, had low reliability (0.45) and was excluded from analyses. Additional information and individual ICCs are presented in the supplemental online material (SOM).

Affective displays. Composites were computed for shame and anxiety affective displays. Reliability was excellent for both (shame: Cronbach's alpha = .91, anxiety: $\alpha = .97$). The shame composite consisted of self-handicapping statements; how embarrassed, ashamed, and disengaged participants appeared; and a reverse-scored assessment of how confident the participant appeared. Many of items were global assessments of affect, and so were not operationalized to discrete behaviors. Self-handicapping was defined as a specific statement made that indicated weakness or an apology for performance (e.g., "Sorry, I am really bad at this"). The anxiety composite included how nervous and anxious the participant appeared, as well as a reverse-scored item assessing the participant's comfort level during the speech.

Nonverbal signaling. The nonverbal signaling composite ($\alpha = .72$) included measures of eye contact, smiling, gestures,

[1] The anxiety and stress appraisal self-reports from 73 participants (of the total sample of 85) appeared in a prior study (Jamieson, Nock, & Mendes, 2013), but none of the behavioral and physiological measures appeared in that research.

fidgeting (reverse-scored), and three items related to body orientation: tense versus loose, closed versus open, and leaning forward versus back (reverse-scored). Lower scores indicated more avoidant signaling. For instance, participants scoring highly on this composite would make eye contact with the evaluators and smile, use frequent, appropriate hand gestures to emphasize points, barely fidget (e.g., kicking feet, twirling hair), lean back with arms spread apart and shoulders down and relaxed, and make fluid movements.

Speech performance. Raters judged participants' overall speech performance at each minute to reduce primacy/recency effects. An average of the minutes indexed overall speech performance. Excellent reliability was observed across minutes ($\alpha = .97$).

Physiological Measure

Saliva samples (1 ml) were taken at baseline and again immediately after the TSST. After collection, samples were stored at −30 °C in a locked medical freezer. Upon study completion, samples were packed in dry ice and shipped to the Laboratory for Biological and Health Psychology (Brandeis University, Waltham, MA) to be assayed for sAA. Analyses focused on changes from baseline (i.e., reactivity).

Results

Data Analysis Plan

Data were analyzed in 2 (Social Anxiety: SAD vs. less anxious) × 2 (Instruction: reappraisal vs. no instruction) between-subjects ANOVAs unless otherwise noted. Due to experimenter error, two participants did not fully complete self-report measures. One participant's speech was not recorded because of equipment problems and was excluded from behavioral analyses. Two socially anxious participants chose to terminate the study early (one no instruction control, one reappraisal participant) and were not analyzed. Finally, due to an insufficient saliva sample, sAA could not be assayed from three participants (two socially anxious, one nonanxious, all in the no instruction group).

Self-Report Measures

Anxiety. Self-reports of anxiety were first analyzed in a 2 (Social Anxiety) × 2 (Instruction) multivariate ANOVA (MANOVA) model. Reports were standardized as z-scores and then entered simultaneously. Consistent with predictions, we observed a multivariate main effect for social anxiety, Wilks' $\lambda = .978$, $F(2, 78) = 136.23$, $p < .001$, $\eta_p^2 = .777$. Across anxiety measures, SAD participants reported more anxiety than the less

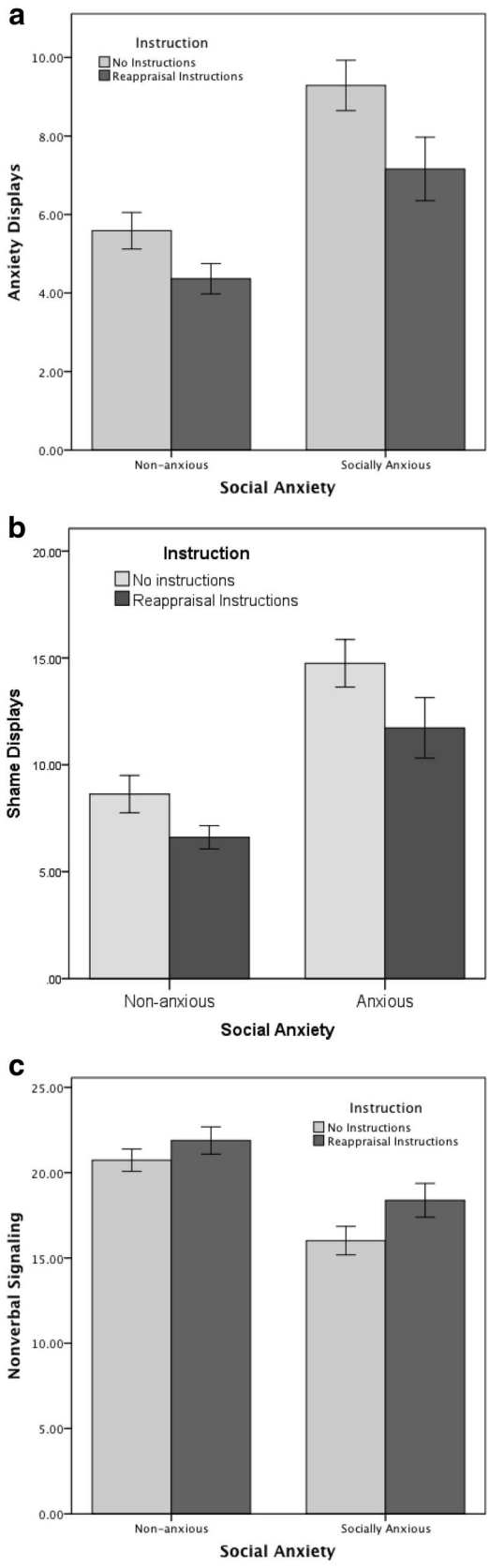

Figure 1 (opposite). a. Anxiety displays as a function of social anxiety and instruction condition. Error bars represent +/− standard error of the mean. b. Shame displays as a function of social anxiety and instruction condition. Error bars represent +/− standard error of the mean. c. Nonverbal signaling as a function of social anxiety and instruction condition. Higher nonverbal signaling scores reflect more approach-oriented nonverbal signals. Error bars represent +/− standard error of the mean.

anxious group. No other multivariate effects approached significance, Fs < 1.

Univariate tests of raw measures indicated that SAD participants reported more anxiety on the BAI ($M = 1.47$, $SD = .61$) than less anxious individuals ($M = .35$, $SD = .41$), $F(1, 79) = 38.01$, $p < .001$, $d = 1.39$. Likewise, the SAD group reported high levels of social anxiety on the IAS ($M = 4.17$, $SD = .46$) than controls ($M = 2.42$, $SD = .49$), $F(1, 79) = 275.94$, $p < .001$, $d = 3.73$. Again, no differences emerged as a function of instruction condition nor were interactions significant, Fs < 1.

Stress appraisals. Participants assigned to reappraise arousal demonstrated more positive stress appraisals (more resources relative to demands; $M = 1.59$, $SD = .94$) relative to no instruction controls ($M = 1.22$, $SD = .59$), $F(1, 80) = 6.96$, $p = .01$, $d = .47$. SAD participants reported more negative stress appraisals ($M = .99$, $SD = .48$) compared with less anxious individuals ($M = 1.87$, $SD = .84$), $F(1, 80) = 37.01$, $p < .001$, $d = 1.29$. The interaction did not reach significance, $F < 1$.

Behavioral Measures

Shame displays, anxiety displays, nonverbal signaling, and speech performance were correlated, rs $> .58$, ps $< .001$. Thus, behavioral measures were first analyzed in a 2 (Social Anxiety) $\times$ 2 (Intervention) MANOVA model. Measures were standardized (z-scores), and shame displays (reverse-scored), anxiety displays (reverse-scored), nonverbal signaling, and speech performance were entered as dependent variables.

Consistent with predictions, we observed a multivariate main effect for instruction condition, Wilks' $\lambda = .868$, $F(4, 77) = 2.92$, $p = .026$, $\eta_p^2 = .132$. Participants assigned to reappraise stress arousal exhibited improved behavioral affective outcomes. The MANOVA also revealed a significant multivariate main effect for anxiety, Wilks' $\lambda = .657$, $F(4, 77) = 10.06$, $p < .001$, $\eta_p^2 = .343$. Across measures, the socially anxious group exhibited worse outcomes than the less anxious group. The multivariate Anxiety $\times$ Intervention interaction did not approach significance, $F < 1$. For ease of interpretation and to provide more detailed examinations of behavioral effects, univariate analyses for raw measures are presented below.

Affective displays. Analyses of displays revealed main effects for instruction condition on both anxiety, $F(1, 80) = 7.83$, $p = .006$, $d = .63$, and shame, $F(1, 80) = 5.91$, $p = .017$, $d = .54$. Reappraisal participants displayed less anxiety and shame than no instruction controls (see Figure 1). Moreover, SAD participants displayed more anxiety, $F(1, 80) = 29.43$, $p < .001$, $d = 1.21$, and shame, $F(1, 80) = 29.34$, $p < .001$, $d = 1.21$, compared with less anxious controls.

Nonverbal signaling. As shown in Figure 1c, participants instructed to reappraise arousal engaged in more approach-oriented nonverbal signaling compared with controls, $F(1, 80) = 4.51$, $p = .037$, $d = .48$. Less anxious participants also engaged in more approach-oriented nonverbal signaling than SAD participants, $F(1, 80) = 24.52$, $p < .001$, $d = 1.11$.

Speech performance. Analysis of speech performance produced a marginal main effect for instruction, $F(1, 80) = 3.62$, $p = .061$, $d = .43$, and a main effect for social anxiety, $F(1, 80) = 15.03$, $p < .001$, $d = .87$. Participants who received reappraisal instructions performed marginally better ($M = 3.61$, $SD = .96$) than no instruction controls ($M = 3.25$, $SD = .91$). SAD participants performed more poorly on the speech ($M = 3.06$, $SD = 1.05$) than less anxious participants ($M = 3.80$, $SD = .66$).

In none of the univariate behavioral analyses reported above did the Instruction $\times$ Anxiety interaction approach significance, Fs < 1.

Physiological Reactivity

We first analyzed raw sAA levels at baseline to examine whether group differences might have obscured reactivity effects. We observed no baseline differences as a function of instruction or social anxiety, and the interaction was not significant, Fs < 1.

After finding no baseline differences, we examined reactivity and observed a main effect for instruction, $F(1, 78) = 7.07$, $p = .01$, $d = .59$. Participants who received reappraisal instructions exhibited greater sAA increases in response to the TSST ($M = 75.97$, $SD = 67.89$) than no instruction controls ($M = 40.33$, $SD = 51.09$). Consistent with autonomic research (Jamieson, Mendes, et al., 2013) and research on sAA reactivity in children with SAD (Krämer et al., 2012), we observed no differences as a function of anxiety level, $F < 1$. The interaction was also not significant, $F(1, 78) = 1.68$, $p = .199$.

Mediation

Mediation analyses explored the mechanism(s) through which arousal reappraisal impacted affective responses. Specifically, we hypothesized a priori that arousal reappraisal would function to improve affective display outcomes by increasing appraisals of coping resources relative to task demands. Following the procedures outlined by Kenny, Kashy, and Bolger (1998), we found that resource/demand appraisals mediated the relationships between instruction condition and affective displays of anxiety, Goodman $Z = -2.03$, $p = .04$ (see Figure 2a), and displays of shame, Goodman $Z = -2.12$, $p = .03$ (see Figure 2b).[2]

Discussion

This research examined the effects of reappraising arousal during a stressful evaluative task on affective outcomes. Perhaps the most interesting findings were the "across the board" improvements that resulted from the reappraisal instructions. Participants instructed to reframe stress arousal as beneficial displayed less negative affect (anxiety and shame), engaged in less avoidant nonverbal signaling, and performed an evaluative speech marginally better compared with controls. The behavioral findings suggests arousal reappraisal cannot only benefit cardiovascular and cognitive outcomes (Jamieson et al., 2013), but may also help improve social-interactive outcomes (i.e., displays of affect and social performance) in evaluative situations.

[2] As specified by psychological construction and emotion regulation models, appraisals are proximal determinants of affective responses. Thus, the relatively larger effect sizes for the stress appraisal-affective display associations (see mediation tests) relative to the effect size for the experimental effect of intervention condition on appraisals is consistent with theoretical models. Moreover, the effect sizes for instruction-outcome effects are diluted by individual differences, whereas the appraisal-outcome relationship captures this source of variance.

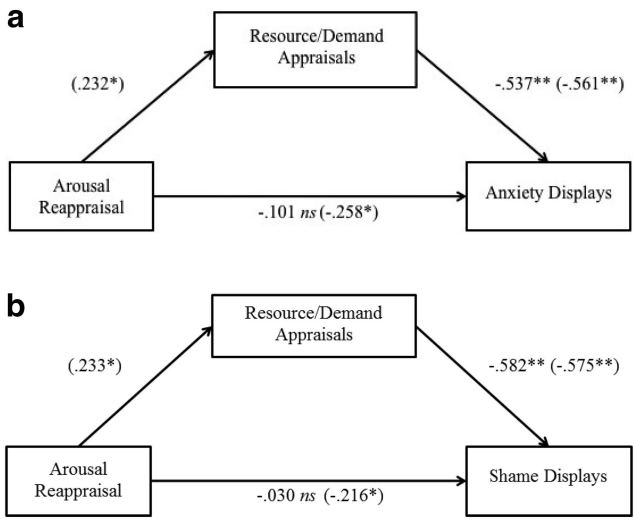

Figure 2. a. The ratio of appraisals of coping resources to task demands as a mediator of anxiety displays. Coefficients in parentheses indicate zero-order correlations. Coefficients not in parentheses represent parameter estimates for a recursive path model including both predictors. Instruction condition is dummy coded (1 = reappraisal instructions, 0 = no instructions). * $p < .05$. ** $p < .001$. b. The ratio of appraisals of coping resources to task demands as a mediator of shame displays. Coefficients in parentheses indicate zero-order correlations. Coefficients not in parentheses represent parameter estimates for a recursive path model including both predictors. Instruction condition is dummy coded (1 = reappraisal instructions, 0 = no instructions). * $p < .05$. ** $p < .001$.

The arousal reappraisal instructions also elevated levels of sAA in response to social stress compared with controls. Thus, the improvements observed as a function of reappraisal were achieved without attenuating SNS activation. In fact, reappraisal participants exhibited *increased* sympathetic activation relative to no instruction controls. This pattern of findings fits nicely with up-regulation methods of emotion regulation (see Webb, Miles, & Sheeran, 2012, for a review). That is, these data suggest affective outcomes can be improved by maintaining or up-regulating emotional intensity (i.e., arousal)—provided SNS activation is adaptive in the situation. The physiological findings are also interesting given the association between sAA and catecholamines (e.g., Thoma et al., 2012) because physiological toughness models suggest a positive association between endogenously generated catecholamines and performance (cf., Dienstbier, 1989).

Finally, participants assigned to reappraise arousal reported higher levels of coping resources relative to task demands than controls. These improved stress appraisals then mediated associations between the instruction condition and behavioral displays of affect. Thus, consistent with psychological construction and emotion regulation models (e.g., Barrett, 2006; Gross, 2002), cognitive appraisal processes were proximal determinants of downstream affective outcomes.

We also observed interesting social anxiety findings. First, the effects of the reappraisal instructions did not differ as a function of anxiety level. Both SAD and less anxious participants benefited from reinterpreting stress arousal as a coping tool across all measures. However, main effects for anxiety level indicated that SAD was associated with more negative affective displays, avoidant nonverbal signaling, and worse performance relative to less anxious participants. These assessments mirror perceptions of "real world" social functioning in SAD (Depp et al., 2010). Furthermore, cognitions were in line with behavior; socially anxious individuals reported possessing fewer coping resources relative to task demands than less anxious participants.

Interestingly, triangulating the self-report, behavioral, and physiological data highlighted a disjunction among systems in socially anxiety. Physiologically, SAD and less anxious individuals responded similarly, but SAD individuals exhibited worse behavioral outcomes. This implies that socially debilitating effects of social anxiety may be driven by "top-down" cognitive factors. Specifically, the negative effects of social anxiety on behavioral measures in the SAD group were likely tied to maladaptive appraisal processes rather than elevated SNS arousal. Consistent with this idea, post hoc correlations indicate that more negative stress appraisals in the SAD group were associated with increased displays of shame ($r = -.49$, $p = .001$) and anxiety ($r = -.51$, $p = .001$), and impaired speech performance ($r = .40$, $p = .011$; the appraisal-nonverbal display correlation was not significant, $r = .18$, $p = .273$). On the other hand, none of the sAA-behavioral correlations were significant, $ps > .06$. In fact, the only marginal effect was opposite to the expected direction: *Increased* sAA was marginally associated with *fewer* shame displays ($r = -.29$).

Given the important role appraisal processes play in determining affective responses, it is not surprising that cognitive–behavioral therapy (CBT) treatments that incorporate reappraisal techniques are effective for improving outcomes in anxiety disorders (see Hofmann & Smits, 2008, for a review). As touched on previously, however, situational factors should be considered when determining the potential effectiveness of specific reappraisal-based approaches. To illustrate, an individual with SAD may experience sympathetic arousal when eating at crowded restaurants. In such situations, it is not advantageous to reinterpret the arousal as a coping tool. Instead, a more effective approach is to reappraise contextual factors (i.e., "those people are not actually watching me") or to let the arousal "wash over" them and subside. Alternatively, arousal reappraisal may be effective when the same SAD individual is interviewing for a job because in that instance SNS arousal can aid performance. Arousal reappraisal and cognitive restructuring components of CBT, however, work through similar mechanisms. In fact, *resource-oriented CBT* specifically encourages patients to focus on their strengths and resources, and has been shown to be an effective treatment for SAD (Willutzki, Teismann, & Schulte, 2012).

Several important limitations should be considered when interpreting these data. First, it is possible that comorbid depression moderates the effects observed here. Although efforts were made to control for depression, depressive symptoms were not measured so we cannot quantify what effect, if any, comorbid depression may have had. In fact, examining depressive symptoms as a moderator of behavioral responses to social evaluation would be an interesting area for future research, considering anxiety is predictive of subsequent depression (Starr & Davila, 2008). The cross-sectional nature of the research should also be considered. Participants completed a single evaluative laboratory task. This leaves unanswered questions of duration and generalizability. However, similar arousal reappraisal instructions have been asso-

ciated with improved test performance both in the laboratory and months later (Jamieson et al., 2010). Future research might seek to study the effects of arousal reappraisal in subsequent evaluative situations outside the laboratory.

Channeling cognitions to improve affect and social functioning in evaluative situations is an important, albeit difficult, endeavor. That is, negative affect is not only unpleasant, but also elicits negative judgments from others, which can impair occupational and educational outcomes. The results presented here indicate that simply changing the way we think about stress arousal can help improve affective responses in social evaluative situations. Traditional programs for improving public speaking and performance on high stakes exams commonly tout the benefits of relaxation and down-regulating emotional intensity. However, these data suggest program developers might also seek to teach individuals to embrace stress arousal as a coping tool to facilitate their social performance.

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