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Brief Report

The effects of trait reappraisal and suppression on anger and blood pressure in response to provocation

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ABSTRACT

Given the many negative consequences of unrestrained anger, understanding successful anger regulation is of critical importance. The present study investigated the effects of two common emotion regulation strategies, *cognitive reappraisal* and *expressive suppression*, on self-reported anger and blood pressure. Fifty undergraduate women were insulted by a fictitious participant. Those high in trait reappraisal showed attenuated anger and blood pressure in response to the provocation. These relationships persisted even when controlling for negative emotionality. The results suggest that changing the habitual way in which individuals respond to anger-inducing events could be an important component of anger regulation interventions.

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1. Introduction

Managing emotional impulses is necessary in order to pursue important life goals and function adaptively in social contexts. The process by which individuals influence what emotions they have and how they experience and express them is known as emotion regulation (Gross, 1998). Although healthy emotion regulation in general can be beneficial, it is especially important that anger can be effectively regulated in daily life (Mauss, Cook, Cheng, & Gross, 2007). Unrestrained anger can lead to severe consequences such as verbal attacks, physical and sexual assaults, and domestic violence. Successful anger regulation is related to positive psychological health outcomes (e.g., Chemtob, Novaco, Hamada, Gross, & Smith, 1997), whereas the frequent experience of anger has been implicated in physical health problems, most notably cardiovascular disease (Friedman & Booth-Kewley, 1987). Surprisingly, despite the prevalence of anger and the problems associated with it, with two notable exceptions (Mauss et al., 2007; Ray, Wilhelm, & Gross, 2008), there is a lack of empirically rigorous, systematic research on the regulation of anger.

A prominent model of emotion regulation that has received substantial empirical support over the last decade is Gross' (1998) process model of emotion regulation. At the broadest level, the process model distinguishes between *antecedent-focused* and *response-focused* strategies (Gross, 2001). Antecedent-focused strategies are initiated *before* response tendencies have been generated which can influence behaviour and physiological responses

(Gross, 2001). Response-focused strategies on the other hand, are initiated *after* the response tendencies have already been elicited (Gross, 2001).

Cognitive reappraisal is an *antecedent-focused* strategy that involves changing the way one thinks about a potentially emotion-eliciting situation in order to reduce its emotional impact. For example, rather than being angered by a colleague's rude comment, one might reinterpret their behaviour as a sign of tiredness rather than a personal attack. By contrast, *suppression* is a *response-focused* strategy that involves inhibiting ongoing emotional expression (Gross, 1998). For example, a person might attempt to appear unaffected by the rude comment, despite experiencing anger.

The process model predicts important differences in how reappraisal and suppression affect emotional experience. Because reappraisal occurs early in the emotion generative process and intervenes before the emotion is fully elicited, this strategy should reduce the experiential, expressive, and physiological aspects of a negative emotion (Gross, 1998). In comparison, suppression occurs later in the emotion generative process and primarily targets and reduces the expression of emotion. Therefore, suppression should have little or no impact on the subjective emotional experience (Gross, 1998). Furthermore, because of the effort involved in inhibiting ongoing emotion-expressive behaviour, suppression may lead to an undesirable increase in physiological responding (Gross, 1998; Mauss et al., 2007). Outside of the anger arena, reappraisal effectively decreases the experience of negative emotions in response to distressing visual stimuli, without leading to maladaptive increases in physiological responding (e.g., Gross, 1998; Richards & Gross, 2000). By contrast, suppression is ineffective in reducing the intensity of negative emotions such as disgust,

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sadness, and embarrassment, and sometimes increases sympathetic activation of the cardiovascular system (Gross & Levenson, 1993; Harris, 2001).

Reappraisal and suppression are also associated with psychological health in distinct ways. Specifically, trait reappraisal is associated with enhanced emotional and interpersonal functioning, whereas trait suppression is associated with worse functioning in these important life domains (Gross & John, 2003). A related conceptual issue is that the effects of these regulatory strategies should be disentangled from the consequences of general psychological symptoms such as depression and anxiety. Gross and John (2003) found that trait reappraisal was inversely associated with neuroticism and the experience and expression of negative emotion. Conversely, suppression was positively associated with negative emotion and inversely associated with positive affect and extraversion. These findings underscore the importance of controlling for general negative emotionality when examining the impact of habitual emotion regulation style.

Because anger has a strong underlying cognitive appraisal component (e.g., Baumeister, Stillwell, & Wotman, 1990) it should be especially amenable to cognitive strategies such as reappraisal. Surprisingly, in the context of anger, only two studies to date have investigated reappraisal, and no study has investigated the effects of suppression. Mauss et al. (2007) examined the effect of trait reappraisal on state anger following a laboratory provocation. Compared to participants who were low in reappraisal, those high in reappraisal reported less anger and less negative affect in general, as well as more adaptive cardiovascular responses (Mauss et al., 2007). The second study compared the effects of induced rumination and reappraisal on anger after recalling an anger-inducing autobiographical event (Ray et al., 2008). Participants who were induced to reappraise reported less anger and exhibited smaller increases in sympathetic reactivity compared to participants who were instructed to ruminate.

Although these studies suggest that reappraisal is indeed an adaptive strategy for anger regulation, methodological considerations limit their conclusions. While Mauss and colleagues (2007) investigated the consequences of naturally occurring differences in the use of reappraisal, they did not examine individual differences in the use of suppression. In addition, Mauss et al. (2007) interpreted their findings as suggesting that individuals high in trait reappraisal responded more adaptively to a challenging situation without controlling for the possibility that group differences were simply the manifestation of general negative emotional styles. The study by Ray and colleagues (2008) did not include a control condition, which precludes clarification of whether reappraisal was beneficial or rumination was harmful.

With these issues in mind, we assessed individual differences in trait use of reappraisal and suppression and examined the impact of these strategies on anger experience and physiological reactivity following an anger-provoking event. To our knowledge this study is the first to examine the effects of reappraisal and suppression in the context of a direct provocation. Anger was assessed through self-report and blood pressure responses. Blood pressure was the chosen index of physiological responding for two main reasons. First, previous studies of emotion regulation have indicated that both systolic and diastolic blood pressure are sensitive to the effects of reappraisal and suppression (e.g. Mauss et al., 2007; Richards & Gross, 1999; Stemmler, 1997). Second, diastolic blood pressure seems to be a candidate for anger-specific autonomic reactivity (e.g., Cacioppo, Klein, Berntson, & Hatfield, 1993). In contrast, other cardiovascular responses (e.g., elevated skin conductance) are not specific indicators of anger but occur as a consequence of other emotions as well (e.g., Cacioppo et al., 1993; Sinha & Parsons, 1996). As such, blood pressure was a particularly appropriate physiological measure for the present study. We hypothesized that following provocation, trait

reappraisal would be associated with decreased anger and systolic and diastolic blood pressure, whereas trait suppression would be associated with increased systolic and diastolic blood pressure and have no effect on anger. We also predicted that these relationships would persist even when controlling for measures of general negative affect and emotionality (i.e., anxiety, depression, and stress).

2. Method

2.1. Participants and design

A total of 50 undergraduate women (ranging in age from 18 to 26 years, $M = 21.00$, $SD = 3.91$; 30% Caucasian, 56% Asian, and 14% other) participated in exchange for extra course credit or AUD\$20. We examined women exclusively in order to reduce variability due to gender differences in anger regulation (e.g., Timmers, Fischer, & Manstead, 1998), and to avoid recruiting a gender-imbalanced sample, as the majority of students in the undergraduate pool are female. One participant was excluded for difficulty with English.

2.2. Materials and procedure

2.2.1. Emotion regulation style

Individual differences in participants' habitual emotion regulation styles were assessed with the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). The ERQ contains 10 items, six of which measure the tendency to use reappraisal ($\alpha = .73$), while the other four assess expressive suppression ($\alpha = .66$). The scales have acceptable test–retest reliability (.69 for both scales; Gross & John, 2003).

2.2.2. Negative emotionality

Participants completed the 21-item version of the Depression Anxiety Stress Scales which assess symptoms of depression, anxiety and stress (DASS-21; Lovibond & Lovibond, 1995). This measure is reliable and has good external validity (Antony, Bieling, Cox, Enns, & Swinson, 1998). We used all three subscales: depression ($\alpha = .81$), anxiety ($\alpha = .73$) and stress ($\alpha = .75$).

2.2.3. Provocation procedure

Participants arrived at the laboratory for a study ostensibly investigating the effects of web-based communication on impression formation and physiology. Participants were provided with an information statement that explained that they would be paired with a female student from another university, and that, as a basis for forming an impression of one another, they were both required to give a speech about their life goals to each other via webcam. Participants were then shown a slideshow of 40 neutral pictures from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1997) for 4 min, after which baseline measures of self-reported emotion and blood pressure were obtained.

One minute later, the experimenter returned to start the bogus web conference. Specifically, participants were shown a pre-recorded video of an actor giving a speech about her life goals. In order to make the video seem realistic, the experimenter began the web conference with a series of questions and instructions for the bogus participant, timed such that the bogus participant appeared to be responding to them. After introducing the participants to one another, the experimenter instructed the participants not to interrupt each other with questions to ensure that the real participant would not attempt a conversation with the video participant. The experimenter then left the room.

Following the speeches, the participant was instructed to give feedback to her partner about her impression of her and her life

goals and was informed that the feedback from her partner would appear on the screen shortly after. All participants then received the insulting feedback, which read as follows: “Your speech was kinda boring to be honest. . . your life goals seemed vague and unrealistic. I got the impression from your speech that you probably have not thought this through as much as most students by this stage. Overall a pretty disappointing speech coming from a uni student. . . It felt like a waste of my time listening to you.”

2.3. Dependent measures

2.3.1. Anger experience

Participants were asked to rate on a 7-point scale how much various positive and negative emotions applied to them after the visual slide show (baseline) and after the provocation (post-provocation). Angry feelings were assessed with three items: *angry*, *bothered*, and *irritated*. Scores on these three items were summed to form an anger experience composite, which was the score used in analyses.

2.4. Blood pressure

Two measures of cardiovascular responding were obtained: SBP and DBP. They were recorded with an Omron IA2 automatic blood pressure cuff at two time points: after the visual slide show (baseline), and following provocation (post-provocation).

3. Results

The means and standard deviations for participants' scores on the DASS, emotion regulation measures and their correlations are shown in Table 1.

3.0.1. Anger experience

Self-reported anger increased following the provocation, suggesting an effective provocation procedure ($M_{pre} = 1.43$, $SD_{pre} = 1.89$, $M_{post} = 6.57$, $SD_{post} = 4.29$), $F(1, 48) = 70.53$, $p < .001$, $d = 1.24$. Next, we tested the hypothesis that individual differences in emotion regulation would predict anger in response to the provocation. We controlled for baseline anger experience in order to adjust for individual differences in initial levels of anger. Consistent with hypothesis, trait reappraisal was associated with lower levels of state anger in response to the provocation, $\beta = -.45$, $t = -3.48$, $p = .001$, $R^2 = .25$. No effects were observed for trait suppression, $\beta = .24$, $t = 1.64$, $p = .11$, $R^2 = .06$.

Second, we sought to determine the extent to which trait reappraisal and suppression uniquely predict anger responses above and beyond measures of emotional disturbance (see Table 2). To this end, we repeated the above analysis controlling for baseline anger as well as self-reported depression, anxiety and stress. Trait reappraisal remained significantly associated with decreased anger. No effects were observed for trait suppression. Thus, trait reappraisal was associated with attenuated anger in response to the provocation.

Table 1
Correlations between the negative emotionality and trait measures.

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5
Depression	4.16	3.34	–	.36*	.42**	–.44**	–.03
Anxiety	4.51	3.91	–	–	.63**	–.31*	–.16
Stress	6.16	3.74	–	–	–	–.44**	–.18
Reappraisal	29.47	5.59	–	–	–	–	–.10
Suppression	13.29	4.07	–	–	–	–	–

Note: * $p < .05$, ** $p < .01$ (all tests 2-tailed).

Table 2

Standardized coefficients illustrating the effects of trait suppression, trait reappraisal, and negative emotionality on blood pressure and anger following interpersonal provocation.

	Anger	SBP	DBP
<i>Reappraisal model</i>			
Trait reappraisal	–.36*	–.24*	–.33***
Depression	.19	–.04	.07
Anxiety	.09	.21	–.06
Stress	–.05	–.03	–.09
R^2	.29	.55	.62
<i>Suppression model</i>			
Trait suppression	.13	.19*	.09
Depression	.29*	.03	.16
Anxiety	.10	.22	–.05
Stress	.08	.07	.02
R^2	.21	.54	.50

Note: * $p = .08$, * $p = .06$, ** $p \leq .01$, *** $p \leq .001$ (all tests 2-tailed).

praisal was associated with attenuated anger in response to the provocation.

3.0.2. Blood pressure

As expected there were significant increases in blood pressure from baseline to post-provocation for both SBP ($M_{pre} = 111.02$, $SD_{pre} = 13.80$, $M_{post} = 116.08$, $SD_{post} = 12.01$), $F(1, 49) = 11.23$, $p = .002$, $d = .48$, and DBP ($M_{pre} = 68.38$, $SD_{pre} = 8.41$, $M_{post} = 72.70$, $SD_{post} = 8.55$), $F(1, 49) = 23.29$, $p < .001$, $d = .68$.

Analogous to the anger data, we next examined the effects of trait reappraisal and suppression on cardiovascular responses following the provocation. Because individuals vary widely in resting blood pressure, we controlled for baseline blood pressure. Consistent with our hypothesis, trait reappraisal uniquely predicted decreased SBP in response to the provocation ($\beta = -.27$, $t = -2.63$, $p = .01$, $R^2 = .52$). Trait reappraisal also predicted decreased DBP following the provocation ($\beta = -.30$, $t = -3.25$, $p = .002$, $R^2 = .61$). There were no effects for trait suppression.

We next examined the extent to which individual differences in emotion regulation would predict additional unique variance in SBP and DBP following provocation above and beyond measures of emotional disturbance. We therefore conducted regression analyses controlling for baseline BP and self-reported depression, anxiety and stress (see Table 2). Although none of the control measures predicted blood pressure in response to the provocation, trait reappraisal remained a predictor of decreased SBP and DBP even when controlling for negative emotionality.

4. Discussion

The grave nature of problems associated with unrestrained anger make successful anger regulation a goal of utmost importance for both angry individuals and for those around them. Although many strategies for emotion regulation exist, not all are necessarily effective or adaptive. The present study investigated whether the consequences of trait reappraisal and suppression in the context of anger regulation accord with the predictions of the process model of emotion regulation (Gross, 1998). We found that a greater dispositional reliance on reappraisal was related to less anger and lower blood pressure following an anger provocation. This finding is consistent with those of Mauss and colleagues (2007), who also found that individuals high in trait reappraisal reported less anger and exhibited more adaptive cardiovascular responses to a provocation than individuals low in trait reappraisal. Our study importantly extends this literature by being the first to demonstrate that the association between trait reappraisal and more adaptive

anger responding persisted even when controlling for overall negative emotionality; specifically, levels of depression, anxiety and stress. Our findings highlight that reappraisal plays a unique role in anger regulation, over and above general psychological maladjustment. In conjunction with the results from the Mauss et al. (2007) study, the results support the idea that reappraisal may be an effective strategy for anger regulation.

Contrary to prediction, trait suppression did not significantly affect anger responding. One possible explanation for this null result is that we employed an all-female sample, as there is evidence that women tend to rely on suppression as a regulatory strategy less than men (Gross & John, 2003). Although our sampling approach was consistent with previous studies that have examined the effect of emotion regulation on anger (Mauss et al., 2007; Ray et al., 2008), nonetheless, future research should evaluate the effects of trait suppression on anger in a mixed gender sample.

These findings suggest that changing the habitual way in which individuals construe angering events could be an effective treatment target in anger regulation interventions. Future studies should begin to investigate whether it is possible to alter individuals' habitual emotion regulation strategies. Several clinical investigations have instructed individuals with anxiety and mood disorders to apply various emotion regulation strategies and found differences in self-reported emotions in response to stimuli (e.g., Campbell-Sills, Barlow, Brown, & Hofmann, 2006). However, no studies to date have examined the effects of instructing participants to reappraise or suppress anger in the context of a direct, confronting provocation. If we are able to experimentally manipulate an individual's strategy for regulating anger, it follows that we may be able to help individuals with anger problems to more effectively modulate the experience and expression of anger in therapy. For example, individuals who habitually suppress their anger responses may be educated about the potential negative effects of this strategy and practice using reappraisal in response to provocation. Given the anger-reducing effects of trait reappraisal, future research could also investigate whether reappraisal is effective in reducing aggressive behaviour. Together, our results suggest that the tendency to use specific emotion regulation strategies influences anger experience and physiological responding over and above general indicators of negative emotion and distress. The findings suggest that reappraisal might be especially promising as an anger regulation strategy. As such, reappraisal could prove a key therapeutic strategy for clinicians who work with clients who are characterized by an inability to adaptively manage their anger.

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