The effect of emotion regulation strategies on anger

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**Abstract**

This study examined the effects of different emotion regulation strategies on the experience and expression of anger. Participants consisted of undergraduate students who endorsed at least a moderate level of state anger. As part of a laboratory experiment, they were instructed to reframe (n = 24), suppress (n = 24), or accept (n = 25) their anger during a frustrating task. Reappraisal was more effective at reducing anger than attempts to suppress or accept it. Furthermore, participants in the reappraisal condition persisted significantly longer with the frustrating task than those who were instructed to suppress or accept their negative feelings. These findings suggest that reappraisal techniques are more effective than acceptance and suppression techniques for modulating the experience and expression of anger.

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Being able to regulate one’s emotions is adaptive and promotes psychological well-being, especially when dealing with anger and distress (Mauss, Cook, Cheng, & Gross, 2007). Emotion regulation consists of processes through which individuals modulate their emotions in an automatic and effortless and/or conscious and effortful manner (Bargh & Williams, 2007; Campbell-Sills & Barlow, 2007), and try to influence the occurrence, intensity, duration, and expression of those emotions to appropriately respond to environmental demands (Campbell-Sills & Barlow, 2007; Gross, 1998). Effective emotion regulation is associated with good health outcomes, and improved relationships and academic work performance (Brackett & Salovey, 2004; John & Gross, 2004), whereas difficulties with emotion regulation are associated with greater distress that may be associated with emotional disorders and other illnesses (Berenbaum, Raghavan, Le Vernon, & Gomez, 2003; Greenberg, 2002; Gross & Levenson, 1997; Mennin & Farach, 2007; Mennin, Holoway, Fresco, Moore, & Heimberg, 2007; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008).

The most commonly researched emotion regulation strategies include suppression and cognitive reappraisal. A direct comparison between these strategies suggests that reappraisal is more effective at regulating negative emotions, whereas suppression is associated with counterproductive effects that lead to experiences of elevated levels of physiological arousal and negative affective consequences (Gross, 1998; Hofmann, Heering, Sawyer, & Asnaani, 2009; Richard & Gross, 2000; Wegner & Gold, 1995; Wegner & Zanakos, 1994).

More recently, investigators have also examined the effects of acceptance strategies to regulate emotions (Eifert & Heffner, 2003; Najmi, Riemann, & Wegner, 2009). Whereas some authors view this approach as being significantly different from conventional CBT, others have taken a more critical stance (e.g., Hofmann & Asmundson, 2008). Acceptance is an important feature of Acceptance and Commitment Therapy (ACT; Hayes, Strohsahl, & Wilson, 1999) and defined as “the active and aware embrace of private events occasioned by one’s history without unnecessary attempts to change their frequency or form, especially when doing so cause psychological harm” (Hayes, Luoma, Bond, Masuda, & Lillis, 2006, p. 14).

Studies have shown that acceptance strategies are more effective than suppression in moderating subjective distress in patients with panic attacks (Eifert & Heffner, 2003; Levitt, Brown, Orsillo, & Barlow, 2004). For example, participants who are exposed to 10% CO\textsubscript{2} enriched air report less fear and less catastrophic thoughts when asked to use acceptance strategies than when instructed to control their symptoms using diaphragmatic breathing techniques or no instructions (Eifert & Heffner, 2003).
It has further been shown that participants with anxiety and mood disorders generally judge their negative emotions in response to a distressing film as less acceptable and tend to suppress their emotions to a greater extent than nonanxious participants (Campbell-Sills, Barlow, Brown, & Hofmann, 2006a). However, when instructed to use acceptance strategies, individuals with clinical diagnoses of anxiety or depression report less subjective distress and lower autonomic arousal than when asked to suppress their emotions in response to a distressing film (Campbell-Sills, Barlow, Brown, & Hofmann, 2006b).

Similar effects have also been shown in healthy individuals using a social stress task (Hofmann et al., 2008). In this study, participants were randomly assigned to reappraise, suppress, or accept their anticipatory anxiety prior to an impromptu speech. The instructions to suppress anxiety were associated with greater increase in physiological arousal than the instructions to reappraise and accept. Furthermore, the suppression group reported more subjective anxiety than the reappraisal group. However, the acceptance and suppression groups did not differ in their subjective anxiety response. These findings suggest that both reappraising and accepting anxiety is more effective for moderating the physiological arousal than suppressing anxiety, but reappraising is more effective for moderating the subjective feeling of anxiety than attempts to suppress or accept it. This study showed that cognitive reappraisal of the emotional response to an impromptu speech is more effective at moderating subjective distress and autonomic arousal than attempts to accept or suppress the response.

The majority of studies on emotion regulation have examined the regulation of anxious arousal or emotional distress. In contrast, relatively few studies have focused on the regulation of anger, despite its central importance in human interactions (e.g., Baumeister, Stillwell, & Wortman, 1990; DiGiuseppe & Froh, 2002). Consistent with the anxiety literature, trait reappraisal moderates state anger in a situation of anger provocation (Mauss et al., 2007). In this study, individuals who were low or high in cognitive reappraisal were made angry in the laboratory using an experimental anger induction (Stemmler, 1997). Results indicated that, compared with low reappraisers, high reappraisers reported less anger, less negative emotion, and more positive emotion, and exhibited adaptive physiological responses.

Another study compared the effects of induced anger rumination and anger reappraisal on anger after recalling an anger-inducing autobiographical event (Ray, Wilhelm, & Gross, 2008). The results showed that participants who were instructed to ruminate reported greater anger, more cognitive perseveration, and greater sympathetic nervous system activation than participants who reappraised their anger experience. Similar findings were reported in a study that examined the effects of cognitive reappraisal and expressive suppression on self-reported anger and blood pressure during anger provocation (Menedovic, Grisham, Denson, & Moulds, 2010). Participants high in trait reappraisal showed attenuated anger and blood pressure in response to anger provocation.

Recently, it has been suggested that people may choose to increase their anger when anticipating a confrontation task despite experiencing short-term hedonic costs (Tamir, Mitchell, & Gross, 2008). This experiment has shown that angry participants perform better than controls in a violent video game by successfully killing more enemies. This suggests that, depending on the context, functional levels of anger can help individuals achieve their goals. In contrast to Tamir et al.’s experiment, however, the present study focused on dysfunctional anger that is elicited by recalling personal situations in which participants experienced anger toward another person.

Previous studies have found that low frustration tolerance is associated with state and trait anger (Dryden, 2002; Jones & Trower, 2004; Martin & Dahlen, 2004). Frustration tolerance as a behavioral measure in combination with self-report measures can be used to gain information about the interaction between frustration-intolerant cognitions and distress-intolerant behaviors (Rodman, Daughters, & Lejuez, 2009). Based on this literature, it can be assumed that longer persistence on difficult tasks is associated with higher levels of frustration tolerance, and lower levels of anger.

In sum, the results of these studies suggest that cognitive reappraisal is a more effective strategy for regulating anger than suppression and rumination strategies. More recently, proponents of ACT (Hayes et al., 1999) have argued that acceptance-based regulation would provide an even more effective alternative for regulating negative mood states, including anger (Eifert & Heffner, 2003). However, no study has directly compared the effects of acceptance, cognitive reappraisal, and suppression on anger. Therefore, the goal of the present study was to investigate the differential effects of the strategies on state anger at the subjective and behavioral level. Based on previous studies, we predicted that suppression is associated with the most anger experience and the least level of frustration tolerance during a frustrating task. The traditional cognitive model (e.g., Beck, 1976; Ellis, 1962) predicts that cognitive reappraisal is associated with the least anger experience and a high level of frustration tolerance (longer task persistence). In contrast, the more recent ACT model (Hayes et al., 2004) predicts that acceptance is associated with the least anger experience and a high level of frustration tolerance (longer task persistence).

**Method**

**Participants**

Participants included 97 undergraduate students (61.9% female) from computer science, mathematics, sociology, and psychology classes at Babes-Bolyai University. They received course credit for participating in this study. All participants completed the anger induction procedure. In order to be able to study the effects of the instruction manipulation on anger, only those participants were included in the final analysis if they endorsed at least a moderate level of state anger based on their state anger ratings after a frustrating task (n = 73). A moderate level of anger was defined as a score of 3 on a scale ranging from 1 (not present) to 5 (very much) points using a composite score that included items (angry, mad, and irritated) derived from the negative emotion subscale of the Profile of Affective Distress (PAD). Participants’ age ranged from 19 to 38 (mean age 22.30, SD = 4.27). Informed consent was obtained from each participant.

**Self-report measures**

**Profile of affective distress (PAD)**

This measure was used to assess affective states using a scale of positive and negative emotions on a 5-point Likert scale ranging from 1 to 5 (1 = not present, 5 = very much; Opris & Macavei, 2007). The PAD is a 39-item scale that measures negative and positive emotions. The scale has high internal consistency (Cronbach’s a = .94). Three items from the negative emotions subscale were used to assess state anger (angry, mad, and irritated).

**Affective style questionnaire (ASQ)**

The ASQ (Hofmann & Kashdan, 2010) is a 20-item instrument that measures individual differences in emotion regulation. The questionnaire consists of three subscales: Concealing (referring to habitual attempts to conceal or suppress affect), Adjusting (a general ability to manage, adjust, and work with emotions as needed), and Tolerating (an accepting and tolerant attitude toward emotion).
administered the Concealing (for suppression) and Tolerating (for acceptance) subscales as manipulation checks to verify that participants followed the suppression and acceptance instructions, respectively. The scale has good internal consistency (Concealing $\alpha = .84$, Adjusting $\alpha = .82$, Tolerating $\alpha = .68$).

Attitudes and beliefs scale II (ABS-II)

The ABS-II (DiGiuseppe, Leaf, Exner, & Robin, 1988; Macavei, 2002) is a self-report scale that measures rational and irrational beliefs uncontaminated by affective items (DiGiuseppe et al., 1988). The ABS-II is a reliable and valid measure (e.g., David, Schnur, & Belloiu, 2002; DiGiuseppe et al., 1988). We selected and administered as a manipulation check a sub-set of seven items from the rational subscale reflecting rational beliefs of preferences and frustration tolerance and we used it to assess whether participants employed the instructed emotion regulation strategy of negative functional reappraisal (internal consistency $\alpha = .72$).

Computerized mirror-tracing persistence task

We employed the computerized Mirror-Tracing Persistence Task (MTPT; Rodman et al., 2009) as a behavioral indicator of frustration tolerance. Based on Quinn, Brandon, and Copeland (1996) and Strong et al. (2003), we developed a computerized version of the MTPT in which participants were asked to trace a red dot along a star on the computer screen using a computer mouse, which was programmed to move the red dot in the reverse direction. If a participant moved the red dot outside the star or stalls for more than two-seconds, a loud buzzer turned on, and the red dot returned to its starting position. Participants were told that they could end the task at any time by pressing any key on the computer. The task ended after 7 min, but participants did not know how long the task would last. Frustration tolerance was measured as latency in seconds to task termination. Additionally, the number of errors per second (i.e., the number of times the participant had to return to the starting position during the task divided by the task time) was recorded to control for the effects of skill on persistence. For the present study, a modified version was used that was translated into Romanian language by Cătălin Kopetz and Nicholas T. Calvín (Center for Addictions, Personality, and Emotion Research, University of Maryland).

Procedure

Upon arrival to the laboratory, written consent was obtained from each participant. The entire procedure took approximately 35 min and participants were sitting at a desk in front of a computer. After signing the consent form, participants were asked to complete the visual analog scale as a baseline measure. Next, the anger induction procedure followed. This procedure included a mental imagery instruction. Extensive empirical data shows that mental imagery can be effective for inducing emotions, especially anger (e.g., Holmes & Mathews, 2010; Pylyshyn, 2006). Participants were told that their ability to voluntarily induce an emotion would be evaluated. They might happen that in some situations in which you try to do something and you fail, or things don’t come up as you want, you could become angry, mad or irritated and feel some level of distress and discomfort. Next, please try to tell yourself that it would be preferable that the others are nice and/or fair to you, but if they are not, it does not mean that you or they are worthless human beings. It would be preferable that the others be nice and/or fair to you, but if they are not, remember that it is only (very) bad, not catastrophic (the worst thing that could happen to you). It would be preferable that the others are nice and/or fair to you, but if they are not, you can tolerate it, and go on enjoying life, even if it’s more difficult in the beginning.

Acceptance instructions: It might happen that in some situations in which you try to do something and you fail, or things don’t come up as you want, you could become angry, mad or irritated and feel some level of distress and discomfort. In some situations you might succeed to control your negative beliefs or emotions, but it is not always easy to control emotions as anger. Instead of trying to control your anger please try to accept and experience your anger fully and not try to control or change it in any way. Think of acceptance on a continuum, like some angry beliefs or emotions of anger you could accept more easily, for some you’ll have to work more, and some could be very difficult to accept. But, please try to accept, experience your anger fully as a normal response without trying to control, change it or fight against it in any way.

Suppression instructions: It might happen that in some situations in which you try to do something and you fail, or things don’t come up as you want, you could become angry, mad or irritated and feel some level of distress and discomfort. Next, try not to think of the situation that makes you angry, mad or irritated. Please try as much as you can not to think about the situation, don’t think about how you feel or what had happened, and try to suppress your emotions and not feel them. It’s very important to try as much as you can not to think about the situations that makes you angry, mad or irritated.

Upon receiving either one of these instructions, participants were asked to perform the MTPT-C (Rodman et al., 2009; Strong et al., 2003). At the end, participants completed the PAD to measure anger and affective distress after performing the task. They also completed the ASQ subscales (Hofmann & Kashdan, 2010) and ABS-II sub-set items to confirm that participants employed the instructed emotion regulation strategy.

Results

Manipulation checks

The ASQ subscales and ABS-II sub-set items scores confirmed that the participants successfully used the strategy that they were instructed to use (Table 1).
Furthermore, no difference was observed on unresolved situation, group, and 24 participants from the Suppression group. Randomization

Participants were randomly assigned to one of the three experimental groups (Reappraisal, Acceptance, and Suppression). The three groups were comparable in their level of positive affect, $F(2, 70) = 0.19$, $p > .82$, and negative affect, $F(2, 70) = 1.34$, $p > .26$, on the Profile of Affective Distress for baseline measure (Table 2). Furthermore, no difference was observed on unresolved situation, $F(2, 70) = 0.36$, $p > .89$.

Effects of emotion regulation on anger

In order to control for differences in anger at baseline, we calculated individual change scores for anger (a composite score for anger, mad, irritated) from PAD and included those differences scores as the dependent variable in all subsequent analyses. We also calculated scores for anger after the anger induction procedure, after the manipulation (following the instructions for the three emotion regulation strategies) and after the MTPT-C. Table 3 contains means and standard deviations scores for all these measures in the three experimental conditions (Reappraisal, Acceptance, and Suppression).

In order to explore the impact of the three emotion regulation strategies (Reappraisal, Acceptance, and Suppression) on anger levels as measured with the PAD, we conducted a $4 \times 3$ (Conditions/instructions) repeated measures ANOVA with anger as the dependent variable, Time (baseline, post-anger induction, post-intervention/instructions, and post-MTPT-C task) as a within subjects variable, and the three emotion regulation strategies as a between subjects variable (Condition: reappraisal, acceptance, and suppression). Complete data was available from 24 participants of the Reappraisal group, 25 participants from the Acceptance group, and 24 participants from the Suppression group.

The results revealed a significant Time effect for anger, $F(2, 69) = 64.73$ (Wilks’ Lambda), $p < .001$, partial $\eta^2 = 0.65$, a significant Group effect, $F(2, 70) = 30.10$, $p < .001$, partial $\eta^2 = 0.46$ with a large size effect, and a significant Time by Condition interaction effect, $F(4, 138) = 12.00$, $p < .01$, partial $\eta^2 = 0.26$, indicating that the reappraisal group showed greater changes than the suppression and the acceptance group. Within contrast analysis showed a significant linear contrast for general effect of emotion regulation strategies on anger, $F(2, 70) = 23.58$, $p < .001$, partial $\eta^2 = 0.40$. Furthermore, the three emotion regulation strategies were associated with a reduction in anger across time (Fig. 1).

Post-hoc analysis (Bonferroni test) of the Group effect showed that participants in the Suppression group reported more anger than those in the Reappraisal group (mean difference: $-1.13$, SE = 0.15, $p < .001$). Furthermore, there was a significant difference between the Reappraisal group and the Acceptance group (mean difference: $-0.77$; SE = 0.15, $p < .001$). The difference in anger scores between the Acceptance and Suppression groups did not reach the level of statistical significance (mean difference: $-0.36$, SE = 0.15, $p = .54$).

Effects of emotion regulation strategies on frustration tolerance

In order to examine the impact of emotion regulation strategies on frustration tolerance (measured as task persistence), we conducted an ANOVA with participants’ distress scores in response to the MTPT-C task as the dependent variable. Results showed

![Image](Image 312x84 to 563x283)
a significant effect of the three emotion regulation strategies on frustration tolerance, $F(2, 70) = 20.05, p < .001$, partial $\eta^2 = 0.36$. The mean duration in the MTPT-C task is shown in the last row of Table 3.

Post-hoc tests (Bonferroni) showed that participants in the Reappraisal group persisted significantly longer with the frustrating task than those in the Suppression group (mean difference: 88.23, SE = 14.17, $p < .001$) and the Acceptance group (mean difference: 58.22, SE = 14.03, $p < .001$). We found no difference in task persistence for the participants in the Acceptance and Suppression groups (mean difference: $-30.01, SE = 14.03, p = .11$). Fig. 2 depicts the difference in task persistence for the three experimental groups.

**Association between anger and persistence**

In order to examine the association between state anger and persistence, we computed correlations between state anger reported after the MTPT-C and the duration of the task as a measure of persistence. In order to account for the non-normal distribution of state anger, we calculated the Spearman’s rank correlation coefficient ($\rho$). As predicted, we observed a significant negative association between the levels of state anger after finishing the task and task duration, $\rho(73) = -0.53, p < .01$, in the combined group. In the Reappraisal group, this correlations was $\rho(24) = -0.41, p < .05$. The magnitude of this association was slightly weaker and did not reach the level of conventional significance in the Acceptance group, $\rho(25) = -0.38, p = .06$. In contrast, the correlation in the Suppression group was only $\rho(24) = 0.01, p = .70$.

**Discussion**

The present study investigated the effects of different emotion regulation strategies (reappraisal, acceptance, and suppression) on experimentally-induced anger at the subjective and behavioral level, as measured by anger and task persistence. Previous studies have consistently indicated that suppression is the least effective emotion regulation strategy because it leads to elevated levels of physiological arousal and psychological distress (Campbell-Sills & Barlow, 2007; Gross, 1998). Cognitive reappraisal is based on the traditional cognitive model, and has been shown to be one of the most effective emotion regulation strategies (Richard & Gross, 2000). Relatively little research exists on acceptance strategies, which are based on the more recent ACT model. This popular treatment approach predicts that acceptance-based strategies are the most effective strategies for regulating negative emotions.

Our results suggest that suppression was the least effective and reappraisal the most effective strategy for regulating anger. These effects were evident in participants’ subjective ratings and behavioral responses; participants in the reappraisal condition reported lower levels of state anger and persisted significantly longer with a frustrating task than those who were instructed to suppress or accept their negative feelings. These results are in line with a previous study directly comparing the effects of reappraisal, acceptance, and suppression for regulating anxiety in response to a social stress test (Hofmann et al., 2009). Our findings further suggest that, as predicted, anger was negatively associated with task persistence. This association was significant in the reappraisal condition, borderline significant in the acceptance condition, and not significant in the suppression condition.

The results of this study add to the growing body of literature on emotion regulation (e.g., Gross, 1998). We suggest that future studies examine modifications of instructional manipulations to explore the crucial differences between the various emotion regulation strategies. Moreover, we suggest that future studies include psychophysiological measures, especially blood pressure, heart rate, and cortisol to further examine the effects of different emotion regulation strategies on anger. In sum, our findings suggest that reappraisal strategies are more effective than suppression and acceptance strategies for regulating anger. This might suggest that individuals with anger control problems benefit most from reappraisal techniques that allows them to effectively modulate the experience and expression of anger.

It is important to point out that our experiment is by no means an adequate comparison of ACT vs. CBT, because we only tested isolated emotion regulation strategies that are rough and simplified approximations of therapeutic strategies that occur in the context of complex interpersonal therapeutic processes (Hofmann et al., 2009). Nevertheless, we believe that such micro-analyses of therapeutic techniques can provide valuable information for the further development of psychotherapy models. Another limitation is related to the instructions we used. The suppression instructions contained elements of thought suppression and emotional suppression, whereas previous studies focused primarily on emotional suppression (Gross, 1998). The reappraisal instructions were adapted from the CBT/REBT model and the “psychological pills metaphor” to control anger (David, 2006; Ellis, 1962), whereas the

![Fig. 2. Means and standard errors (Error bars: 2 SE) for task persistence on MTPT-C task for the three experimental groups.](image-url)
individual differences in habitual tendencies to regulate anger. In task. The results clearly support the use of reappraisal strategies. can be drawn to other contexts, including psychotherapy. self-regulation that incorporates these strategies, little inference can be drawn to other contexts, including psychotherapy. In sum, this study is the first to investigate the impact of reappraisal, acceptance, and suppression on anger during a frustrating task. The results clearly support the use of reappraisal strategies. Future studies are needed to elucidate the effects of the different emotion regulation strategies in clinical groups and to examine individual differences in habitual tendencies to regulate anger. In addition, more studies are needed to evaluate the impact of acceptance-based strategies on anger.

References