



## The Effects of Analytical Rumination, Reappraisal, and Distraction on Anger Experience

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The manner in which individuals recall negative life events has important affective consequences. The present experiment investigated the effects of emotion regulation strategies on anger experience. One hundred and twenty-one undergraduates recalled an anger-inducing memory and were instructed to engage in either analytical rumination, cognitive reappraisal, or distraction for 20 minutes. In the remaining (control) condition, participants were instructed to write about their thoughts but were not given any emotion regulation instructions. Rumination maintained anger, whereas participants in the remaining conditions reported decreased anger following the writing task. Our results suggest that reappraisal facilitates adaptive processing of anger-inducing memories and distraction facilitates rapid reductions in anger experience. These findings have implications for the management of clinical populations that commonly experience difficulty with anger regulation.

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WHEN REMEMBERING AN ANGER-ELICITING event, an individual may engage in a range of potential cognitive processes. These processes determine

whether recalling the event reinstates, attenuates, maintains, or amplifies the feelings of anger that were experienced at the time that it occurred. In the current experiment, we examined whether three distinct emotion regulation strategies—rumination, reappraisal, and distraction—differentially influence the degree to which angry feelings are activated when anger-eliciting events are recalled.

At its broadest, *rumination* refers to a type of perseverative cognition that has been characterized as “the experience of having repetitive, intrusive, negative cognitions” (Brosschot, Gerin, & Thayer, 2006, p. 114; for reviews see Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Watkins, 2008). Rumination has been studied extensively in the context of depression. The relationship between rumination and anger has received relatively less empirical attention, although interest in this area has grown in recent years. Angry rumination involves focusing on anger-inducing memories, reexperiencing anger responses, and thoughts of revenge (Caprara, 1986; Denson, Pedersen, & Miller, 2006; Sukhodolsky, Golub, & Cromwell, 2001). Rusting and Nolen-Hoeksema (1998) found that ruminating about an anger-inducing event exacerbated anger, whereas distraction decreased it. Angry rumination also increases aggression over extended periods, even toward undeserving individuals (Bushman, 2002; Bushman, Bonacci, Pedersen, Vasquez, & Miller, 2005). Moreover, chronic angry rumination is related to frequent anger experience, reduced life satisfaction, self-reported domestic abuse, road rage, and other forms of aggression (Anestis, Anestis, Selby, & Joiner, 2009; Caprara, 1986; Collins & Bell, 1997; Denson et al., 2006; Martin & Dahlen, 2005; Sukhodolsky et al., 2001).

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Within the anger literature, researchers have increasingly specified subtypes of rumination that can result in different affective and behavioral consequences. For instance, focusing on an interpersonal provocation and the associated feelings of anger (termed “provocation-focused rumination”) rather than focusing on the identical event with a self-critical, inward focus (termed “self-focused rumination”; e.g., “Why do I always react this way?”) produces unique cognitive, affective, and physiological responses (Denson, Fabiansson, Creswell, & Pedersen, 2009; Pedersen et al., 2011). Similarly, in the context of depression, researchers have differentiated subtypes of rumination. However, rather than a distinction between subtypes based on the *content* of rumination, recent developments in the depression field have emphasized the distinctive consequences of adopting different modes of *processing* (i.e., analytical vs. experiential) during rumination. This work has highlighted that while thinking in an analytical and abstract way during rumination (i.e., thinking about the causes, meanings, and consequences of one's current state) has maladaptive consequences, thinking about the same content in a more concrete, experiential manner (i.e., focusing directly on how one feels, without analyzing the causes, meanings, and consequences) is beneficial (e.g., Watkins, 2008; Watkins, Moberly, & Moulds, 2008; Watkins & Moulds, 2005).

Recent studies in the anger literature have further distinguished between analytical rumination that is conducted in either an emotionally immersive manner or in a distanced, detached manner. Specifically, when analytical rumination is conducted in a “hot” (i.e., emotionally immersive) manner it tends to result in higher levels of anger than a “cool” (i.e., distanced perspective; Ayduk & Kross, 2008; Kross, Ayduk, & Mischel, 2005). In the present research, we induced analytical rumination and subsequently determined whether it was effective in reducing anger when individuals adopted a hot versus cool perspective.

In contrast to rumination, a substantial body of research suggests that *cognitive reappraisal* may be an adaptive way to manage negative emotional experiences (Gross, 2002). Cognitive reappraisal involves mentally modifying the way that a situation is evaluated prior to the elicitation of a full-scale emotional response. Lazarus and colleagues' influential theories of stress and coping emphasized the effects of appraisal and reappraisal processes in determining and reducing anger, respectively (Lazarus, 1991; Lazarus & Folkman, 1984). Similarly, the general aggression model (Anderson & Bushman, 2002) emphasizes that when sufficient

cognitive resources are available, reappraisal can reduce the likelihood of aggressive behavior, which is the end result of action tendencies commonly associated with anger (Averill, 1982; Frijda, 1986). Therapeutic interventions also recognize the role of reappraisal in anger management. For example, Novaco's (1977) stress inoculation anger-reduction program includes reappraisal as a key component of effective anger reduction. Furthermore, a recent meta-analysis of anger treatments reported a moderate reduction in anger for programs that utilized cognitive restructuring ( $d=0.51$ ; DiGiuseppe & Tafrate, 2003). Given that the primary goal of cognitive therapy is to encourage patients to adopt alternative, more balanced interpretations of themselves and the world in order to modulate their emotional responses (consistent with the objective of reappraisal), this meta-analysis highlights the utility of reappraising anger-inducing situations as a means to reduce anger.

Individual differences in positive reappraisal are related to lower levels of trait anger as well as depression, anxiety, and stress (Martin & Dahlen, 2005; Memedovic, Grisham, Denson, & Moulds, 2010). Mauss, Cook, Cheng, and Gross (2007) found that participants who were high in trait reappraisal reported less anger and a more adaptive cardiovascular challenge response to an interpersonal provocation relative to participants low in trait reappraisal, who showed a less beneficial cardiovascular threat response. Similarly, we found that high levels of trait reappraisal were associated with attenuated anger and blood pressure reactivity following provocation (Memedovic et al., 2010). In another experiment, undergraduates were randomly assigned to recall an anger-eliciting event, and then instructed to either ruminate or reappraise the episode (Ray, Wilhelm, & Gross, 2008). Participants who reappraised responded with less anger and sympathetic nervous system activity than participants who ruminated. To our knowledge, the study by Ray et al. is the only one that has experimentally investigated the relative consequences of rumination and reappraisal on anger experience.

Researchers frequently compare the impact of rumination to that of *distraction*, an alternate emotion regulation strategy that involves attentional focus on external stimuli. Indeed, thinking about a neutral topic unrelated to the anger-inducing event is the antithesis of ruminating about it. However, as noted by Ray et al. (2008), the use of a condition that involves the active direction of attention toward external stimuli does not clarify whether the aversive impact of rumination is a function of

simply focusing on a negative event, or the mode of thinking adopted when thinking about the event (see also Watkins, 2008). Furthermore, a distraction control condition precludes participants from adopting their individual default styles of cognitive processing. With these issues in mind, we included both a distraction condition and spontaneous regulation condition, in which participants were not given emotion regulation instructions. To our knowledge, this is the first study to compare these conditions to rumination and reappraisal.

### The Present Study

After recalling an anger-inducing autobiographical memory, we predicted that rumination would maintain or increase feelings of anger, whereas the reappraisal and distraction would decrease anger. We expected that participants in the spontaneous regulation condition would engage in a range of habitual emotion regulation strategies, so we withheld predictions regarding this condition. We also coded participants' written responses in the rumination condition to determine whether they wrote about the memory in a hot or cool manner. We expected that participants who ruminated in a hot manner would report greater levels of anger than participants who wrote about the anger-inducing memory in a cool manner, as well as more anger than participants in the remaining conditions.

### Method

#### PARTICIPANTS AND DESIGN

A total of 121 undergraduates from the University of New South Wales (UNSW) first-year psychology subject pool participated in the study in exchange for course credit ( $M_{\text{age}}=21.26$  years,  $SD_{\text{age}}=3.85$ ; 80 women; 48% Asian, 36% Caucasian, and 16% other). Participants were randomly assigned to one of four conditions, with the restriction that one full replication of the design be completed prior to starting the next: analytical rumination ( $n=31$ ), reappraisal ( $n=30$ ), distraction ( $n=30$ ), or spontaneous regulation ( $n=30$ ).

#### MATERIALS AND PROCEDURE

Upon arrival at the laboratory, participants were told that the present study investigated the effects of recalling different memories on mood and cognitive performance. After providing informed consent, participants completed demographic information.

#### Baseline Mood

Participants rated the extent to which they were currently experiencing each of 28 emotions. The measure formed three subscales by computing the

mean of the items in each subscale: angry affect (e.g., "angry," "annoyed"; 7 items;  $\alpha=.89$ ,  $M=1.62$ ,  $SD=0.81$ ), general negative affect (e.g., "down," "afraid"; 13 items;  $\alpha=.92$ ,  $M=2.06$ ,  $SD=0.94$ ), and positive affect (e.g., "happy," "vigorous"; 8 items;  $\alpha=.85$ ,  $M=3.52$ ,  $SD=1.03$ ). Response options ranged from 1 (*not at all*) to 7 (*extremely*). The item "angry" from the angry affect subscale served as the baseline measure of state anger in the main analyses.<sup>1</sup>

#### Anger Memory Recall

Participants were then given 5 minutes to recall a time when they became angry. They were asked specifically to recall an anger-inducing event that involved another person within the past year and was not a time when they were angry at themselves. Participants were asked to write down details of the event on a piece of paper. Participants then retrospectively reported how angry they were during the anger-inducing event and how they felt about the event now on a scale from 1 (*not at all angry*) to 11 (*extremely angry*). These two items were included in order to ensure that the experimental groups did not differ in the extent to which the memories induced anger. Following recall, participants reported how angry they were currently feeling from 1 (*not at all*) to 7 (*extremely so*). This item served as the measure of state anger following the memory recall in the main analyses. These latter two items are conceptually the same, but have different scale endpoints. Indeed, they were highly correlated,  $r=.69$ ,  $p<.001$ .<sup>2</sup>

#### Emotion Regulation Manipulation

Following the recall of the angry memory, participants were assigned to one of the four experimental conditions. Specifically, participants were asked to write for 20 minutes about the anger-inducing event on a computer alone in a small room. The instructions between groups differed. In the *analytical rumination* condition, participants received the following instructions:

"I want you to write about it in a way that brings to mind the causes and consequences of the event. Try to think about the reasons for and the causes of the event, what it means that it happened the

<sup>1</sup> We relied on the single-item assessment to equate measurement across the time points. Nonetheless, the interaction and follow-up tests remained significant when using the multi-item angry affect subscale.

<sup>2</sup> Although different scale endpoints may influence the manner in which participants responded to these two items, the pattern of results remained identical when the variables were  $z$  transformed and the Time 2 anger measure was replaced with the former item (i.e., "How angry do you feel about the incident now?").

way it did, and the future implications of the event. Try to think about why people acted the way they did and what the event means to you.”

In the *reappraisal* condition:

“I want you to think about it in a different, more objective and positive way. Try to think about some positive aspects of the event, such as lessons you have learned, and ways that you could improve in the future if the same event were to arise. Also, try to think about factual, non-emotional details, such as where and when the event occurred.”

In the *distraction* condition:

“Please describe the layout of the UNSW campus as you see it in your mind and how you would describe it to someone who has never been here before. Please write a thorough and detailed description.”

In the *spontaneous regulation* condition:

“I would like you to write about whatever is on your mind in this moment. It can be anything at all. Please describe all the things that you are thinking about, as well as the way in which you are thinking about them.”

Upon completion of the writing period, participants rated how angry they were currently feeling for the third time, which served as the measure of postwriting task anger in the main analyses.

### Delay Period

Next, participants viewed a slideshow of neutral photos from the international affective picture system (IAPS; Lang, Bradley, & Cuthbert, 2008) for 15 minutes. Participants then rerated their level of current anger, which served as the measure of anger for the delay period in the main analyses. The purpose of including the delay period was to enable us to examine whether any effects that were observed immediately following the inductions (i.e., posttask) were maintained or rather dissipated over time (i.e., following a 15-min delay). Any differences between the effects of the inductions at the two time points would be clinically informative, as they would shed light on whether the emotion regulation strategies have different immediate versus (relatively more) long-term consequences.

### Manipulation Checks

As a manipulation check, written transcripts from the writing task were analyzed using the Linguistic Inquiry Word Count (LIWC 2007) program (Pennebaker, Chung, Ireland, Gonzales, & Booth, 2007). The LIWC program searches for over 2,300

words, counts them, and places them in a priori categories. LIWC is a reliable and valid quantitative tool used to synthesize written or spoken language that has been used in numerous studies (see Niederhoffer & Pennebaker, 2009; Pennebaker & Graybeal, 2001; Pennebaker, Mehl, & Niederhoffer, 2003), and has also been specifically used as a manipulation check in experimental research on rumination (e.g., Watkins, 2004). We were interested in three categories that identified emotion words and three categories that identified temporal orientation. The emotion categories consisted of words related to anger (e.g., *hate, kill, annoyed*), negative emotions (e.g., *ugly, hurt, nasty*), and positive emotions (e.g., *love, nice, sweet*), as reappraisal should be associated with more positive emotion words and rumination with more negative emotion words. Reappraisal and rumination should not differ on anger words as both conditions involve processing the anger-inducing memory (in contrast to distraction and possibly spontaneous regulation). The temporal orientation categories consisted of coding for verb tense (past, present, future) as rumination should be primarily associated with a focus on the past, whereas reappraisal should be more future oriented in light of the instructions participants were given. We also examined the cognitive mechanism word category (e.g., *accept, feel, forgive, provoke*) as we expected that participants in the reappraisal and rumination conditions should use more cognitive mechanism words than those in the distraction and possibly spontaneous regulation conditions. Following Watkins (2004), we also computed the number of words related to causality (e.g., *why, cause, consequence*) as the analytical rumination condition was specifically designed to induce thinking about the causes and consequences of the anger-inducing memory.

## Results

### PARTICIPANT CHARACTERISTICS AND BASELINE ASSESSMENTS

Men and women were equally distributed among the conditions,  $\chi^2(3) = 3.62, p = .31$ , as were Asians and Caucasians,  $\chi^2(3) = 3.84, p = .28$ . One-way ANOVAs with condition as the independent variable revealed no differences in baseline mood (all  $ps > .27$ ). There were also no group differences in the retrospective ratings of how angry participants reported feeling during the anger-inducing event ( $M = 9.21, SD = 2.04$ ) or how angry they felt about the event now ( $M = 5.56, SD = 3.08$ ).

### MANIPULATION CHECKS

In order to further understand differences in processing mechanisms between the emotion

Table 1  
Means (and Standard Deviations) of Word Frequencies in Relevant Linguistic Categories as a Function of Experimental Condition

	Spontaneous Regulation ( $n=27$ ) <i>M, SD</i>	Distraction ( $n=26$ ) <i>M, SD</i>	Reappraisal ( $n=29$ ) <i>M, SD</i>	Rumination ( $n=26$ ) <i>M, SD</i>	Significance Test
Anger	0.57 <sup>a</sup> , 0.73	0.06 <sup>b</sup> , 0.15	1.24 <sup>c</sup> , 0.91	1.62 <sup>c</sup> , 1.06	$F(3, 104)=20.21^{***}$
Negative Emotions	2.15 <sup>a</sup> , 1.21	0.68 <sup>b</sup> , 0.62	2.87 <sup>c</sup> , 1.24	3.57 <sup>d</sup> , 1.65	$F(3, 104)=26.18^{***}$
Positive Emotions	4.06 <sup>a</sup> , 1.64	1.48 <sup>b</sup> , 0.99	3.47 <sup>a</sup> , 1.27	2.70 <sup>d</sup> , 1.11	$F(3, 104)=20.24^{***}$
Past Tense	2.72 <sup>a</sup> , 1.68	0.71 <sup>b</sup> , 0.59	5.53 <sup>c</sup> , 2.29	7.75 <sup>d</sup> , 2.29	$F(3, 104)=72.79^{***}$
Present Tense	11.07 <sup>a</sup> , 2.83	8.78 <sup>b</sup> , 2.11	7.39 <sup>c</sup> , 2.02	6.48 <sup>c</sup> , 2.34	$F(3, 104)=19.57^{***}$
Future Tense	1.33 <sup>a</sup> , 0.64	0.71 <sup>b</sup> , 0.78	1.72 <sup>a</sup> , 1.01	1.14 <sup>b</sup> , 1.41	$F(3, 104)=4.87^{**}$
Cognitive Processes	18.94 <sup>a</sup> , 3.18	12.30 <sup>b</sup> , 2.50	20.79 <sup>c</sup> , 2.69	19.34 <sup>a,c</sup> , 4.72	$F(3, 104)=33.55^{***}$
Causation	2.03 <sup>a</sup> , 0.78	0.52 <sup>a</sup> , 0.57	2.08 <sup>a</sup> , 0.77	3.06 <sup>b</sup> , 1.84	$F(3, 104)=23.55^{***}$
Total Word Count	577 <sup>a</sup> , 215	415 <sup>b</sup> , 196	471 <sup>a,b</sup> , 145	491 <sup>a,b</sup> , 197	$F(3, 107)=3.49^*$

Note. Within rows, values with different superscripts are significantly ( $p<.05$ ) different from each other controlling for family-wise error. \*\*\* $p<.001$ , \*\* $p<.01$ , \* $p<.05$ .

regulation strategies, one-way ANOVAs with condition as the independent variable were conducted on the word counts coded by the LIWC program. Data from nine participants were excluded due to computer failure to record written responses. Table 1 reports the means and differences between conditions on the relevant linguistic categories.<sup>3</sup> The results were largely consistent with our hypotheses. The number of anger words was greatest in the rumination and reappraisal conditions. There was a trend for participants in the rumination condition to use more anger words than in the reappraisal condition ( $p=.08$ ). Participants in the rumination condition used more negative emotion words than participants in the remaining conditions and, conversely, participants in the reappraisal condition used more positive words than all of the other conditions with the exception of the spontaneous regulation condition. Participants in the rumination condition used the largest number of past tense verbs and causality words, consistent with an analytical, ruminative mode of processing. The largest number of future verbs words was in the reappraisal and spontaneous regulation conditions, suggesting that participants in these conditions were engaging in future-oriented processing. Participants in the reappraisal conditions reported using more words related to cognitive mechanisms than participants in the distraction and spontaneous regulation conditions. Partici-

pants in the analytical rumination condition reported using more cognitive mechanism words than participants in the distraction condition, but not more so than participants in the reappraisal or spontaneous regulation conditions. Of the linguistic categories we investigated, anger words,  $r=.34$ ,  $p<.001$ , negative emotion words,  $r=.24$ ,  $p=.01$ , and past tense words,  $r=.24$ ,  $p=.001$ , were associated with increased anger following the writing task. There was also a trend for the increased use of present tense words to be associated with decreased anger following the writing task,  $r=-.18$ ,  $p=.06$ .

#### ANGER EXPERIENCE

A  $4 \times 4$  (Condition  $\times$  Time) mixed ANOVA revealed a main effect of time,  $F(3, 339)=64.14$ ,  $p<.001$ ,  $\eta^2=.36$ , and the expected Condition  $\times$  Time interaction,  $F(9, 339)=3.00$ ,  $p=.002$ ,  $\eta^2=.07^4$  (see Figure 1). Because our main hypothesis was that rumination would maintain or possibly increase anger and the remaining conditions would reduce anger, we conducted follow-up tests within each condition. These tests examined whether anger ratings following the writing task were reduced from anger ratings following memory recall. In the rumination condition, there was no significant change in anger,  $t(29)=0.68$ ,  $p=.51$ ,  $d=.12$ , demonstrating that rumination maintained participants' angry mood. By contrast, there was a significant decrease in anger in the reappraisal condition,  $t(29)=3.89$ ,  $p<.001$ ,  $d=.71$ . There were also significant decreases in anger in the spontaneous regulation,  $t(28)=3.92$ ,  $p<.001$ ,  $d=.76$ , and distraction conditions,  $t(28)=5.00$ ,  $p<.001$ ,  $d=.93$ . Thus, rumination maintained the angry mood

<sup>3</sup> A one-way ANOVA with word count as the dependent measure revealed a significant main effect of condition (see Table 1). Post hoc revealed that the only difference was that participants in the spontaneous regulation condition wrote more than participants in the distraction condition ( $p=.01$ ). There were no other differences between the groups ( $ps>.22$ ) and there were no significant differences in word count between the hot and cool groups,  $F(1, 25)=0.37$ ,  $p=.55$ . Moreover, a  $4 \times 4$  (Condition  $\times$  Time) ANCOVA revealed that the Time  $\times$  Condition interaction remained significant when controlling for word count,  $F(9, 306)=3.66$ ,  $p<.001$ .

<sup>4</sup> A  $2 \times 4 \times 4$  (Gender  $\times$  Condition  $\times$  Time) mixed ANOVA revealed no main effect or interactions for gender ( $ps>.71$ ).

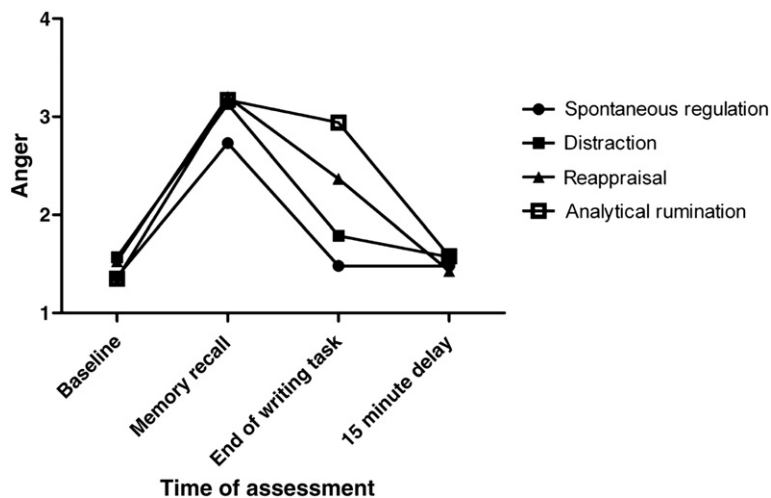


FIGURE 1 Self-reported anger during the experiment. Significant differences emerged at the end of the writing task as a result of the experimental manipulations. Possible values for anger range from 1 to 7.

induced by recalling the memory, whereas the remaining conditions were effective in decreasing anger.

Follow-up one-way between-group ANOVAs at each of the four time points revealed that self-reported anger did not differ at baseline (as noted above), as a result of recalling the anger-inducing memory, or following the 15-minute delay. However, consistent with our hypotheses, there was a significant between-group difference in anger at the end of the writing task,  $F(3, 118) = 6.28$ ,  $p = .001$ ,  $\eta^2 = .14$ . Tukey's HSD post hoc pairwise comparisons controlling for familywise error revealed that participants in the rumination condition reported more anger as a result of the writing task than participants in either the spontaneous regulation ( $p = .001$ ,  $d = 1.00$ ) or distraction conditions ( $p = .01$ ,  $d = .75$ ). There was a trend toward more anger reported by participants in the reappraisal condition during the writing task than that reported by participants in the spontaneous regulation condition ( $p = .08$ ,  $d = .70$ ), but statistically indistinguishable from the distraction ( $p = .40$ ,  $d = .43$ ) and analytical rumination conditions ( $p = .39$ ,  $d = -.38$ ), despite these effects being of moderate magnitude. We investigate this unexpected result further in the post hoc coding section below.

In order to determine the pattern of anger across time that best characterized our data, we conducted tests of nonlinear contrasts. These results revealed a significant quadratic function for the rumination condition,  $F(1, 29) = 39.63$ ,  $p < .001$ ,  $\eta^2 = .58$ , and significant cubic functions for the reappraisal condition,  $F(1, 29) = 11.79$ ,  $p = .002$ ,  $\eta^2 = .29$ , distraction condition,  $F(1, 28) = 22.09$ ,  $p < .001$ ,

$\eta^2 = .44$ , and the spontaneous regulation condition,  $F(1, 27) = 14.49$ ,  $p = .001$ ,  $\eta^2 = .35$ .

#### POST HOC CODING

##### *Spontaneous Regulation Condition*

Because the spontaneous regulation condition was effective in reducing anger to the same extent as the distraction and reappraisal conditions, we conducted a post hoc analysis in which two coders (the first author and a research assistant) independently judged whether participants in the spontaneous regulation condition engaged in distraction, reappraisal, or rumination (93% agreement). Of the 27 participants whose written responses were available, 23 (85%) engaged in distraction, 5 (19%) engaged in rumination, and 1 (4%) engaged in reappraisal (the total percentages is  $>100\%$  because 3 participants engaged in more than one strategy). Thus, the large majority of participants chose to distract themselves when given the opportunity to write about whatever came to mind, suggesting that distraction may be a common anger regulation strategy in undergraduates. Common themes that participants wrote about included family, friends, upcoming coursework, and fun events.

##### *Analytical Rumination Condition*

As noted above, recent research suggests that when thinking about the causes of an anger-inducing event from a "cool," distanced perspective, it can reduce anger relative to "hot," emotionally immersive rumination (Kross et al., 2005). Following prior work (Denson et al., 2009) two judges therefore coded whether participants ruminated in

primarily a hot manner or wrote about the memory in a cool manner. Following Kross et al.'s conceptualization of processing anger-inducing events in a "hot" versus "cool" style, individuals who wrote about the memory in an emotionally evocative manner, were coded as "hot"; whereas those who wrote about the event in a detached, informational manner were coded as "cool." For example, a participant judged to have ruminated in a hot manner wrote, "I felt SO angry at N for making me hurt my D . . . I still feel angry . . . I hope that the fleas of a thousand camels get onto him and his limbs are too short to scratch them eternally. I will probably keep this grudge forever." A participant judged to have written in a cool manner wrote, "The people involved in the event acted the way they did because they were each other's catalysts. There might be hidden/secretive reasons why person A will make person B angry, and person B, reacting to person A then becomes angry and bitter and if the cycle goes on, both A and B are making each other angry. Person A might have acted the way he/she did because he/she may have insecurities within the self or is just simply inconsiderate. In this case, both reasons seem highly possible." Initial agreement was 86% and disagreement on four cases was resolved via discussion prior to examining the anger data.

There were no differences between the hot and cool groups in terms of how angry participants reported feeling immediately after recalling the memory ( $p > .20$ ), ruling out differences in affect prior to the rumination manipulation. Following the writing task, participants who engaged in hot analytical rumination ( $n = 18$ ,  $M = 3.44$ ,  $SD = 1.79$ ) reported significantly more anger than participants in the reappraisal condition ( $M = 2.37$ ,  $SD = 1.33$ ),  $t(46) = 2.39$ ,  $p = .02$ ,  $d = .71$ , and a trend toward more anger than participants who wrote in a cool manner ( $n = 10$ ,  $M = 2.30$ ,  $SD = 1.33$ ),  $t(26) = 1.76$ ,  $p = .09$ ,  $d = .69$ . Participants who wrote in a cool manner reported nearly identical levels of anger as participants in the reappraisal condition,  $t(38) < 1$ ,  $p > .80$ ,  $d = .05$ . These data are consistent with the notion that distancing when thinking about an angry memory can result in lower levels of anger than emotionally evocative, hot rumination.

### Discussion

The present experiment adds to a growing literature that has demonstrated the utility of reappraisal as an effective emotion regulation strategy (e.g., Gross, 1998; Gross & John, 2003). Our results are consistent with and extend the only previous study to have examined the relative effects of reappraisal and rumination within the context of anger (e.g.,

Ray et al., 2008). Specifically, we found that rumination maintained anger, and by contrast, reappraisal reduced anger. We note that our observation that rumination maintained anger departs from previous studies in which rumination increased anger (e.g., Rusting & Nolen-Hoeksema, 1998). Despite this difference, the persistence of rumination from memory recall until the end of the writing task nonetheless speaks to the aversive impact of this cognitive process. Participants in the distraction condition and those who did not receive an emotion regulation instruction (i.e., spontaneous regulation condition) reported reduced anger following the writing task. Post hoc coding revealed that the anger-reducing effects observed in the spontaneous regulation condition were most likely caused by the majority of participants who chose to distract themselves by writing about positive content (e.g., family, friends, fun events) and/or upcoming academic assignments. Interestingly, following the delay, anger had dissipated in all four groups.

At the end of the writing task, participants in the reappraisal condition reported anger levels in between the rumination and spontaneous regulation/distraction conditions. Post hoc coding revealed that this effect was likely due to some participants ruminating in a hot manner and others ruminating in a cool manner. Although reappraisal did reduce anger following the memory, at first glance these data suggest that reappraisal was not as effective as distraction in reducing anger. One important consideration is that reappraisal involves thinking about (i.e., directing attention toward) the anger-inducing event, whereas distraction involves actively diverting attention from it. Thus, it is likely that the cognitive processing involved in reappraisal can facilitate resolution of the event, but that the effects on anger might not be immediately observable. By contrast, distraction might offer immediate relief, but may not be an effective long-term strategy, for example, in situations that involve repeated interaction with a disliked other. Distraction following a one-off confrontation (e.g., with a salesclerk) might quickly and effectively reduce anger because the angry individual can choose not to shop at a given store again in future. However, repeated anger-inducing encounters with a spouse or supervisor at work, for instance, are unlikely to be aided by distraction. Clearly such interactions would benefit from an individual being able to reappraise in such a manner that he or she can remain calm and objective in order to resolve the situation. Future research that investigates the relative effects of the emotion regulation manipulations over extended time periods is needed to explore these possibilities.

We relied on post hoc coding to provide a closer examination of the written content during the rumination condition. These analyses revealed that participants who ruminated in a hot manner reported more anger than participants in the reappraisal condition. By contrast, participants in the rumination condition who wrote about the anger-inducing event in a cool manner showed a trend toward less anger than hot ruminators and a similar degree of anger to those in the reappraisal condition. This latter finding suggests that self-distancing may be responsible for the anger-reducing effects of reappraisal. Indeed, some recent work on reappraisal has included self-distancing within the manipulation. For example, in the study by Ray et al. (2008), the reappraisal instructions included “you might try to see this event from the perspective of an impartial observer” (p. 135). Similarly, in another study participants were asked to view emotionally evocative images “from a detached, third-person perspective” in the context of emotion regulation (Moser, Most, & Simons, 2010, p. 198; see also Ochsner et al., 2004). One could argue that seeing an anger-inducing event from a third-party perspective requires some amount of self-distancing. Nonetheless, in two studies Ayduk and Kross (2010) found only small, positive, nonsignificant correlations between self-distancing and reappraisal. The authors concluded that self-distancing may be an aspect of reappraisal but did not find strong relationships between the two constructs in two studies. Thus, reappraisal likely involves additional cognitive processes other than self-distancing.

On a related note, our operationalization of cool rumination was adapted from prior empirical work (e.g., Denson et al., 2009; Kross et al., 2005). We acknowledge that the emotionally detached manner in which participants wrote about their memory lacked the distressing or intrusive quality that characterizes most definitions of rumination (e.g., Nolen-Hoeksema et al., 2008). Nonetheless, manipulation checks indicated that regardless of whether they were categorized as hot or cool ruminators, participants engaged in analytical rumination (i.e., thinking about the causes, meanings, and consequences) as instructed.

As a more general comment, treatment developments in the area of anger are needed. Indeed, teaching clients alternative ways of appraising anger-eliciting situations is a key goal of cognitive therapy for individuals who have difficulty managing anger. On the basis of the findings of their meta-analysis, DiGiuseppe and Tafra (2003) drew attention to “the lack of programmatic research on anger treatments” (p. 80). In particular, they

called for future work to investigate the impact of cognitive factors that mediate anger. Our experimental findings have highlighted effective ways to regulate anger when recalling an anger-eliciting memory. The next step will be to evaluate the effectiveness of these emotion regulation strategies in reducing anger in response to more ecologically valid situations (e.g., when deliberately provoked). Such experimental studies will build a picture of the most efficacious strategies to employ in order to reduce anger, which in turn will inform treatment advances. For instance, the present results suggest that expressive writing treatments should emphasize the type of processing that individuals engage in when writing about anger-inducing life episodes.

A number of methodological issues limit the conclusions that we are able to draw from our findings. First, we relied on a single-item self-report measure of anger. Because we assessed anger multiple times, we sought to reduce fatigue and the distracting effects of filling in a multiple-item measure. As such, we cannot rule out the possible impact of demand effects on participants' ratings on this item. This concern is allayed in part by our inclusion of content analyses, which we expect would be less susceptible to demand characteristics or self-presentation concerns because participants were not aware that their written responses would be examined. Second, we have discussed possible clinical implications of our results but need to be mindful that we examined a nonclinical undergraduate sample that of course differs in many ways from clinical populations that are characterized by extreme levels of anger and aggression. For instance, the low mean levels of anger we observed in the spontaneous regulation condition may be attributable to our use of a high-functioning nonclinical undergraduate sample. Another issue that warrants mention is our post hoc coding of participants' written responses in the analytical rumination condition, and our use of this information to classify responses as either emotionally hot or cool. Our coding drew on the distinction between subtypes of angry rumination made in prior work (e.g., Kross et al., 2005). However, we acknowledge that the absence of a direct manipulation of these rumination subtypes limits our capacity to directly compare our findings to earlier work. Future work could usefully compare the relative outcomes of these two types of rumination to other emotion regulation strategies.

Despite these considerations, ours is another study in a long tradition of laboratory-based investigations in experimental psychopathology. The findings of such studies have significant scope to advance understanding of the factors that

maintain clinical disorders, and in turn, give rise to the development of effective psychological treatments (Clark, 2004).

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