



The impact of rumination on aggressive thoughts, feelings, arousal, and behaviour

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Although rumination following a provocation can increase aggression, no research has examined the processes responsible for this phenomenon. With predictions derived from the General Aggression Model, three experiments explored the impact of two types of post-provocation rumination on the processes whereby rumination augments aggression. In Experiment 1, relative to distraction, self-focused rumination uniquely increased the accessibility of arousal cognition, whereas provocation-focused rumination uniquely amplified the accessibility of aggressive action cognition. In Experiment 2, provocation-focused rumination uniquely increased systolic blood pressure. In Experiment 3, both types of rumination increased aggressive behaviour relative to a distraction condition. Angry affect partially mediated the effects of both provocation- and self-focused rumination on aggression. Self-critical negative affect partially mediated the effect of self-focused rumination but not provocation-focused rumination. These findings suggest that provocation-focused rumination influences angry affect, aggressive action cognition, and cardiovascular arousal, whereas self-focused rumination increases self-critical negative affect, angry affect, and arousal cognition. These studies enhance our understanding of why two types of post-provocation rumination increase aggressive behaviour.

Imagine receiving a highly unprofessional and personally insulting review of a manuscript. At least two ruminative responses are possible. You might focus on anger towards the reviewer and acts of retaliation – *provocation-focused rumination*, wherein one broods over a specific provoking incident (Bushman, 2002; Bushman, Bonacci, Pedersen, Vasquez, & Miller, 2005; Denson, Fabiansson, Creswell, & Pedersen, 2009; Denson, Pedersen, & Miller, 2006). Provocations incite anger, or irritate and are a significant cause of aggressive behaviour (Anderson & Bushman, 2002; Geen, 1990).

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Alternatively, you might focus on yourself, thinking about your faults as a scientist and why this sort of thing always seems to happen to you – *self-focused rumination*, wherein one directs attention inward, particularly on one's own negative emotions (Lyubomirsky & Nolen-Hoeksema, 1995; Nolen-Hoeksema & Morrow, 1993).

Following a provocation, induced rumination augments *direct aggression* (i.e., aggression towards the provocateur; Bushman, 2002; Bushman *et al.*, 2005). In contrast, preventing rumination reduces direct aggression towards an insulting confederate (Konenci, 1974). Rumination also augments *displaced aggression* (i.e., aggression directed towards someone other than the initial provocateur). In three studies (Bushman *et al.*, 2005), experimentally induced self- or provocation-focused rumination augmented triggered displaced aggression (TDA) – wherein, after an initial provocation, participants receive a subsequent minor annoyance from the displaced aggression target (Miller, Pedersen, Earleywine, & Pollock, 2003). These findings were robust across different types of rumination, diverse operationalizations of aggression (i.e., physical and verbal aggression measures), and even after an 8 h interval between provocation and trigger.

Nonetheless, we lack understanding of the underlying process driving these effects. Identification of these processes is the first step towards reducing the harm associated with rumination-induced aggression. Within the context of the General Aggression Model (GAM; Anderson & Bushman, 2002), the current studies investigate theoretically specified mechanisms by which provocation- and self-focused rumination increase aggression.

The GAM posits that both person factors (e.g., personality, sex, genetic dispositions) and situational factors (e.g., the presence of provocation, alcohol) determine an individual's current internal state (Anderson & Bushman, 2002; Lindsay & Anderson, 2000). They impact (a) cognition (i.e., aggressive thoughts), (b) affect (i.e., anger), and (c) physiological arousal. These latter three routes to aggression influence immediate appraisals. Higher-order, conscious appraisal, and decision-making processes can also modify aggressive behaviour. Indeed, our previous research established that, for those induced to ruminate, conscious appraisals of a provoking incident mediated its effect on aggressive behaviour (Bushman *et al.*, 2005). However, prior rumination research has not explored the potential aggression-augmenting effects of the *three internal states* postulated by the GAM to elicit aggression. Consequently, we herein investigate the influence of rumination on: (a) aggressive cognition, (b) angry affect, and (c) physiological arousal.

The differential impact of self- and provocation-focused rumination

We propose that self- and provocation-focused rumination differentially influence these three routes to aggression. *Provocation-focused rumination* directs attention towards a provoking incident. Bushman (2002) found that provocation-focused rumination increased self-reported anger, an emotion associated with an *approach* motivation (Carver & Harmon-Jones, 2009; Harmon-Jones, Vaughn-Scott, Mohr, Sigelman, & Harmon-Jones, 2004). Although self-focused rumination, too, increases anger (Rusting & Nolen-Hoeksema, 1998), provocation-focused rumination more specifically concerns a focus on anger and planning aggressive acts of retaliation (e.g., Caprara, 1986; Denson *et al.*, 2006; Sukhodolsky, Golub, & Cromwell, 2001). Furthermore, anger is associated with cardiovascular reactivity. Studies of angry memories link provocation-focused rumination to increased cardiovascular reactivity relative to more adaptive forms of emotional processing (Ax, 1953; Kross, Ayduk, & Mischel, 2005; Ray, Wilhelm, & Gross, 2008). We

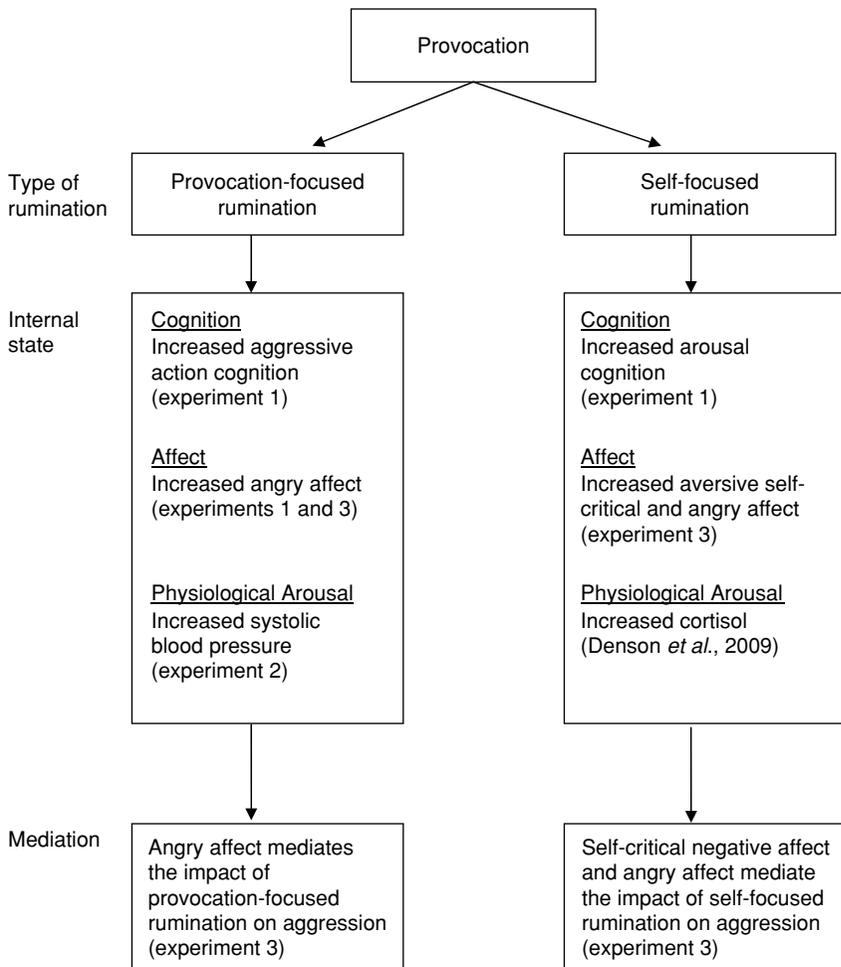


Figure 1. Overview and predictions of the differential effects of provocation- and self-focused rumination on cognition, affect, physiological arousal, and aggression.

therefore propose that by comparison with self-focused rumination, provocation-focused rumination will more strongly impact anger, the cognitive accessibility of aggressive actions, and cardiovascular arousal (see Figure 1).

Unlike provocation-focused rumination, *self-focused rumination* requires inward focused attention on the self. Relative to distraction conditions, self-focused rumination exacerbates feelings of depression (e.g., Lyubomirsky & Nolen-Hoeksema, 1993; Morrow & Nolen-Hoeksema, 1990; Nolen-Hoeksema & Morrow, 1993). Depressed individuals who subsequently engage in self-focused rumination experience longer and more severe episodes of depressed mood (e.g., Carver, Scheier, & Weintraub, 1989; Nolen-Hoeksema, Morrow, & Fredrickson, 1993). Yet, as noted, such rumination also increases anger (Rusting & Nolen-Hoeksema, 1998).

This internalizing aspect of self-focused rumination also likely increases self-critical evaluation. According to Objective Self-Awareness (OSA) theory, self-awareness initiates a process whereby individuals compare their current state with personal standards (Duval

& Wicklund, 1972). Negative affect and psychological arousal arise from a discrepancy between the two. Thus, self-focused rumination might be associated with psychological arousal and self-critical negative affect, augmenting the latter to a greater extent than other forms of self-focused attention (Mor & Winquist, 2002). Regarding physiological arousal, after provocation, self-focused rumination maintained elevated cortisol (Denson, Fabiansson, *et al.*, 2009) – a characteristic effect of social evaluation (Denson, Spanovic, & Miller, 2009; Dickerson & Kemeny, 2004).

The considerable literature on the self-conscious emotion of shame and its relationship with anger is also relevant. Many studies show a relationship between proneness to shame and anger (e.g., Bennett, Sullivan, & Lewis, 2005; Harper & Arias, 2004; Tangney & Dearing, 2002). Situational influences on shame are also linked to anger. Shamed partners within romantic couples displayed more anger and aggressive behaviour (Tangney, 1995). Thus, ‘shame and anger go hand in hand. Desperate to escape painful feelings of shame, shamed individuals are apt to turn the tables defensively, externalizing blame and anger outward onto a convenient scapegoat’ (Tangney, Stuewig, & Mashek, 2007, p. 352).

Figure 1 summarizes our predictions. Based on the preceding work, we expected process differences between self- and provocation-focused rumination. First, because OSA theory suggests that self-focused rumination produces an internal focus that increases psychological arousal, we expected it to heighten the accessibility of arousal cognitions. Second, we expected it to augment self-critical affect, which in turn should drive aggressive behaviour. Although both types of rumination should augment angry affect, we expected self-critical affect to uniquely contribute to the aggression-augmenting effect of self-focused rumination.

Overview of studies

Experiment 1 assessed the effects of rumination on the cognitive accessibility of the three types of aggressive cognition invoked in the GAM: aggressive action, angry affect, and arousal. Experiment 2 examined the impact of rumination on cardiovascular measures of arousal. Experiment 3 directly compared the impact of both provocation- and self-focused rumination on aggressive behaviour, while investigating the distinct mediating mechanisms that underlie their aggression-augmenting effects.

Taken together, they make several contributions. First, as already discussed, although rumination reliably augments aggression, this is the first investigation of its impact on the underlying processes of cognition, affect, and arousal. Second, Experiment 3 is the first to compare within the same study the relative impact of self- and provocation-focused rumination on subsequent aggression. Third, we test theoretically derived hypotheses concerning the distinct processes by which the two types of rumination increase aggression.

EXPERIMENT 1

Experiment 1 provides the first evidence on the extent to which provocation- and self-focused rumination affect the cognitive accessibility of the three routes posited by the GAM to increase aggression. To do so, we created an implicit measure of aggressive action tendencies, angry affect, and arousal. Specifically, we modified Anderson *et al.*'s (2004) word completion task, which consists primarily of words related to *aggressive*

actions, adding separate sets of words related both to *angry affect* and *arousal*. We also tested our prediction that provocation- and self-focused rumination differentially impact the three types of aggressive cognitions. Specifically, because self-focused rumination turns attention towards one's internal state and is associated with psychological arousal, we expected it to most strongly influence arousal cognitions. By contrast, we expected provocation-focused rumination to direct attention to the provocation and its source, thereby inducing an aggressive action orientation. Consequently, we expected it to most strongly influence aggressive action cognitions (Denzler, Förster, & Liberman, 2009). Furthermore, because both types of rumination maintain angry affect (Bushman *et al.*, 2005; Rusting & Nolen-Hoeksema, 1998), we expected each to increase the accessibility of angry affect. Finally, we assessed explicit anger (via self-report), thereby examining the effects of both types of rumination on hostile affect.

Method

Participants and design

In exchange for extra course credit, 206 undergraduate volunteers (169 females and 37 males), were randomly assigned to one of three writing task conditions (*viz.*, provocation-focused rumination/self-focused rumination/distraction). Within conditions, the relative frequency of each gender was approximately equal, with the per cent of males ranging from 16.4 to 20.5%.

Materials and procedure

Participants were informed that the experiment concerned the relationship between measures of verbal ability and the impact of current mood on them.

Provocation procedure

As their first test of verbal ability, participants received a list of 15 anagrams and given 3.5 min to solve them. The experimenter then re-entered the room, took their answer sheet (ostensibly to grade it), and provided feedback indicating that a (bogus) previous sample had performed quite well on that same task. After a brief departure, the experimenter returned with the participant's score.

The anagrams were very difficult (e.g., NVTNIMEREON = ENVIRONMENT). No participant completed them in the allotted time and actual performance was quite poor ($M = 4.62$ anagrams solved, $SD = 1.37$). When presenting the participant's score, the experimenter indicated that it was below average compared to the previous sample. He then harshly criticized the participant's problem solving ability and effort, stating that this portion of the experiment should be repeated. Then, in an exasperated and irritated tone, he added that it would waste his time, and they should just proceed with the study. This procedure reliably induces negative affect (e.g., Pedersen, Gonzales, & Miller, 2000, Experiment 1; Vasquez, Denson, Pedersen, Stenstrom, & Miller, 2005).

Rumination manipulation

Relying on effective rumination manipulations (e.g., Bushman *et al.*, 2005; Denson *et al.*, 2006; Denson, Fabiansson, *et al.*, 2009), we next asked participants to complete

a 20-min writing task that purportedly assessed their writing effectiveness. Participants were told that one among several different writing topics had been randomly chosen for them. Those in the *provocation-focused rumination* condition had to write about what had occurred in the experiment up to that point, including their actions, feelings, and interactions with others. We intentionally chose these very general instructions to avoid potential demand characteristics that would arise had we directly instructed participants to write about the provoking feedback. Participants in the *self-focused rumination* condition received a packet with a phrase on each page. As in Bushman *et al.* (2005, Experiment 1), they were asked to think about each, spend 1- or 2-min writing thoughts that came to mind on a pad of paper, and then proceed to the next page, continuing this process for 20 min (cf. Rusting & Nolen-Hoeksema, 1998). To avoid demand effects, the phrases mentioned no specific emotions (e.g., anger). Examples included 'what kind of a person you are', 'why people treat you the way they do', and 'how you interact with people'. Judges had rated these phrases as affectively neutral (Rusting & Nolen-Hoeksema, 1998). Participants in the *distraction* condition wrote about the layout of their college campus. All participants were instructed not to worry about spelling or grammar. Analyses showed no difference in number of written words across conditions, $F(2,201) = 0.03, p = .97$.

Dependent measures

Cognition

To assess the cognitive accessibility of aggression-related affect, actions, and arousal, participants were given our modified word completion task after their 20-min writing task. To more fully capture the distinct routes to aggression specified in the GAM, we added separate sets of angry affect (e.g., mad, irate, annoyed) and arousal words (e.g., tense, alert, active) to Anderson *et al.*'s (2004) original version, which primarily contained aggressive action words (e.g., hit, stab).

Within the constraint of not having more than 2 adjacent words from a given category, participants completed a set of 34 randomly ordered word fragments (14 incomplete aggressive action words, 11 incomplete anger words, and 9 incomplete arousal words). *Action* words described physically aggressive responses (e.g., 'h_t', when completed to make the word 'hit', was scored as an aggressive action response, whereas 'hat' was scored as a non-aggressive response); *affect* words described aggressive emotional responses (e.g., 'm_d', when completed to make the word 'mad' was scored as an aggression-related emotional response, whereas 'mud' was scored as a non-aggressive response); *arousal* words described the cognitive representation of arousal (e.g., 'l_ _ely', when completed to make the word 'lively', was scored as an arousal response, whereas 'lonely' was scored as a non-arousal response).

Because the number of words in each category differed, we calculated the percentage correct in each category. Consider for instance, the category *action-related aggression words*. We divided the total number of a participant's completed words in that category by the total number of words within that category, yielding a percentage. Although a one-way ANOVA indicated that the three word types did not differ in their frequency of occurrence in the English language (Leech, Rayson, & Wilson, 2001), $F(2, 30) < 1$, ns, nevertheless, the low power of analysis of variance makes this result susceptible to a Type II error (Wilcox, 1995). Therefore, percentage scores within each category were standardized across participants prior to analysis. Parenthetically, use of standardized versus unstandardized scores did not alter any results.

Clearly, the word completion task taps the cognitive accessibility of a construct, but not necessarily that actual construct. Thus, the arousal words measured cognitive accessibility of arousal, not physiological arousal. Nonetheless, cognitive accessibility of a construct is likely to be positively correlated with other more direct measures of it.

Self-reported angry affect

Next, participants completed the State Hostility Scale (Anderson, Deuser, & DeNeve, 1995) to assess their angry affect ($\alpha = .95$). It consists of 32 affect statements (e.g., 'I feel furious', 'I feel angry') with responses ranging from 1 ('strongly disagree') to 5 ('strongly agree').

Rumination manipulation checks

Finally, as a rumination manipulation check, participants rated *how often* and *how strongly* they thought about their performance on the anagram task (viz. the initial provocation) while performing the 20-min writing task (1 = *not at all*, 7 = *very often* or *very strongly*) ($\alpha = .74$).

Results

Rumination manipulation check

Confirming a successful rumination manipulation, the three conditions differed on *how often* and *how strongly* they thought about the anagram task, $F(2,200) = 8.52$, $p < .001$, partial $\eta^2 = .08$. Participants in the provocation-focused rumination condition ($M = 4.27$, $SD = 1.54$) reported thinking about the provocation more than those in either the self-focused rumination ($M = 3.42$, $SD = 1.81$) or the distraction conditions ($M = 3.21$, $SD = 1.46$) (both pairwise p values $< .01$).

To further understand thoughts elicited by self-focused rumination, two research assistants (blind to conditions and hypotheses) independently rated each participant's content produced during the 20-min self-focused rumination and distraction writing tasks. Using scales ranging from 1 (not at all) to 5 (very much), they evaluated the degree to which participants were (a) reflective, (b) introspective, (c) indicated negative self-feelings, and (d) were angry or annoyed with themselves. Additionally, they assessed the focal point of participants' writing samples (1 = all others, 5 = all self) as a measure of self-focus.

In line with our expectations, relative to distraction, those in the self-focused rumination condition thought more about themselves in general, as evidenced by higher ratings on the items 'self-focused', 'reflective', and 'introspective' (all t values > 4.50 and all p values $< .001$). Consistent with thinking about themselves in relation to the provocation, the self-focused condition also produced higher ratings for 'negative self-feelings', $t(106) = 2.61$, $p < .05$, and 'anger or annoyance with self', $t(105) = 3.41$, $p < .01$.

Cognitive accessibility of aggressive constructs

The three word types (i.e., action, arousal, and affect) were combined into a single measure of the accessibility of aggression-related cognitions (i.e., an average of the three standardized word types). Relative to the distraction condition ($M = -0.30$, $SD = 0.53$), participants in both the provocation-focused condition ($M = 0.16$, $SD = 0.59$, $p < .001$, partial $\eta^2 = .14$) and the self-focused rumination condition ($M = 0.12$, $SD = 0.47$,

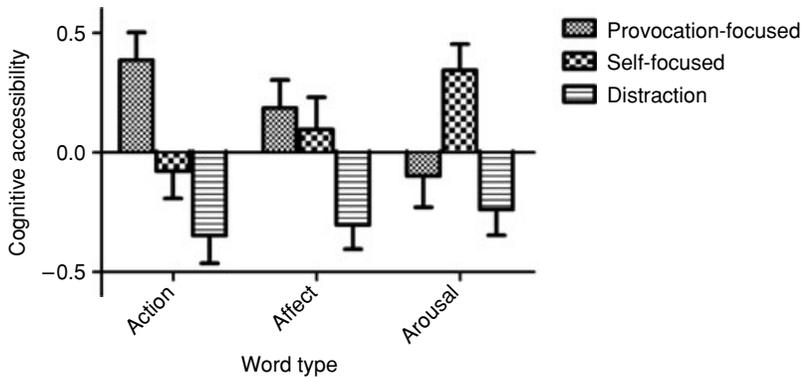


Figure 2. Means and standard errors representing the impact of experimentally induced rumination on the cognitive accessibility of different aggression-related word types (z scores) (Experiment 1).

$p < .001$, partial $\eta^2 = .15$) showed greater accessibility of aggression-related cognition. The two rumination conditions did not differ.

Next, a 3 (Word type: action/arousal/affect) \times 3 (Rumination condition: provocation-focused/self-focused/distraction) repeated measures ANOVA was performed. Results revealed the anticipated word type \times rumination interaction, $F(4,406) = 3.82$, $p < .01$. Separate analyses of each word type indicated that, as expected, provocation-focused rumination heightened accessibility of aggressive *actions* ($M = 0.39$, $SD = 0.99$) relative to either the self-focused rumination ($M = -0.08$, $SD = 0.93$) or distraction conditions ($M = -0.35$, $SD = 0.94$), $F(2,203) = 10.50$, $p < .001$, partial $\eta^2 = .09$, both pairwise p values $< .05$; see Figure 2). Self-focused rumination, however, increased the accessibility of *arousal* words ($M = 0.34$, $SD = 0.89$) compared to either the provocation-focused rumination condition ($M = -0.10$, $SD = 1.12$) or the distraction condition ($M = -0.24$, $SD = 0.88$), $F(2,203) = 6.52$, $p < .01$, partial $\eta^2 = .06$ (both pairwise p values $< .05$). Both provocation-focused ($M = 0.19$, $SD = 0.99$) and self-focused rumination ($M = 0.10$, $SD = 1.10$) impacted the accessibility of aggressive *affect* words, $F(2,203) = 4.76$, $p = .01$, partial $\eta^2 = .05$, inducing greater accessibility of anger-related words relative to distraction ($M = -0.30$, $SD = 0.82$) (pairwise p values = .011 and .053, respectively).

Self-reported angry affect

A Welch-Sidak linear contrast (Wilcox, 1996) indicated that those in the provocation-focused rumination condition ($M = 73.45$, $SD = 18.01$) reported more anger and hostility on the State Hostility Scale, relative to the combination of the self-focused rumination ($M = 66.02$, $SD = 17.86$) and distraction ($M = 66.15$, $SD = 18.06$) conditions, $T = 1.68$, $p < .05$, which did not differ.

Discussion

Experiment 1 provides the first evidence that both provocation- and self-focused rumination increases the accessibility of aggression-related thought, relative to distraction. This finding is consistent with associate network models of aggression wherein an initial aversive event such as a provocation activates aggression-related thoughts, feelings,

and motor responses (Berkowitz, 1990, 1993), thereby increasing the likelihood of subsequent aggressive behaviour.

It might be concluded that participants under provocation-focused rumination simply showed heightened accessibility for whatever they were asked to think about. Because we did not explicitly instruct participants to write about a provocation, however, such a possibility seems unlikely. Moreover, the interaction discussed next further argues against this view.

As previously reported, experimentally induced rumination interacted with word type. Supporting our theorizing, provocation-focused rumination uniquely amplified the accessibility of aggressive *actions*. Therefore, this finding is consistent with the notion that provocation-focused rumination produces an aggressive approach orientation and activates a goal to aggress (cf. Denzler *et al.*, 2009). Also confirming expectations, those who experienced self-focused rumination differentially showed increased accessibility of *arousal* words. This meshes nicely with the notion that self-focused attention increases psychological arousal (Duval & Wicklund, 1972). Finally, both rumination conditions equally augmented the accessibility of aggressive *affect* words relative to distraction.

Experiment 1 also demonstrated that relative to distraction and self-focused rumination, provocation-focused rumination augmented another route to aggression specified by the GAM, namely self-reported *angry affect*. This latter finding might seem at odds with our previously discussed result showing that both types of rumination had a similar effect in increasing the accessibility of angry affect words. Although both measures assess anger and hostility, the State Hostility Scale is an explicit self-report measure wherein participants are directly asked how they feel. In contrast, the word accessibility measure is an implicit measure that asks participants to fill in blanks to make a word, thereby assessing whatever is pre-potent in the mind. Thus, both forms of rumination increase the cognitive accessibility of angry affect, yet only provocation-focused rumination significantly increased angry feelings that were noticeable to participants. These findings are consistent with the GAM's distinction between aggressive cognition and affect (Anderson & Bushman, 2002).

EXPERIMENT 2

Experiment 2 investigated the effects of provocation- and self-focused rumination on physiological arousal, addressing two unresolved issues from Experiment 1. First, in Experiment 1 provocation-focused rumination produced higher levels of self-reported angry affect than did self-focused rumination or distraction. The experience of anger *elevates* systolic blood pressure (SBP; e.g., Ax, 1953; Schum, Jorgensen, Verhaeghen, Sauro, & Thibodeau, 2003), especially when that anger is retained and not expressed (e.g., Thomas, 1997), as is ordinarily true during rumination. Indeed, relative to adaptive forms of emotional processing, provocation-focused rumination is associated with higher levels of cardiovascular reactivity (Kross *et al.*, 2005; Ray *et al.*, 2008). In Experiment 1, the procedure allowed participants to express their anger by positioning the State Hostility Scale directly after the implementation of the rumination conditions. Experiment 2 omitted the State Hostility Scale, thereby precluding anger expression immediately after induced rumination. If provocation-focused rumination increases angry affect (as shown in Experiment 1), an analogous increase in SBP is expected for this condition, relative to the other rumination conditions in Experiment 2. Second, to show that effects observed under provocation-focused rumination were not due to priming,

Experiment 2 added a negative event control condition wherein participants wrote about an unrelated anger-inducing occurrence.

Method

Participants and design

In exchange for extra course credit, 63 undergraduates (53 females and 10 males) were initially provoked and then randomly assigned to one of four Writing Tasks: Provocation-focused Rumination/Self-focused Rumination/Distraction/Negative Event. The frequency of each gender was approximately equal in each condition.

Procedure

Participants were told that the experiment investigated the relationship between verbal ability and ones current physiological state. They were subsequently provoked via the anagram task procedure used in Experiment 1. The anagrams were followed by the 20-min writing task. The procedures in the first three conditions (viz. Provocation-, Self-focused Rumination, and Distraction) matched those of Experiment 1. The additional control (*Negative Event*) condition asked participants to write about a personal experience wherein someone provoked them and made them angry.

Dependent measures

SBP was measured at four points: prior to the anagram task (baseline) (*Time 1*), following the provocation (*Time 2*), halfway through the writing task (*Time 3*), and after the writing task (*Time 4*). Then, participants completed the rumination manipulation check used in Experiment 1.

Results and discussion

Rumination manipulation check

To check the rumination manipulation, Experiment 2 employed the composite variable used in Experiment 1 ($\alpha = .89$). As expected, the four rumination conditions differed $F(3, 53) = 19.03, p < .001$, partial $\eta^2 = .52$. Consistent with, but adding to Experiment 1, those in the provocation-focused rumination condition ($M = 5.54, SD = 1.42$) not only reported thinking about the anagram task more than those in the self-focused rumination ($M = 2.07, SD = 1.24$) and distraction conditions ($M = 2.80, SD = 1.37$), but also more than those in the negative event ($M = 2.54, SD = 1.36$) condition (all pairwise p values $< .001$). No differences emerged among the latter three conditions.

Systolic blood pressure

Participants in the four writing tasks did not differ in their baseline level of SBP, $F(3, 59) = 0.005, p > .99$. To assess whether rumination augments SBP, we compared the Time 2 (immediately following the provocation) and Time 4 (at the conclusion 20-min writing task) readings for the four writing task conditions. Consistent with the self-reported angry affect results found in Experiment 1, only participants in the

provocation-focused rumination condition exhibited increased SBP (viz. $M = 112.67$, $SD = 12.63$ at Time 2 and $M = 115.73$, $SD = 13.29$ at Time 4), $t(14) = 4.08$, $p = .001$, $d = 0.99$. SBP levels did not differ across the writing task for any other condition. Furthermore, in an analysis of SBP difference scores between Times 2 and 4, the increase of the provocation-focused rumination group ($M = 3.07$, $SD = 2.91$) exceeded that of the combination of the three other groups ($M = 0.27$, $SD = 7.03$), $t(56.01) = 2.21$, $p < .05$, $d = 0.65$. Thus, as predicted, only provocation-focused rumination reliably augmented SBP levels. This expands our understanding of the effects of rumination on physiological arousal and replicates the self-reported angry affect results from Experiment 1.

EXPERIMENT 3

Experiments 1 and 2 assessed the impact of provocation- and self-focused rumination on the three internal states discussed in the GAM - (a) cognition (i.e., aggressive thoughts), (b) affect (i.e., anger), and (c) physiological arousal. Experiment 3 focused on aggressive behaviour within the context of the TDA paradigm (Miller *et al.*, 2003). As discussed, aggression is *direct* when an individual is provoked and, in retaliation, inflicts harm against the provoker. Aggression is *displaced* when the target is someone other than the initial provocateur. Sometimes this target is completely innocent but this does not capture all instances of displaced aggression. Oftentimes, the target is someone who emits a mildly annoying act (e.g., someone cuts in front of you on the freeway). TDA refers to instances when, following an initial provocation, the target of aggression commits a minor provocation, the triggering event, that in turn prompts an aggressive response (Dollard, 1938). This type of aggression seemingly corresponds to many instances of aggression seen in real-world settings wherein a relatively minor annoyance (viz. a trigger) elicits a response towards the triggering target that exceeds what would be expected given a tit-for-tat matching rule (Axelrod, 1984). Some examples include road rage, intimate partner abuse, and child abuse. In the current study, the experimenter provoked participants in the context of the anagram task but the aggressive behaviour of participants was instead aimed at a (bogus) participant who provided a second, minor provocation.

In addition, Experiments 1 and 2 employed *general* measures of angry affect that do not specify the target of the anger. Ellsworth and Tong (2006) make a distinction between other- and self-anger and empirically distinguish between them on a variety of outcomes including appraisals, action tendencies, and their impact on the experience of other emotions (e.g., shame, contempt, guilt). In correspondence with Ellsworth and Tong (2006), Experiment 3 employed two different types of affect measures: (1) self-critical negative affect and (2) angry affect reflecting participants' reaction to the trigger.

This study was also the first to directly compare the aggression augmenting effects of both types of rumination and to assess affective processes that might explain how they differentially increase aggressive behaviour. Specifically, based on the findings of Experiments 1 and 2, we expected angry affect concerning the trigger to mediate the effect of provocation-focused rumination on subsequent aggression. In contrast, self-focused rumination produces an internal focus, which can increase self-awareness and self-critical evaluation. As indicated previously, OSA theory (Duval & Wicklund, 1972) posits that negative affect results from unresolved discrepancy between one's present

self and one's standards. Furthermore, the specific operationalization of provocation employed in this study (viz. insult following poor task performance) constitutes a negative social evaluation and potential loss of status. This threatens the social self (Dickerson, Gruenewald, & Kemeny, 2004). In addition, the work of Tangney and colleagues (e.g., Tangney, 1995; Tangney *et al.*, 2007) clearly links the self-critical emotion of shame with subsequent anger. Therefore, individuals engaged in self-focused rumination are likely to experience angry affect regarding the triggering event, which might in turn increase aggression. Moreover, because self-focused rumination should produce more self-critical negative affect than distraction, we expected self-critical negative affect to partially mediate its effect on aggression.

Method

Participants and design

For extra course credit, 100 undergraduates (69 females and 31 males) served in a 3 (Writing Task: Provocation-focused Rumination/Self-focused Rumination/Distraction) \times 2 (Trigger: Yes/No) between-participants design under conditions of constant initial provocation. Gender frequency was not confounded with condition.

Procedure

Participants were told that they would be interacting with another (bogus) participant, supposedly in another room. To induce provocation, participants completed the anagram task employed in Experiments 1 and 2. Next, they performed the same writing tasks used in Experiment 1.

They were then asked to list desirable traits for an astronaut (Pedersen, Bushman, Vasquez, & Miller, 2008). The experimenter then ostensibly took these responses to the confederate and returned 2 min later with the confederate's responses and an evaluation form. After evaluating the confederate's work, participants received the confederate's ostensible evaluation assessing the participant's originality, quality, effort, variety among traits listed, and common sense on the astronaut task. In addition, an overall evaluation was provided. In the *trigger* condition, the individual ratings and overall evaluation were 3, 4, 3, 3, 4, and 4, respectively on seven-point scales (1 = *no good at all*, 7 = *extremely good*), with the written comment: 'The performance was not great. I think a college student could do better'. In the *no trigger* condition, participants received a neutral evaluation (6, 5, 6, 5, 5, and 5), and the written comment: 'My partner did a decent job. I think the task was well done'.

Next, the experimenter told participants that the final task examined sensory distraction effects on cognitive abilities. After indicating that the participant and the other (bogus) participant would receive different distractions, participants were ostensibly randomly assigned a visual distraction (e.g., a pleasant nature video), whereas the other participant was assigned a tactile distraction (e.g., placing their hand in painfully cold water). To guide their decision about the length of distraction for the other participant, participants immersed their own hand in the cold water (10°C, 50°F) for 5 s (Vasquez *et al.*, 2005). Allegedly, the confederate was simultaneously previewing the nature video and would make a similar distraction decision.

Participants then received two envelopes. A form in the first instructed them to circle the duration that the other participant should be distracted using a nine-point

scale which started at '1 = no distraction at all' (0 s) and increased by 10 s intervals to '9 = 80 s/very strong distraction'. Participant thereby indicated how long their partner must hold a hand in painfully cold ice water. For this dependent measure of *physical TDA*, longer durations indicated more aggression.

The second envelope contained three measures. The rumination manipulation check of Experiments 1 and 2 appeared first. Second, participants indicated how *happy, pleased, annoyed, irritated, and angered or upset* they felt about the confederate's evaluation of their NASA task (viz. the trigger). These items, rated on seven-point linear scales (1 = *not at all*, 7 = *extremely*), checked the adequacy of the trigger manipulation and measured angry affect. The third measure asked participants to retrospectively rate the extent from 1 ('not at all') to 9 ('very intensively') to which they experienced five emotions after finishing the anagram test administered at the outset (viz. the provocation). These items assessed internally focused negative affect (i.e., regret, sorry, disgraced, disappointed at the task, disappointed in myself) ($\alpha = .87$).

Results and discussion

Manipulation checks

Rumination

We assessed the rumination manipulation with the measure used in Experiments 1 and 2 ($\alpha = .86$). A 3 (Writing Task: Provocation-focused Rumination/Self-focused Rumination/Distraction) \times 2 (Trigger: Yes/No) between-participants ANOVA revealed the expected main effect of rumination, $F(2, 93) = 9.85, p < .001, \eta^2 = .18$. Consistent with Experiments 1 and 2, participants in the provocation-focused rumination condition ($M = 4.00, SD = 1.55$) reported thinking about the provocation more than those in either the self-focused rumination ($M = 2.42, SD = 1.53$) or the distraction conditions ($M = 2.66, SD = 1.55$) (both *post hoc p* values $< .01$). The latter two conditions did not differ. Neither the main effect of trigger, $F(1, 93) = 1.87, ns, \eta^2 = .02$, nor the interaction, $F(2, 93) = 2.91, ns, \eta^2 = .06$, were significant.

Trigger

To assess the effectiveness of the trigger manipulation, participants reported their mood after feedback on the NASA task (i.e., how *irritated, happy, angered or upset, pleased* and *annoyed* they felt). After reverse scoring *happy* and *pleased*, items were averaged, forming a composite of angry affect ($\alpha = .90$). As expected, a 3 (Writing Task: Provocation-focused Rumination/Self-focused Rumination/Distraction) \times 2 (Trigger: Yes/No) between-participants ANOVA yielded a main effect for trigger, $F(1, 94) = 110.73, p < .001, \eta^2 = .54$, wherein triggered participants ($M = 4.65, SD = 1.06$) reported more anger in response to the evaluation than those not triggered ($M = 2.42, SD = 1.06$). Neither a main effect of rumination, $F(2, 94) = 1.50, ns, \eta^2 = .03$, nor an interaction, $F(2, 94) = 1.97, ns, \eta^2 = .04$, emerged.

Aggression

A 3 (Writing Task: Provocation-focused Rumination/Self-focused Rumination/Distraction) \times 2 (Trigger: Yes/No) between-participants ANOVA revealed both a main effect of Writing Task, $F(2, 94) = 4.29, p < .05, \eta^2 = .08$, and Trigger, $F(1, 94) = 13.84,$

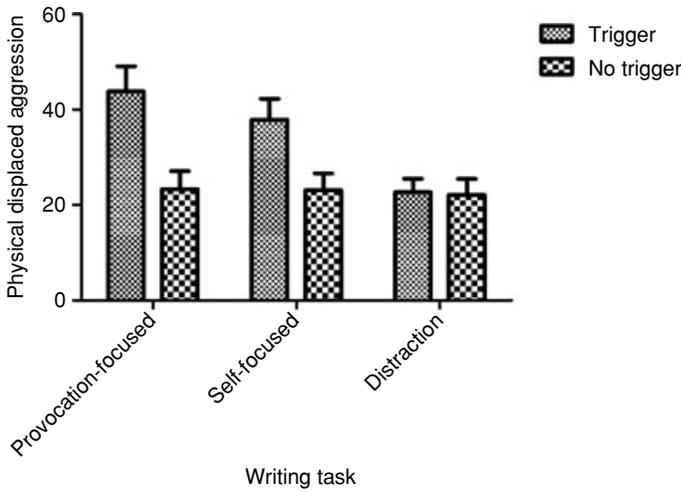


Figure 3. Means and standard errors for representing the impact of experimentally induced rumination on TDA (Experiment 3).

$p < .001$, $\eta^2 = .13$. However, the expected interaction between Writing Task and Trigger, $F(2, 94) = 3.38$, $p < .05$, $\eta^2 = .07$ qualified these effects. As anticipated, rumination did not impact aggression among non-triggered participants, $F(2, 50) = 0.04$, $p > .10$, but did have an effect when combined with the trigger, $F(2, 44) = 6.07$, $p < .01$. Tukey *post hoc* tests indicated aggression in both the provocation-focused ($M = 43.85$, $SD =$

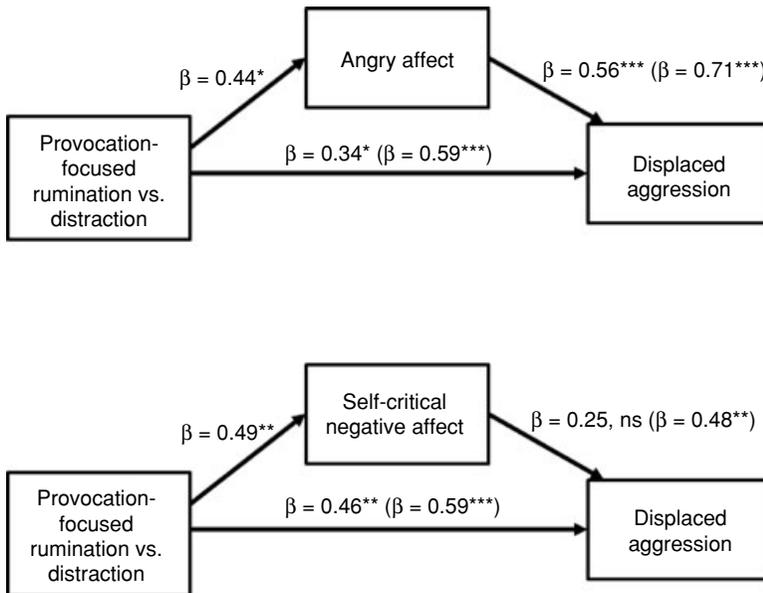


Figure 4. Angry affect partially mediates the effect of provocation-focused rumination on displaced aggression when triggered (Experiment 3). Parameter estimates are standardized coefficients. Values in parentheses are zero-order correlations; * $p < .05$; ** $p < .01$; *** $p < .001$.

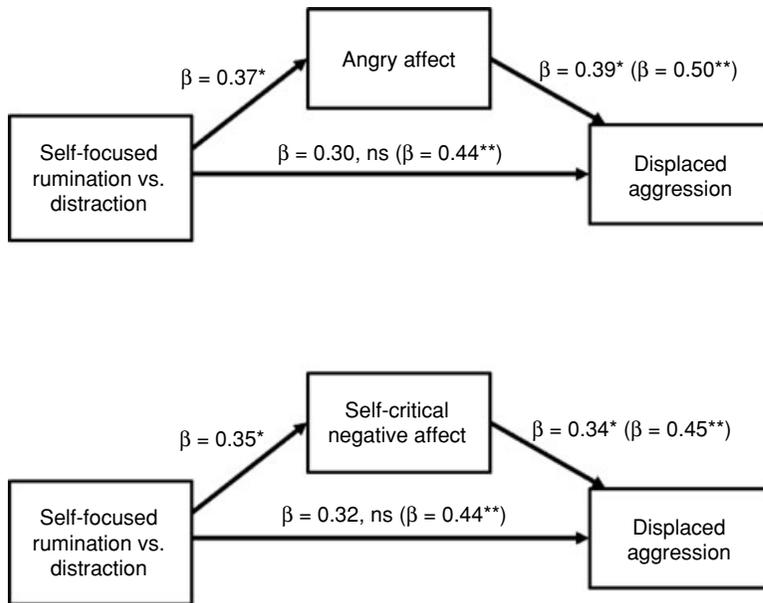


Figure 5. Both angry affect and self-critical affect partially mediate the effect of self-focused rumination on displaced aggression when triggered (Experiment 3). Parameter estimates are standardized coefficients. Values in parentheses are zero-order correlations; * $p < .05$; ** $p < .01$.

18.95) and self-focused ($M = 37.89$, $SD = 19.03$) rumination conditions exceeded that in the distraction condition ($M = 22.67$, $SD = 11.00$) (both pairwise p values $< .05$). The rumination conditions did not differ (see Figure 3).

Mediation analyses

To establish whether angry affect and self-critical negative affect mediate the effects of provocation- and self-focused rumination on TDA, respectively, we conducted separate causal steps mediation analyses for each type of affect (Baron & Kenny, 1986; see Figures 4 and 5) as well as Preacher and Hayes' (2004) bootstrap test of indirect effects (IE). As evident in Figure 4, angry affect (bootstrap IE = 4.49, $p < .05$), but not self-critical negative affect (bootstrap IE = 2.23, ns), partially mediated the effects of provocation-focused rumination on TDA. As seen in Figure 5, both self-critical negative affect (bootstrap IE = 4.11, $p < .08$) and angry affect (bootstrap IE = 4.91, $p < .05$) partially mediated the effect of self-focused rumination on TDA. *Post hoc* analyses also revealed that self-critical negative affect was marginally correlated with angry affect among those under self-focused rumination, $r = .39$, $p < .10$, but not among those under provocation-focused rumination conditions, $r = .05$, ns. Although correlational, these results support Tangney and colleagues' notion that shame can lead to anger and aggression (e.g., Tangney, Wagner, Hill-Barlow, Marschall, & Gramzow, 1996).

In summary, both provocation- and self-focused rumination increased TDA. However, the process by which each did so differed. Consistent with hypotheses, provocation-focused rumination augmented aggression via increases in angry affect whereas an additional aggression-augmenting role was observed for self-critical negative affect among those in self-focused rumination condition.

GENERAL DISCUSSION

Although recent research shows that rumination increases aggression (e.g., Bushman, 2002; Bushman *et al.*, 2005; Denson *et al.*, 2006), no previous study investigated why. Here, we attempted to understand the *processes* by which this occurs by deriving predictions from the GAM concerning three possible routes to aggression - cognition (Experiment 1), physiological arousal (Experiment 2), and affect (Experiments 1 and 3; Anderson & Bushman, 2002; Lindsay & Anderson, 2000).

Study 1 showed that, relative to distraction, provocation- and self-focused rumination increased the accessibility of aggressive action and arousal cognitions, respectively. Furthermore, provocation-focused rumination augmented both self-reported angry affect (Study 1) and SBP (Study 2). Study 3 showed that whereas both types of rumination increased aggressive behaviour, this effect was partially mediated by angry affect in the case of provocation-focused rumination and by both angry affect and self-critical negative affect in the self-focused rumination condition.

Our research advances understanding of rumination-induced aggression. For the first time, we compared the aggression-augmenting impact of these two forms of rumination. Although existing literature provides no single definition of rumination, many conceptualize it as a form of *self-focused attention* (e.g., Mor & Winquist, 2002; Pyszczynski, Holt, & Greenberg, 1987). We borrowed from these studies to create our 'self-focused rumination' condition. In contrast, others used rumination manipulations that induce more *externally focused attention* (e.g., Ayduk, Mischel, & Downey, 2002; Bushman, 2002). Here, we build on Martin and Tesser's (1989) definition to argue that rumination can be conceptualized as 'conscious thinking directed toward a given object for an extended period of time' (Martin & Tesser, 1989, p. 306) - a definition that includes our operationalization of 'provocation-focused rumination'.

Our finding that self-focused rumination increased the cognitive accessibility of aggression-related constructs, TDA, and self-critical negative affect, seemingly opposes the alleged benefit implied by the common proscription: 'know thyself' (Thales cited in Laertius, 1938). Western societies generally encourage introspection, suggesting that insight into our 'true self' is psychologically beneficial. By contrast, our data show that after having been provoked, the self-knowledge generated by self-focused rumination acts to augment negative outcomes. Although introspection may be beneficial in certain circumstances, our data do not support one form of introspection - rumination - as a means of alleviating negative affect, aggression, or the accessibility of aggressive cognition following a provocation.

A second, and perhaps more important conceptual advance, is that this is the first research to provide an exploration of the process by which rumination augments aggression. More specifically, we examined potential differences in the process by which two well-established operationalizations of rumination might increase aggression. Moreover, our data do show a theoretically expected dissociation in the processes underlying self- and provocation-focused rumination. Specifically, they suggest that provocation- and self-focused rumination, respectively, influence aggression via angry affect and internally focused, self-critical negative affect.

The role of self-critical evaluation induced when self-focused rumination follows a provocation is consistent with OSA and social threat theories (Dickerson *et al.*, 2004; Duval & Wicklund, 1972). Social threats are produced by negative social evaluation, rejection, or potential loss of social status (Dickerson *et al.*, 2004). Our provocation, operationalized as an insult regarding cognitive ability, is interpretable as a social threat.

The self-focused attention that follows social threats presumably induces individuals to consider discrepancies between their ideal self and current state, resulting in negative physiological outcomes.

In contrast to self-focused rumination, provocation-focused rumination promotes a focus on anger and retaliation. The process dissociation that we have identified in the present research expands upon our recent work on these two forms of rumination. Relative to distraction, both increase aggression and share a largely identical neural substrate (Bushman *et al.*, 2005; Denson *et al.*, 2006; Denson, Pedersen, Ronquillo, & Nandy, 2009). Yet their underlying cognitive, affective, and physiological mechanisms differ. For instance, relative to provocation-focused rumination and distraction, self-focused rumination following a provocation maintained high levels of salivary cortisol (Denson, Fabiansson, *et al.*, 2009). Thus, taken together with the present findings, provocation-focused rumination uniquely increases self-reported angry affect, aggressive action cognition, and blood pressure, whereas self-focused rumination uniquely augments self-critical affect, aggressive arousal cognition, and cortisol levels.

Future research

Our findings suggest additional avenues for future research. Given the role of distraction in reducing aggressive behaviour relative to self- and provocation-focused rumination, future work could develop distraction-based interventions in response to provocations or frustrations. Future research could also investigate the effects of positive mood rumination on aggression (see Bushman *et al.*, 2005). A focus on the identification of situations wherein self-focus is beneficial is important. Indeed, meta-analytic evidence suggests that increased self-awareness exerts an inhibitory effect on alcohol-induced aggression (Ito, Miller, & Pollock, 1996).

Because rumination occurs over time, it would be worthwhile to investigate the temporal sequence of affect, arousal, and cognition in producing aggressive behaviour. For instance: (a) affect, arousal, and cognitive accessibility may occur simultaneously, (b) one could cause another, or (c) each could influence the other bidirectionally over time. Identifying whether one precedes or influences another may benefit the development of cognitive or biofeedback interventions.

The specific operationalization of provocation we employed in the current set of studies (*viz.* negative feedback from a researcher regarding a participant's performance) is conceptually similar to a status manipulation. It is possible, therefore, that our findings in some part reflect participant's responses to differential levels of status. Although we believe this unlikely, it is important for future studies to investigate the impact of status by manipulating (a) the status of the provocateur and (b) aspects of the provocation which result in social comparison processes to more fully understand their impact on ruminative aggression.

Limitations

Our experiments were limited in some aspects. For instance, although outside the laboratory rumination occurs spontaneously, in response to internal validity concerns, we chose to assign individuals to rumination conditions. Another limitation of the current work is that we had very few male participants. Experimental studies sometimes show that men behave more aggressively than women. The presence of provocation, however, dramatically attenuates this sex difference (Bettencourt & Miller, 1996). Finally, a sceptic might argue that our rumination/distraction manipulations are not conceptually and

qualitatively distinct, but rather, that they merely differ in the degree to which they distract the participant from the preceding provocation. While this simplifying account has some face validity, the differential underlying process outcomes we obtained argue against it.

Conclusion

By determining the process through which ruminative activity may increase aggression, psychologists and laypeople alike may be better equipped to recognize early signs of ruminative thought or avoid situations that induce rumination. Such insight may allow individuals to gain better control over subsequent thoughts, affect, physiological arousal, and aggressive behaviour.

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