Research Article

Inhibition Versus Switching Deficits in Different Forms of Rumination

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ABSTRACT—*Individuals who depressively ruminate about their current dysphoria tend to perseverate more than nonruminators. The goal of the current study was to determine whether such perseverative tendencies are associated with an inability to switch attention away from old to new information or with an inability to effectively inhibit the processing of previously relevant information. We used a task-switching paradigm that can distinguish between these two processes. Two experiments showed that depressive rumination is associated with a deficit in inhibiting prior mental sets. The second experiment also demonstrated that, in contrast to depressive rumination, angry and intellectual rumination are associated with difficulties in switching to a new task set, but not with inhibition of a prior task set. This study suggests that different forms of rumination are associated with different cognitive mechanisms and that both deficits may contribute to the perseveration that is associated with ruminative tendencies.*

Rumination is generally defined as a recurrent series of thoughts united by a common theme (Martin & Tesser, 1996). Depressive rumination is the type of rumination most extensively explored and is defined as recurrent thought focused on the causes, symptoms, and implications of one's depression (Nolen-Hoeksema & Morrow, 1991).

Depressive rumination has received a great deal of attention because of research demonstrating its negative consequences. For example, studies have found that ruminators experience bouts of depression that are more numerous, severe, and long lasting than those of people with less of a tendency to ruminate (Alloy & Abramson, 1997; Lyubomirsky & Nolen-Hoeksema, 1993, 1995; Nolen-Hoeksema, 1991; Nolen-Hoeksema, Morrow, & Fredrickson, 1993).

In addition, depressive rumination is associated with deficits in executive function. These deficits manifest themselves primarily as perseverative behavior and thinking (Hertel, 1998; Martin & Tesser, 1996; Ward, Lyubomirsky, & Nolen-Hoeksema, 2003; Watkins & Brown, 2002; Watkins & Mason, 2002). For example, regardless of level of depression, the more an individual depressively ruminates, the more likely he or she is to perseverate on the Wisconsin Card Sorting Task (Davis & Nolen-Hoeksema, 2000),

These findings have led to the hypothesis that ruminators exhibit "attentional inflexibility" (Davis & Nolen-Hoeksema, 2000). Although an important characterization of the cognitive style of depressive rumination, this hypothesis does not specify which executive mechanisms are associated with such inflexibility. Understanding exactly which executive mechanisms are affected in ruminators is important because it might allow therapies to more effectively target the cognitive processes associated with depressive rumination.

Theories of executive function suggest that three major executive processes are inhibition, set switching, and updating of working memory (e.g., Miyake et al., 2000). According to this conceptualization, attentional inflexibility might occur in ruminators because of switching or inhibitory deficits (or both). On the one hand, faulty inhibitory capabilities could preclude fully deactivating representations of previous thoughts or goals. Hence, the inability to block previously relevant thoughts from competing for attention could be a hallmark of individuals who tend to ruminate. On the other hand, deficits in set switching could preclude the ability to switch from the current conceptual

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set to another one. Hence, switching attention from the mental set associated with ruminative thoughts to a new mental set may be difficult for individuals who tend to ruminate.

EXPERIMENT 1

The goal of Experiment 1 was to determine if executive deficits in individuals with relatively high tendencies to depressively ruminate are associated with difficulties in inhibiting previously relevant information or difficulties in set switching. To differentiate between these two possibilities, we used a modified task-switching paradigm that distinguishes the process of inhibiting a previously relevant task set from the process of switching to a new task set (e.g., Arbuthnott & Frank, 2000; Mayr & Keele, 2000).

Method

Subjects

Subjects were selected from a sample of 776 University of Colorado at Boulder undergraduates who were taking an introductory psychology course. They were selected on the basis of their scores on the Ruminative Response Scale (RRS; Nolen-Hoeksema & Morrow, 1991). Individuals with scores in the top 10% (high ruminators) and bottom 10% (nonruminators) of scores were contacted as potential subjects; 43 (17 males and 26 females) participated in this experiment.

At the time of testing, subjects were given a shortened 10-question version of the RRS that included 4 questions mistakenly excluded during prescreening. The short version has been found to be a reliable measure of rumination and, unlike the full version, is not redundant with measures of depression (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). The shortened version contains two subscales: Reflection and Brooding. The Brooding subscale is negatively valenced and more associated with depression than the neutrally valenced Reflection subscale (Treynor et al., 2003). Overall, subjects' prescreening scores on the full RRS were highly correlated with their scores on the shortened version ($r = .807$, $p < .0001$). The shortened version was used for all statistical analyses.

Materials

Measures of Executive Function. We used the task-switching paradigm of Mayr and Keele (2000) to obtain an index of set shifting and an index of inhibition of previously relevant information. In this task, subjects identify the spatial location of a deviant object. Each stimulus display contains four rectangles arranged into a 2×2 matrix. The rectangles can vary from each other on one of three dimensions: size, motion, or orientation. Shortly before the rectangles appear, a centrally presented cue identifies the dimension that should be used to identify the rectangle that differs from the others. The position of the deviant rectangle is random. Responses are made on keys that have the same spatial position on the number pad as the rectangles have on the screen (i.e., keys "1," "2," "4," and "5").

Reaction times (RTs) are used to obtain separate measures of set switching and inhibition (see Fig. 1 for details). Set-switching cost is measured by the additional time it takes to respond to noninhibitory trials that require the use of a different task set than used in the previous trial (e.g., change from orientation to motion) as compared with repeat trials, in which the same task set is used on two trials (e.g., orientation followed by orientation). Set-switching costs are thought to reflect time needed to reconfigure the cognitive processes involved in the representation of the to-be-used task set (Monsell, 2003). Thus, if ruminators have switching difficulties, ruminative tendency should be associated with increased set-switching costs.

To obtain a measure of the ability to inhibit previously relevant information, we compared performance on inhibitory trials with performance on control trials. Inhibitory trials are defined as those in which the cue is different from the cue on the immediately preceding trial ($n - 1$) but the same as the cue two trials back ($n - 2$; e.g., orientation, size, orientation). Control trials are defined as those in which the cue is different from the cue on the preceding two trials, which also have different cues from each other (e.g., orientation, size, motion). Notice that both control and inhibitory trials are preceded by at least two task switches. Hence, the extra time involved in switching back to a recently abandoned task set (e.g., orientation at the end of an orientation-size-orientation sequence) compared with a less recently abandoned task set (e.g., orientation in a motion-size-orientation sequence) is considered a measure of set inhibition not confounded by switching abilities (e.g., Mayr, 2002; Mayr & Keele, 2000).

When a subject switches from one task to another, the first task set is thought to be inhibited to allow a faster and smoother transition to the second. Thus, if the subject returns to the inhibited task immediately afterward, it takes more time than switching to a less recently abandoned task because of the extra time needed to overcome inhibition of the prior task set's representation (Mayr & Keele, 2000). Hence, if ruminators cannot effectively inhibit prior task sets, they should have less inhibition to overcome than nonruminators do and should therefore have smaller time costs when reusing those representations.

Questionnaires Assessing Other Individual Differences. Subjects answered two additional questionnaires so we could determine whether any observed association between rumination and set switching or set inhibition is independent of other characteristics often associated with depressive rumination.

Subjects completed the Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990), a common measure of tendencies to worry and be anxious. This questionnaire was included because previous research has found worry and rumination to be similar (though separable) constructs (Fresco, Frankel, Mennin, Turk, & Heimberg, 2002; Watkins, 2004).

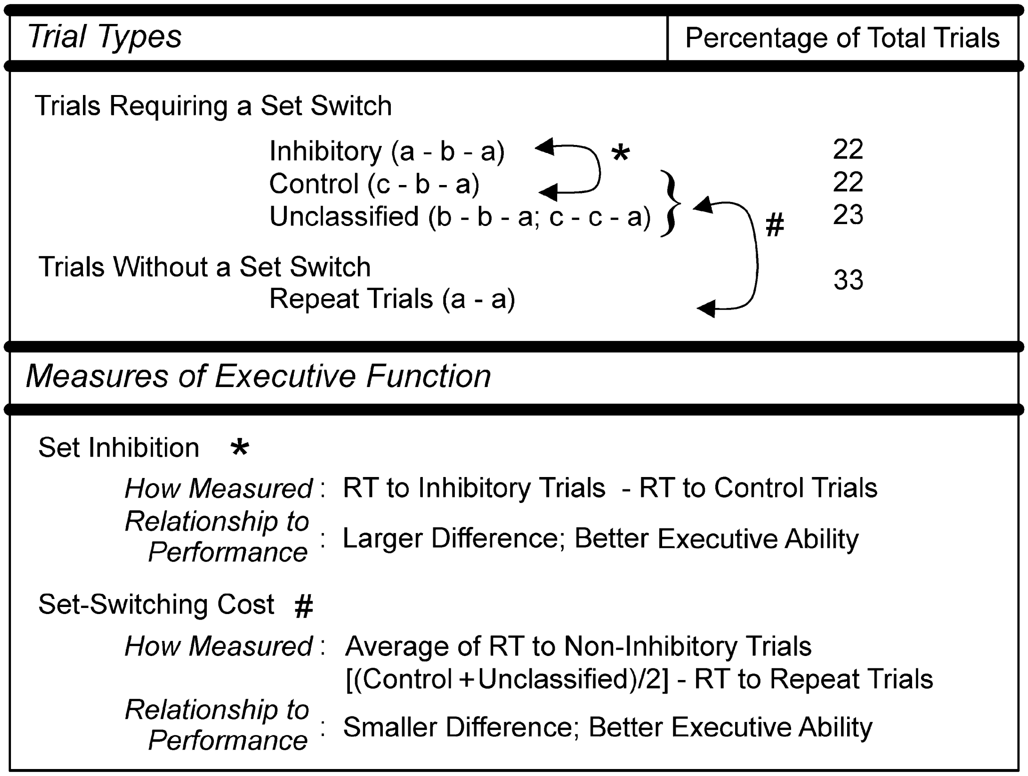

Fig. 1. Trial types and measures of executive function. In the list of trial types, lowercase letters in parentheses indicate the order of the various tasks (i.e., whether size, motion, or orientation is cued). In each example sequence, the trial type is determined by the relation between the final task and the preceding one or two tasks. All calculations are based on reaction time (RT) to the last trial in the sequence (e.g., to "a" in the "c-b-a" series). The asterisk indicates the trial types used to calculate inhibition of a prior task set (set inhibition); in both types, the final trial is preceded by two task switches. The pound sign indicates the trial types used to calculate the cost of switching task sets (set-switching cost).

The Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) was given to subjects to assess their current level of depression. Previous research has suggested that people with depression may have reduced inhibition (e.g., Joormann, 2004; Kaiser et al., 2003).

Procedure

Subjects practiced the experimental task until they responded correctly to 16 out of 20 trials. They then completed two blocks of trials, each consisting of 504 trials, with a break every 126 trials. In one block, the central cue indicating the relevant dimension was presented for 100 ms before the presentation of the stimulus display, and in the other block, it was presented for 900 ms before the stimulus display; block order was counterbalanced across subjects. The manipulation of cue length did not interact with individual differences in ruminative tendencies.

In both blocks, subjects had unlimited time to respond. After a correct response, a blank screen was presented for 100 ms before the cue for the next trial appeared. After an incorrect response, an error sign appeared for 500 ms before the 100-ms blank screen. The order of the cued dimensions was pseudorandom, with the additional constraint that control and inhibitory trials occurred equally often (22% of the time). Repeat trials occurred 33% of the time. The remaining 23% of trials were switch trials that could not be classified as either control or inhibitory trials. After the task-switching paradigm, subjects completed the RRS, PSWQ, and BDI.

Results

Overall Results

Data from 3 subjects were removed from analysis because their overall accuracy was less than 80%, leaving a total N of 40. In accordance with the methods used by Mayr and Keele (2000), we excluded from analysis trials in which the RTs exceeded 2,500 ms, incorrect trials, and the two trials after each incorrect trial. When these trials were all counted as incorrect, average accuracy was 96%.

A 2 (cue length: short vs. long cue) × 4 (trial type: inhibitory vs. control vs. unclassified switch vs. repeat) repeated measures analysis of variance was used to assess differences in RT across conditions. There was a main effect of trial type, $F(3, 37) = 71.11$, $p < .0001$. Bonferroni post hoc tests indicated RT on inhibitory trials (1,061 ms) was significantly longer than RT on control (1,025 ms) and unclassified switch (1,013 ms) trials, $p <$ .0001. RT on repeat trials (919 ms) was significantly faster than RT on control trials, unclassified switch trials, and inhibitory trials, all ps $< .0001$. Thus, the trial types elicited RT relationships similar to those found by Mayr and Keele (2000).

Association of RRS Score With Overall Measures of Performance

RRS score did not predict mean RT across all trial types, accuracy, or RT on repeat trials, all ts(38) < 1. Thus, ruminative tendency was not associated with general cognitive slowing, poorer overall performance, or reduced task focus.

Association of RRS Score With Set-Switching Cost

Regression analyses indicated that increased ruminative tendencies as measured by RRS score were associated with increased set-switching costs (RT on noninhibitory switch trials – RT on repeat trials), $t(38) = 2.256$, $p = .03$, $r = .344$. However, the association disappeared when depression was included in the model, $p = .351$.

Association of RRS Score With Set Inhibition

RRS score was significantly negatively correlated with set inhibition (RT on inhibitory trials – RT on control trials) both when RRS score was the model's sole predictor, $t(38) = -5.919$, $p <$ .0001, $r = -.693$ (see Fig. 2), and when BDI, PSWQ, and average set-switching costs were entered in the model, $t(35) = -4.855$, $p < .0001$ (see Fig. 2). Thus, higher tendencies toward depressive rumination are associated with a decreased ability to inhibit a previously relevant task set.

If rumination was not included in the model, higher depression predicted less set inhibition, $t(38) = -2.035$, $p = .027$, and higher set-switching cost, $t(38) = 2.238$, $p = .031$. However, when RRS was added to the model, depression no longer predicted set inhibition, $p = .534$, or switch costs, $p = .349$. The PSWQ did not predict set inhibition, $t(38) = -1.279$, $p = .209$, or set-switching costs, $t(38) = 1.686$, $p = .10$. Thus, rumination, not depression or worry, is most highly associated with a lack of set inhibition.

To determine if rumination is more predictive of inhibition or switching ability, we performed two analyses. First, we regressed set-switching costs and set inhibition on RRS score and found that set inhibition predicted RRS score while controlling for set-switching costs, $p < .0001$, but set-switching costs did not predict RRS score with set inhibition in the model, $p = .511$. Second, in an analysis using a Fisher z-transform ($df = 37$), we found that the coefficient for the correlation between RRS score and inhibition (.693) was significantly larger ($p = .033$) than the coefficient for the correlation between RRS score and switch costs (.344).

As for the subtypes of depressive rumination, both reflection, $t(38) = -3.998$, $p < .0001$, $r = .544$, and brooding, $t(38) = -5.932$, $p < .0001$, $r = .693$, were negatively correlated with inhibition. Brooding significantly predicted set-switching costs, $t(38) = 2.062$, $p = .046$, $r = .317$, and there was a trend for reflection to predict set-switching costs, $t(38) = 1.94$, $p = .06$, $r = .300$, but neither predicted set-switching costs if BDI and PSWQ were included in the model. None of the significant correlations could be explained by a speed-accuracy trade-off.

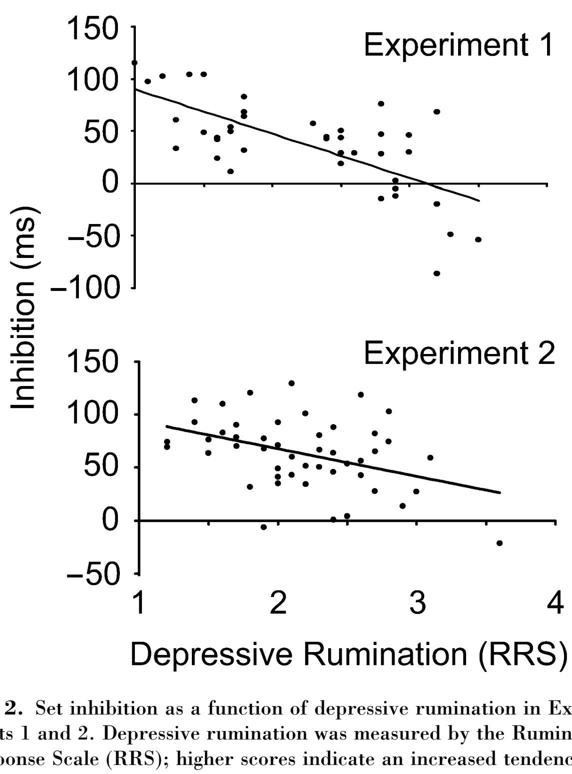

Fig. 2. Set inhibition as a function of depressive rumination in Experiments 1 and 2. Depressive rumination was measured by the Ruminative Response Scale (RRS); higher scores indicate an increased tendency toward depressive rumination. Set inhibition was measured as explained in Figure 1; higher values indicate better ability to inhibit a prior task set.

Discussion

The results of this experiment suggest that executive dysfunction in individuals who tend to depressively ruminate is more closely linked to difficulties in inhibiting previously relevant task sets than to difficulties in switching task sets. The weak association between depressive rumination and set-switching costs may actually reflect the association between task switching and inhibition. The proposed role of inhibition of previous task sets is to enable faster switching (e.g., Arbuthnott & Frank, 2000; Mayr & Keele, 2000). Thus, if ruminators have difficulties inhibiting previously relevant task sets, they may exhibit slight switching difficulties as well. This account is consistent with our finding that when inhibition was controlled for, set-switching costs were no longer predictive of ruminative tendencies.

Our results also demonstrate that the association between ruminative tendencies and set inhibition cannot be explained by any other factors we measured. The association was not due to general task performance, switching difficulties, level of depression, or worry. Hence, an inability to inhibit previously relevant information appears to be specifically related to increased tendency to depressively ruminate.

EXPERIMENT 2

Experiment 2 was designed to address two issues. First, we wanted to determine whether the association between depressive rumination and ineffective inhibition of prior task sets could be replicated, and specifically whether it could be replicated even among individuals who were not preselected to have extreme ruminative tendencies. Second, we wanted to explore whether deficits in either inhibition or set switching extend to types of rumination in addition to depressive rumination. Hence, we measured two additional forms of rumination: anger rumination and intellectual reflection. Anger rumination is characterized as repetitive, unintended thoughts about angry experiences (Sukhodolsky, Golub, & Cromwell, 2001). Intellectual reflection is characterized by philosophical or intellectual self-reflection.

The basic emotions underlying these forms of rumination can be compared along two dimensions: valence (i.e., positive vs. negative) and motivation (i.e., approach vs. avoidance). Depressive rumination is considered to be negatively valenced and driven by avoidance motivations (Dickson & MacLeod, 2004; Leen-Feldner, Zvolensky, Felner, & Lejuez, 2004). Anger rumination is also considered negatively valenced (Sukhodolsky et al., 2001); however, unlike depressive rumination, it may be associated with approach motivations (Harmon-Jones, 2003, 2004; Harmon-Jones & Sigelman, 2001). Intellectual reflection's association with the "openness to experience" personality trait (Trapnell & Campbell, 1999) indicates that it also may be driven by approach motivations. However, in contrast to both depressive and anger rumination, intellectual reflection is positively valenced (Trapnell & Campbell, 1999).

By examining the association of each of these kinds of rumination with inhibition, we attempted to determine which underlying characteristics of rumination potentially predict deficits in inhibiting a previously relevant task set. In Experiment 1, we found that depressive rumination, which is negatively valenced and driven by avoidance motivations, was associated with poor inhibition. Hence, if the motivational but not the valence aspect of rumination is associated with the inhibitory deficit, then it should disappear when the motivation changes from avoidance to approach, regardless of valence. In this case, anger rumination and intellectual reflection would not be correlated with inhibitory ability. However, if the valence but not the motivational aspect of rumination is associated with the inhibitory deficit, than the deficit should disappear when the valence changes from negative to positive, regardless of motivation. In this case, anger rumination and depressive rumination, but not intellectual reflection, would be associated with an inhibitory deficit.

Method

Subjects

Fifty-four undergraduates from an introductory psychology class participated. They were not preselected on the basis of rumination scores.

Materials

We used the Anger Rumination Scale (ARS; Sukhodolsky et al., 2001) to measure the tendency to have repetitive, unintended thoughts about angry experiences (we did not include the subscales related to counterfactual thinking). What we refer to as intellectual reflection was measured by the Reflection portion of the Rumination-Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999). It is considered a measure of tendency toward philosophical or intellectual reflection on one's thoughts. We also used the same questionnaires from Experiment 1 to control for level of depression (BDI) and tendency to worry (PSWQ).

Procedure

We used the same task-switching paradigm as in Experiment 1, except that the cue always preceded the display by 100 ms. The RRS, ARS, and RRQ were administered after the task-switching paradigm in a counterbalanced order across subjects. Finally, the BDI and PSWQ were administered.

Results

Data from 4 subjects were excluded because of low accuracy. Another 2 subjects failed to complete the task, leaving a total N of 48. The same criteria from Experiment 1 were used to exclude aberrant trials from analysis; after counting these trials as incorrect, the average accuracy was 90.26%. The correlations among the different types of rumination are shown in Table 1.

The important effects from the first experiment were replicated. RRS score significantly predicted decreased set inhibition, $t(47) = -3.04$, $p = .004$ (see Fig. 2), even when controlling for set-switching costs, depression, and worry, $t(44) = -2.524$, $p = .015$. When a possible outlier was taken out of the data set for having a high RRS score of 3.6 ($z = 2.74$), the association remained significant, $t(46) = -2.148$, $p = .037$. As in the first experiment, RRS score did not predict RT on repeat trials, $t(47) = 0.759$, $p = .309$. However, the results differed from Experiment 1 in that higher RRS scores did not significantly predict an increase in set-switching costs, $t(47) = 1.39$, $p = .171$. A Fisher's z-transform test, however, showed that the correlation between set-switching costs and rumination was not significantly weaker in this experiment than in the first experiment, $p = .206$.

As for the subscales of the RRS, brooding, $t(47) = -2.375$, $p = .002$, $r = .327$, and reflection, $t(47) = -2.465$, $p = .017$, $r = .338$, negatively correlated with set inhibition. Unlike in

TABLE 1

Correlations Between Different Measures of Ruminative Tendencies

Measure	1	2	3	4	5
1. Depressive rumination (RRS)	—				
2. Depressive brooding (RRS)	.826 ($p < .0001$)	—			
3. Depressive reflection (RRS)	.818 ($p < .0001$)	.351 ($p = .013$)	—		
4. Angry rumination (ARS excluding counterfactual-thinking items)	.436 ($p = .007$)	.441 ($p = .002$)	.275 ($p = .056$)	—	
5. Intellectual reflection (Reflection component of RRQ)	.380 ($p = .002$)	.033 ($p = .597$)	.597 ($p < .0001$)	.110 ($p = .453$)	—

Note. RRS = Ruminative Response Scale; ARS = Anger Rumination Scale; RRQ = Rumination-Reflection Questionnaire.

Experiment 1, brooding did not predict set-switching costs, $p = .983$. However, reflection did, $t(47) = 2.422, p = .19, r = .333$.

A regression analysis demonstrated that ARS scores were not associated with set inhibition, $t(47) = -1.03$, $p = .308$, but higher ARS scores were associated with higher set-switching costs, $t(47) = 2.512, p = .015, r = .344$ (see Fig. 3). Notably, the ARS remained predictive of switching ability even with BDI and PSWQ in the model, $t(45) = 1.034$, $p = .009$ (see Fig. 3).

A regression analysis demonstrated that intellectual rumination (RRQ score) did not predict set inhibition, $t(47) = -1.056, p = .139$, but higher RRQ scores did predict higher set-switching costs, $t(47) = 2.442$, $p = .018$, $r = .336$ (see Fig. 4). RRQ score remained predictive of switching ability even with BDI and PSWQ in the model, $t(45) = 2.221, p = .031$. When an outlier whose RRQ score had a z value over 3 was removed from the analysis, the correlation remained significant, $t(46) = 2.409$, $p = .02$.

Neither the RRQ nor the ARS significantly predicted mean RT or RT on repeat trials. None of the significant correlations could be explained by a speed-accuracy trade-off.

Discussion

Experiment 2 yielded two important results. First, it replicated the finding that depressive rumination is associated with a poor ability to inhibit prior task sets. It also extended this finding by demonstrating that the effect can be obtained without preselecting individuals for large or small tendencies to depressively ruminate.

Second, Experiment 2 demonstrated that different types of rumination are associated with different types of executive deficits. Unlike depressive rumination, anger rumination and intellectual reflection are associated with a set-switching deficit, but not with a deficit in set inhibition.

GENERAL DISCUSSION

Though previous researchers have proposed that an inhibitory deficit plays a role in rumination (Hester & Garavan, 2005; Linville, 1996; Shapiro, 2002; Ursin, 2005; Watkins & Brown, 2002), to our knowledge, these experiments are the first to directly demonstrate such an association. Specifically, they

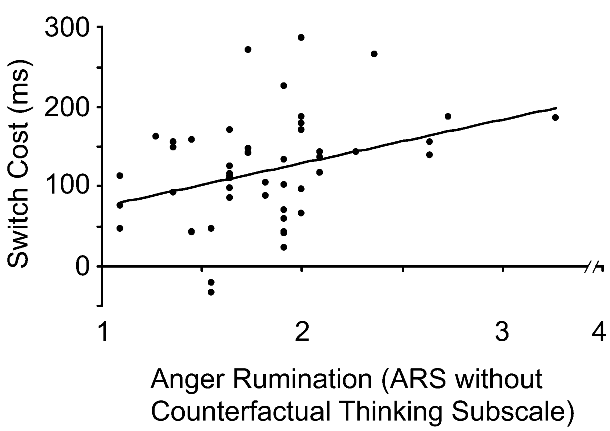

Fig. 3. Switch cost as a function of anger rumination in Experiment 2. Anger rumination was measured by the Anger Rumination Scale (ARS; excluding the items measuring counterfactual angry thoughts); higher scores indicate increased anger rumination. Switch cost was measured by subtracting reaction time on repeat trials from reaction time on noninhibitory switch trials (see Fig. 1); larger values indicate greater switching difficulties.

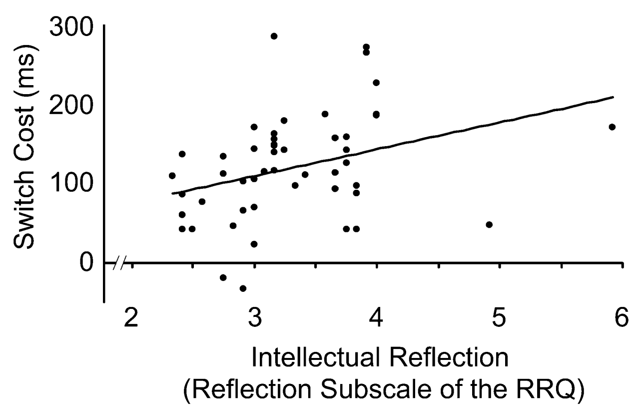

Fig. 4. Switch cost as a function of intellectual reflection in Experiment 2. Intellectual reflection was measured by the Reflection subscale of the Rumination-Reflection Questionnaire (RRQ); higher scores indicate increased intellectual reflection. Switch cost was measured by subtracting reaction time on repeat trials from reaction time on noninhibitory switch trials (see Fig. 1); larger values indicate greater switching difficulties.

suggest that the tendency to depressively ruminate is associated with difficulties inhibiting previously relevant task sets and, at most, weakly associated with a poor ability to switch task set. Thus, depressive ruminators may have extra difficulties disengaging from unattainable goals (Martin & Tesser, 1996; Pyszczynski & Greenberg, 1987) and sad thoughts because weak inhibition is incapable of blocking them from current attention. Our results suggest that this association exists for both the brooding and reflection subtypes of depressive rumination.

Our data also indicate that the cognitive dysfunction associated with depression (Willner, 1984) may be distinct from that associated with depressive rumination. In our study, depressive rumination was associated with an inhibitory deficit even though we used a generally nondepressed sample and statistically controlled for individual differences in depression. Depression, however, was not associated with inhibition when we controlled for depressive rumination. Contrary to certain conceptualizations of rumination (Martin & Tesser, 1996; Pyszczynski & Greenberg, 1987; Watkins & Mason, 2002), such a distinction indicates that a depressive-rumination thinking style may not merely be a reaction to a depressed mood, but rather may carry its own psychological consequences, namely, an attentional inflexibility associated with ineffective inhibition. Additionally, because depression was found to be related to an inhibitory deficit only when rumination's effect was statistically ignored, we suggest that future research on executive dysfunction in depression should consider the influence of depressive rumination.

Experiment 2 may be the first to provide evidence that tendencies for angry rumination and intellectual reflection are also associated with perseverative-like behavior and attentional inflexibility. Interestingly, however, the cognitive mechanism driving attentional inflexibility in these forms of rumination appears to be different from the mechanism that drives attentional inflexibility in depressive rumination. Anger rumination and intellectual reflection were associated with switching difficulties, but not inhibitory deficits. Thus, individuals high in either of these tendencies may have difficulties making the cognitive adjustments needed to switch task sets. These individuals may ruminate because they have difficulties switching their attention away from a particular set of thoughts to new thoughts.

In Experiment 2, we also attempted to provide preliminary evidence as to which emotional characteristic of rumination predicts the type of cognitive deficit observed. Our results suggest that motivation, rather than valence, is the key predictor of executive ability: An inhibitory deficit changed to a switching deficit when the motivation of the rumination changed from avoidance to approach, even though the valence remained constant. Thus, on the one hand, depressive ruminators may have difficulty avoiding depressive ruminations because they lack sufficient inhibition to keep such thoughts from returning. On the other hand, individuals who angrily ruminate or intellectually reflect may not be able to switch away from current ruminations because of a persistent approach drive toward these thoughts.

Given the correlational nature of our experiments, we cannot determine causality. Nonetheless, we propose that the attentional inflexibility associated with a ruminative style causes ruminations. An alternative account is that active, ongoing ruminations cause attentional inflexibility, for example, by overloading cognitive resources (Watkins & Brown, 2002). However, our study does not support this account, as there is evidence that individuals high in trait rumination were not actively ruminating during our task. First, RT data suggest that cognitive resources were not overloaded in subjects with high ruminative tendencies. RT on repeat trials was not correlated with rumination, and increased ruminative tendency was actually associated with faster responding in the most difficult trials of all, inhibitory trials. Second, we designed our task to minimize the possibility that it would accidentally induce active ruminations; specifically, we used neither negative nor emotional stimuli and did not provide performance feedback on every trial. Finally, cognitive tasks are likely to distract individuals from ruminating (Brockner & Hulton, 1978; Davis & Nolen-Hoeksema, 2000). Thus, we think it unlikely that ongoing ruminations could have caused the attentional inflexibility observed in our experiments. In general, however, it still remains possible that actively ruminating increases attentional inflexibility.

In sum, all three ruminative thinking styles appear to be associated with an attentional inflexibility. However, the mechanism driving attentional inflexibility appears to vary in the different forms of rumination. Depressive rumination is associated with deficient inhibition of previously relevant information, whereas angry rumination and intellectual reflection are associated with switching difficulties.

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