Investigating the Relationship Between Rumination and Executive Functions: The case of Inhibition and Switching

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Abstract

The present study aimed to examine the relationship between rumination and two core executive functions, inhibition and switching, through an experimental design. Undergraduate participants (N=153) were randomly assigned to a rumination induction, a negative mood induction, or an abstract distraction control. Participants completed a task-switching paradigm before and after induction, providing inhibition and switch-cost indices. The Ruminative Response Scale (RRS) and the Leiden Index of Depression Sensitivity (LEIDS-R) were administered to measure trait rumination and cognitive reactivity, respectively. Significant three-way interactions were observed, with participants low in trait rumination and high in cognitive reactivity in the negative mood induction group demonstrating the least switching costs. Interestingly, no significant differences emerged among those with either high or low levels of both traits across all conditions. The study showed a complex picture between rumination and cognitive reactivity, suggesting that the impact of rumination on executive function performance depends on reactivity levels. Our results offer preliminary insights into how the two traits interact to influence cognitive performance.

Keywords: rumination, executive functions, negative mood

Introduction

The connection between rumination and depression was first proposed by the Response Style Theory (Nolen-Hoeksema & Morrow, 1991), which defined depressive rumination as "thoughts and behaviors that focus one's attention on depressive symptoms and the meaning of those symptoms" (Nolen-Hoeksema et al., 1994). A slightly different conceptualization emerged from the Control Theory model, which posited that rumination occurs when there is a perceived discrepancy between an individual's current state and their goals (Martin & Tesser, 1996). A synthesis of these ideas later provided a more nuanced understanding, suggesting that rumination can serve both constructive, problem-solving functions and destructive, dysfunctional ones. Specifically, Treynor et al.'s (2003) factor analysis identified two distinct subtypes of rumination: Brooding and Reflection. Reflection is an adaptive mechanism that helps individuals engage in problem-solving, thus closing the gap between their current and desired states. In contrast, brooding is a maladaptive form of rumination, described as "repetitive, prolonged, and recurrent negative thinking about oneself, one's feelings, personal concerns, and upsetting experiences" (E. R. Watkins, 2008). The common feature of these subtypes is their focus on distress and self-referential thoughts. In addition to problem-solving and repetitive negative thinking, researchers have also emphasized that rumination can be viewed as involuntary, automatic, self-focused thinking, often triggered by low mood in response to challenging life situations. Across all these conceptualizations, the core relationship between rumination and negative mood is clear: the activation and maintenance of negative, self-focused thoughts in response to, and as a consequence of, low mood is central to the vicious cycle between rumination and negative mood. The study also draws on the attentional scope model (Whitmer & Gotlib, 2013), which proposes that a narrowed focus of attention can hinder cognitive flexibility, particularly the ability to shift between tasks. Additionally, it incorporates the cognitive emotion regulation model (Garnefski et al., 2001), which describes how people manage stress through specific cognitive strategies. Together, these frameworks help explain the relationship between mood, rumination, and executive functioning.

Rumination and Executive Function

Based on Miyake et al.'s (2000) Unity and Diversity model, executive functions are conceptualized as a "distinct but also interconnected set of control mechanisms" that regulate cognitive processes towards goal-relevant information. The model identifies three major, yet interconnected, components of executive function: inhibition, set shifting, and updating. Inhibition refers to the ability to suppress a dominant response in favor of a more appropriate, task-relevant one. Set shifting is defined as the ability to switch between task

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sets or response rules, while updating involves integrating new information into existing knowledge and maintaining it in working memory for a certain period. Several meta-analytic studies have examined the relationship between executive functions and rumination. For instance, Vălenaș & Szentágotai-Tătar (2017) and Yang et al. (2017), analyzing 70 and 34 studies respectively, reported a small negative correlation between switching, inhibition, and rumination, and a negligible negative correlation between working memory and rumination. Similarly, Zetsche et al. (2018), analyzing results from 94 studies, found a strong negative correlation between repetitive negative thinking (RNT) and cognitive control. While these studies provide valuable insights, most rely on correlational designs, with only a few attempting to establish causality. Executive functions, such as inhibition, enable individuals to "suppress prepotent mental representations, such as unwanted thoughts" (Diamond, 2012). From this perspective, deficits in executive function may contribute to the development of repetitive negative thinking and rumination. However, many of these studies did not include a rumination check in their experimental design, raising questions about the effectiveness of their rumination inductions.

Rumination and Inhibition

Two major hypotheses have been developed to explain the poorer performance of high trait ruminators on cognitive tasks measuring inhibition compared to low ruminators. The first hypothesis, "impaired interference control as a cause of rumination" (Roberts et al., 2017), suggests that low inhibition capacity allows task-irrelevant thoughts to interfere with and enter working memory. Inhibition, which refers to the ability to "override a mental process, in whole or in part, with or without intention" (MacLeod, 2007), is essential for filtering out irrelevant information. When inhibition is impaired, irrelevant thoughts can proliferate, leading to difficulties in cognitive tasks. The second hypothesis, "impaired interference control as a consequence of rumination" (Roberts et al., 2017), explores whether rumination itself can impair inhibitory control. Experimental studies examining this hypothesis have used rumination induction methods. For example, Philippot and Brutoux (2008) employed a "Think about" paradigm to induce rumination and distraction, followed by a Stroop color-word test to assess executive functioning in dysphoric and non-dysphoric participants. They found that induced rumination negatively impacted inhibition abilities only in dysphoric participants. Similarly, Whitmer and Gotlib (2012) used the same induction paradigm in a depressed sample and assessed inhibition in task switching by measuring the n-2 task repetition cost. They reported that depressed individuals showed worse inhibition performance only in the rumination induction group, with trait rumination showing no significant effect. However, these studies did not include a rumination check, leaving the interaction between rumination and inhibition insufficiently explored.

Rumination and Switching

The chicken-and-egg dilemma regarding executive functions and rumination has sparked significant debate, especially in the context of switching. Koster et al. (2011) developed the impaired disengagement hypothesis, suggesting that individuals who struggle to control their thoughts, particularly those triggered by negative emotions, are prone to engaging in repetitive and persistent thought processes. Switching, a critical aspect of attentional control and cognitive flexibility, is essential for disengaging from negative self-referential thoughts. Poor switching ability hampers this disengagement, contributing to rumination. Research has shown that cognitive inflexibility can moderate the relationship between anxiety and rumination (De Lissnyder et al., 2012). Findings from correlational studies paint a more complex picture of the relationship between mood, switching, and rumination. For example, Chen et al. (2016) classified dysphoric and healthy undergraduates based on their trait rumination scores and used a modified Internal Shifting Task (IST) to assess switching ability. They found that rumination, rather than dysphoria, was negatively associated with switching deficits. Recent meta-analytic studies, such as Yang et al. (2017), have also reported a negative correlation between rumination and switching. However, despite this growing body of evidence, there remains a significant gap in experimental research, which the current study seeks to address.

Rumination and Cognitive Reactivity

A key factor in persistent depression is maladaptive and reflexive negative thinking styles. The "reflexive" component refers to involuntary, dysfunctional attitudes and thought patterns that are activated by negative mood following an event (Van Der Does, 2002). Cognitive reactivity has been defined as "the degree of change in negative thinking in response to sad mood" (Segal et al., 1999). As Nolen-Hoeksema and Morrow (1991) proposed in the Response Styles Theory of depression, the duration and intensity of depression are influenced by the amount of rumination on the causes of depression in response to negative mood. In essence, both rumination and cognitive reactivity describe reactions to low mood but differ in one key aspect: rumination refers to a repetitive and passive focus on the causes of negativity, while cognitive reactivity pertains to the degree of change in negative thinking in response to low mood. Theoretically, rumination and cognitive reactivity can reinforce each other. To the author's knowledge, only one study has assessed the relationship between these two constructs. Moulds et al. (2008) administered the LEIDS-R questionnaire and the subscale of the RSS questionnaire measuring depressive rumination to a sample of undergraduate students, finding a strong positive correlation, even after controlling for current depressive symptoms. However, no research has yet explored the effects of the interaction between negative mood, cognitive reactivity, and rumination on executive functions. The present study seeks to address this gap in the literature by examining whether

cognitive reactivity exacerbates the negative impact of rumination on core executive functions.

Purpose of the Present Study

The present study aims to address the lack of experimental designs in the rumination literature. Rumination as a construct has been shown to negatively associate with performance on EF tasks. Research on the interaction between trait and state rumination remains limited, and there is no clear understanding of how negative mood and rumination interact to influence executive functions. Studies show that these constructs are strongly related and may each uniquely affect EF task performance (Nolen-Hoeksema et al., 2008). A key aim of the present study is to differentiate between the effects of negative mood and rumination on executive functions. Additionally, while one study (Moulds et al., 2008) has examined the relationship between rumination and cognitive reactivity, no studies have assessed their potential interaction effects on executive functions. We hypothesize, first, that state rumination will hinder inhibition performance, as measured by increased reaction times in post-induction compared to pre-induction performance on a cognitive task. Second, we hypothesize that state rumination will impair switching performance, as measured by reaction times in a task-switching paradigm. Taking into account the limited research on the interaction between state and trait rumination, and cognitive reactivity, this study aims to explore whether trait rumination amplifies the effect of state rumination. Whether trait rumination is positively correlated with trait cognitive reactivity and whether they interact in the previously mentioned amplification.

Method

Participants

Participants with a history of psychiatric or neurological conditions, or those currently using psychotropic medication, were excluded during the screening process. The study was conducted in a controlled laboratory setting under standardized conditions. Sample size was determined through an a priori power analysis, targeting a medium effect size (f = .25) and .80 power in a 3 × 2 × 2 mixed ANOVA, which indicated a required N of 158. Our final sample of 153 participants (n =80 females, n = 73 males; age range 18-33, M = 24.74, SD = 4.04) closely approximated this target. Participants were recruited through convenience and snowball sampling and randomly assigned to one of the three experimental conditions (n = 51 rumination, n = 50 negative mood, n = 52 distraction). Median-splits were used on the RRS and LEIDS-R scores to classify participants into high and low groups. Those scoring above the group median on the RRS (Mdn = 53) were classified as high ruminators, and those scoring below were classified as low ruminators. Similarly, participants scoring above the group median on the LEIDS-R (Mdn = 97) were classified as high in cognitive reactivity, and those scoring below as low.

Materials

Rumination and Distraction Inductions The present study followed Cooney et al.'s (2010) recommendation and used the rumination induction (RUM IND) vs abstract distraction (ABS DIS) formats. Participants in the rumination induction condition were shown ten thought-provoking phrases such as "Think about the kind of person you think you should be". They were instructed to direct their attention inwardly, focusing on their thoughts and emotions, and to deeply contemplate the feelings that arose during the task. In the distraction group, participants were also shown ten phrases which made them focus on external objects abstractly, such as "Think about what contributes to team spirit". Additionally, following the method of Flores (2014), participants were asked to read each phrase carefully, reflect on its meaning, and then write down their responses.

Negative Mood Induction The present study used a modified technique by (Krauth-Gruber & Ric, 2000) and originally created by (Mosak, 2005). In this modified method, participants were asked to write down a situation in which they experienced sadness and then describe it as vividly as possible, including the emotions they felt throughout the recall process. The duration of the whole induction was 10 minutes.

Trait Rumination Rumination was measured using the Ruminative Response Scale (RRS) of the Response Styles Questionnaire (Nolen-Hoeksema & Morrow, 1991) a self-report measure of rumination consisting of 22 items.

Trait Cognitive Reactivity Cognitive Reactivity was measured using the Leiden Index of Depression Sensitivity-Revised (LEIDS-R) (Willem van der Does & J. M. G. Williams, 2003) a self-report measure consisting of 34 items.

Task Switching The Task-switching paradigm was used to examine two executive functions, inhibition and switching (Ballesio et al., 2019), see Figure 1. Participants were asked to follow one of three rules (A,B, or C) presented in random triplets (A-A-A, A-B-A, C-B-A). Employing three rules allowed for the calculation of two performance indices. The switch cost index was measured by the difference in reaction times (RTs) between the third trial of switching triplets (A-B-A, C-B-A) and repetition triplets (A-A-A). The inhibition index was measured by the difference in RTs between alternating triplets (A-B-A) and non-alternating triplets (C-B-A) sequences.

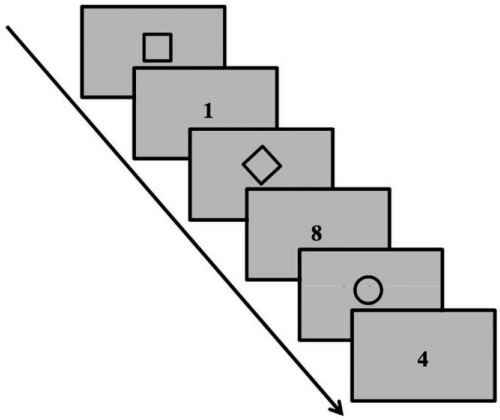

Figure 1:Task Switching Paradigm. The task consisted of 54 triplets, resulting in a total of 162 individual trials. Each shape used to indicate the specific rule to be applied.

Mood Check For the mood-manipulation check, participants were asked before and after the induction to indicate their emotional state on a scale ranging from 0 ('I feel the worst I have ever felt') to 100 ('I feel the best I have ever felt').

State Rumination Check To measure state rumination the present study used ruminative self-focus measure developed by (Michel-Kröhler & Berti, 2023). It includes two items "how much did you focus on your feelings?" and "how much did you focus on your problems?" which are scored on a Likert-type scale from 0 (not at all) to 10 (very).

Procedure

For the development of the task switching task, and the writing format of the rumination, negative mood and distraction inductions, we used the Gorilla Task Builder platform (https://app.gorilla.sc/). The experiment design of the present study was a mixed-subject consisting of three conditions. The study followed a 3 x 2 x 2 mixed-subjects design, with induction (rumination vs distraction vs negative mood), trait rumination (high x low), and cognitive reactivity (high x low) as the independent variables. The dependent variables of the study were (a) switch cost index and (b) inhibition cost index (Ballesio et al., 2019). Participants were invited to the university's psychology laboratory where they were instructed to use a computer to begin the experiment. After accepting the informed consent form, participants were asked a question concerning their current mood state. Next, participants were asked to perform a cognitive task as the pre-induction measurement. Following the induction, participants answered the mood check question again, with the questions concerning state rumination. Following this, participants were randomly assigned to one of the three groups using the Gorilla platform. Each group received different on-screen instructions. The induction stage lasted 10 minutes for all participants, during which they could freely choose how much to write for each question. After the inductions, participants performed the cognitive task again and then completed the RRS and LEIDS-R questionnaires, which were counterbalanced to control for order effects. Following the questionnaires, participants answered demographic questions (e.g. gender, age) and were then presented with the debriefing statement. The entire experiment lasted approximately 25 minutes.

Results

Mood-manipulation check

A between-subjects factorial ANOVA analysis revealed that the mood induction was successful, $F(2, 131) = 9.39$, $p < .001$, $\eta^2 = .121$. Specifically, participants in the negative mood felt significantly worse ($M = -10.34$, $SD = 14.31$) compared to participants in the distraction group ($M = 1.06$, $SD = 7.9$). However, the difference between rumination group ($M = -4.33$, $SD = 13.98$) and negative mood approached statistical significance ($p = .072$) but did not reach the required threshold. Also the difference between rumination and distraction group was not significant. Mixed ANOVA analysis conducted using the scales and subscales of the RRS that high trait ruminators were feeling worse across all experimental conditions compared to low trait ruminators $F(1, 122) = 11.34$, $p < .001$, $\eta^2 = .136$ (see Figure 2).

State rumination manipulation check

A between-subjects factorial ANOVA analysis revealed that rumination induction approached statistical significance $F(2, 133) = 2.88$, $p = .060$, $\eta^2 = .045$ with a trend that participants in the negative mood and rumination induction groups reporting higher levels of state rumination compared to distraction group.

Task Switching

Inhibition A three-way ANOVA was conducted (group: rumination vs distraction vs negative mood) X 2 (trait rumination: high vs low) X 2 (trait reactivity: high vs low) revealed a significant main effect of trait reactivity, $F(1, 114) = 4.394$, $p = .038$, $\eta^2 = .03$ (see Figure 3) and also significant interaction between trait rumination and cognitive reactivity, $F(1, 114) = 5.623$, $p = .019$, $\eta^2 = .047$. The same analysis with the subscales of RSS and LEIDS-R revealed a significant interaction between induction groups, depression and hopelessness, $F(2, 103) = 3.619$, $p = .030$, $\eta^2 = .066$.

Switching A three-way ANOVA was conducted (group: rumination vs distraction vs negative mood) X 2 (trait rumination: high vs low) X 2 (trait reactivity: high vs low) revealed a significant main effect of trait cognitive reactivity, $F(1, 117) = 3.12$, $p = .048$, $\eta^2 = .051$ (see Figure 4). The same analysis with the subscales of RSS revealed a significant interaction between trait rumination and trait cognitive reactivity, $F(1, 114) = 5.623$, $p = .019$, $\eta^2 = .047$. The same analysis with the subscales of RSS revealed a three-way interaction between induction groups, brooding and

depression F(2, 106) = 4.69, p = .011,η^2=.081.

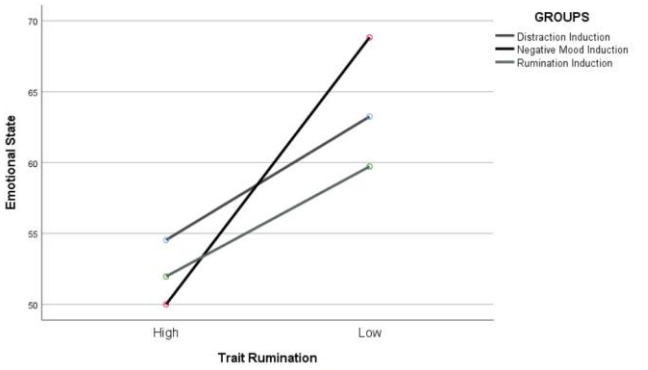

Figure 2:This figure illustrates the relationship between mood state and trait rumination, showing that high ruminators felt significantly worse across induction groups.

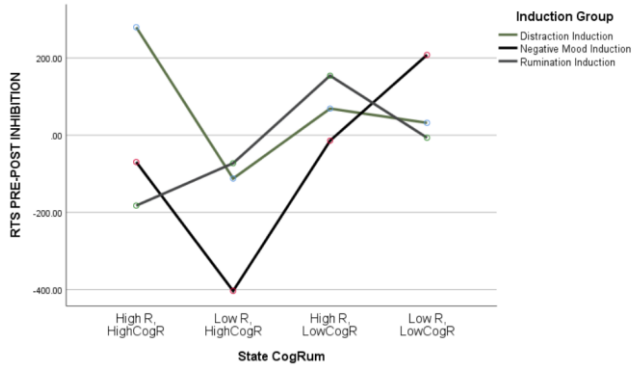

Figure 3:This figure illustrates the interaction between the induction group, trait rumination, and trait cognitive reactivity on reaction time (RT) measuring inhibition, comparing pre- and post-induction performance.

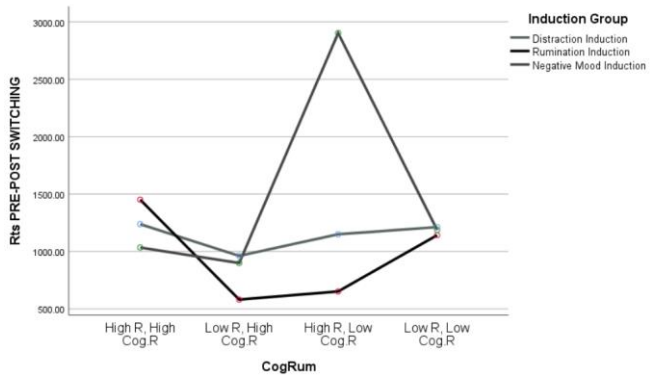

Figure 4:This figure illustrates the interaction between the induction group, trait rumination, and trait cognitive reactivity on reaction time (RT) measuring switching, comparing pre- and post-induction performance

Discussion

Interaction between trait rumination, trait cognitive reactivity and induction group on the levels of Switching

Our findings support the initial hypotheses and further demonstrate that the effects of rumination on executive functioning are influenced by the combined roles of trait rumination and cognitive reactivity. This interaction underscores the importance of considering individual trait profiles when evaluating the cognitive impact of mood induction. Participants showing the least switching cost were those low in trait rumination and high in cognitive reactivity, specifically in the negative mood induction group. This outcome is consistent with "Mood as Information Theory" (Mitchell & Phillips, 2007) which suggest that negative mood is associated with analytic thinking. Individuals interpret negativity as a signal of threat, leading to more careful cognitive processing. In contrast, positive mood is linked to a heuristic style, representing the absence of threat, which may hinder executive functions. In their study, Gabel and McAuley (2018) proposed a more complex picture, suggesting that negative mood only enhances executive function (EF) performance in highly reactive individuals. Our results align with these findings, reinforcing the notion that cognitive reactivity not only serves as a protective mechanism but also enhances cognitive performance in a negative mood context. Discussing their meta-analytical results, Whitmer and Gotlib (2013) proposed the "Attentional Scope Model of Rumination" to explain the complex relationship between rumination and executive function (EF). This model suggests that rumination narrows individuals' attentional scope, limiting their access to a broad range of stimuli. Information outside of their narrowed attentional spotlight is not attended to by high ruminators, making them less flexible. This characteristic can be adaptive for high ruminators, as they can focus on specific information over time without being distracted. This could be an advantage in tasks requiring sustained focus, such as inhibition tasks, but a disadvantage in tasks that require switching abilities. When considering the factor of cognitive reactivity, it can be argued that high ruminators who are low in reactivity (i.e., less sensitive to mood fluctuations) may not benefit from the adaptive response found in highly reactive individuals (Gabel & McAuley, 2018). Interestingly, individuals high in both rumination and cognitive reactivity did not demonstrate switching costs in any of the induction groups. In high-reactive individuals, the concept of compensatory balance may explain their behavior. More specifically, models such as the Cognitive Emotion Regulation Model (CER) suggest that individuals can actively regulate their emotional state by allowing themselves to experience it, focusing on their bodily sensations, and becoming aware of their emotional state (Grecucci et al., 2020). In other words, high-reactive individuals' heightened sensitivity to mood changes promotes a more insightful awareness of their internal state, helping them avoid getting stuck in repetitive thinking

patterns and remain cognitively flexible. On the other hand, individuals low in both rumination and cognitive reactivity do not experience the cognitive load of rumination and therefore demonstrate stable performance. An exploratory analysis of the maladaptive aspects of rumination, as measured by the Brooding subscale and Depression subscale, revealed that the greatest switching deficits were demonstrated by individuals high in depression and low in brooding in the rumination induction group. This finding suggests that state rumination burdens individuals high in depression more than those high in brooding. In other words, the interaction between state and trait rumination, in the absence of depression, may not further affect switching ability. This is also supported by the finding that high brooders with low depression showed the best performance in the negative mood induction group. It appears that, in the absence of depression, brooders demonstrate superior performance, reacting similarly to highly cognitive-reactive individuals. This finding also aligns with "mood as information theory" (Mitchell & Phillips, 2007), which posits that negative mood is perceived as a threat, promoting analytic thinking and enhancing executive function performance. Participants who scored high and low on both subscales did not demonstrate significant differences among induction groups.

Interaction effects between trait rumination, trait cognitive reactivity and induction group on the levels of Inhibition

A opposite trend was observed in inhibition costs compared to switching. Specifically, individuals low in rumination and high in cognitive reactivity in the negative mood group demonstrated greater inhibition costs. Inhibition refers to "the ability to control one's mental processes and responses, to ignore an internal or external prompt, and to perform an alternative action" (Diamond, 2012). Cognitive reactivity, by definition, results from an inability to suppress negative thoughts in response to low mood. In other words, highly reactive individuals struggle to inhibit negative information that interferes with their cognition. This characteristic of reactive cognition could be the underlying factor contributing to their difficulty inhibiting automatic responses. Considering the resource exhaustion model, negative thinking occupies cognitive resources, thus worsening performance in inhibition tasks. Interestingly, high-reactivity individuals who also scored high in rumination did not appear to experience any inhibition burden across any induction group. The interaction between rumination and cognitive reactivity seems to result in stable performance when individuals are either high in both traits or low in both traits. In the former case, the compensatory balance between trait rumination, high reactivity, and adaptive strategies should be explored further in future studies. In the latter case, the absence of any additional cognitive load allows individuals to maintain stable executive function performance.

Limitations

The mood and rumination checks did not reveal significant results among the groups. While the negative mood induction was statistically significant, the difference between the rumination and negative mood groups was not. Additionally, high ruminators reported feeling significantly worse than low ruminators across the experimental procedure, further complicating the relationship between rumination and negative mood. One of the major challenges in rumination research is disentangling the effects of rumination from those of negative mood, so that researchers can attribute results more accurately to each construct. The rumination check also revealed an interconnection between rumination and the negative mood induction groups, as there were no significant differences in state rumination between them. While these findings demonstrate the close relationship between rumination and negative mood, they also introduce some ambiguity in our analysis. Future research could consider alternative methods for measuring state rumination, as the question "How much did you focus on your feelings?" may prompt participants to reflect more on their emotional rather than cognitive state. Moreover, future studies should evaluate and compare the effectiveness of different rumination induction methods. The present study used an induction inspired by the Response Style Theory (Nolen-Hoeksema & Morrow, 1991), which emphasizes the depressive implications of rumination. Other rumination theories, such as those focusing on goal discrepancy, have developed alternative induction procedures, such as the unresolved goal induction method (Roberts et al., 2013). Lastly, the variable used to assess the three-way interaction consisted of four levels, with all combinations of high and low rumination and cognitive reactivity. The sample was concentrated at the extremes, leading to an unequal distribution that may affect the validity and generalizability of the results. This uneven distribution also applies to both analyses of the interaction between trait rumination, cognitive reactivity, and induction group on inhibition and switching levels. As such, a clear direction for future studies is to compare these four groups ensuring equal sample sizes across all four participant subgroups. This would allow for more robust comparisons and help confirm the reliability of the interaction effects reported here.

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References

Altamirano, L. J., Miyake, A., & Whitmer, A. J. (2010). When Mental Inflexibility Facilitates Executive Control. Psychological Science, 21, 1377–1382.

Ballesio, A., Ottaviani, C., & Lombardo, C. (2019). Poor Cognitive Inhibition Predicts Rumination About Insomnia in a Clinical Sample. Behavioral Sleep Medicine, 17(5), 672–681. https://doi.org/10.1080/15402002.2018.1461103

Chen, X., Feng, Z., Wang, T., Su, H., & Zhang, L. (2016). Internal switching and backward inhibition in depression and rumination. Psychiatry Research, 243, 342–348. https://doi.org/10.1016/j.psychres.2016.06.014

Connolly, S. L., Wagner, C. A., Shapero, B. G., Pendergast, L. L., Abramson, L. Y., & Alloy, L. B. (2014). Rumination prospectively predicts executive functioning impairments in adolescents. Journal of Behavior Therapy and Experimental Psychiatry, 45(1), 46–56. https://doi.org/10.1016/j.jbtep.2013.07.009

Cooney, R. E., Joormann, J., Eugène, F., Dennis, E. L., & Gotlib, I. H. (2010). Neural correlates of rumination in depression. Cognitive, Affective, & Behavioral Neuroscience, 10(4), 470–478. https://doi.org/10.3758/CABN.10.4.470

De Lissnyder, E., Koster, E. H. W., Goubert, L., Onraedt, T., Vanderhasselt, M.-A., & De Raedt, R. (2012). Cognitive control moderates the association between stress and rumination. Journal of Behavior Therapy and Experimental Psychiatry, 43(1), 519–525. https://doi.org/10.1016/j.jbtep.2011.07.004

Diamond, A. (2012). Executive Functions. Annual Review of Psychology, 64. https://doi.org/10.1146/annurev-psych-113011-143750

Gabel, M. S., & McAuley, T. (2018). Does mood help or hinder executive functions? Reactivity may be the key. Personality and Individual Differences, 128, 94–99. https://doi.org/10.1016/j.paid.2018.02.027

Grecucci, A., Messina, I., Amodeo, L., Lapomarda, G., Crescentini, C., Dadomo, H., Panzeri, M., Theuninck, A., & Frederickson, J. (2020). A Dual Route Model for Regulating Emotions: Comparing Models, Techniques and Biological Mechanisms. Frontiers in Psychology, 11. https://doi.org/10.3389/fpsyg.2020.00930

Koster, E., Derakshan, N., & De Raedt, R. (2011). Understanding Depressive Rumination from a Cognitive Science Perspective: The Impaired Disengagement Hypothesis. Clinical Psychology Review, 31, 138–145. https://doi.org/10.1016/j.cpr.2010.08.005

Krauth-Gruber, S., & Ric, F. (2000). Affect and stereotypic thinking: A test of the mood-and-general-knowledge-model. Personality and Social Psychology Bulletin, 26(12), 1587–1597. https://doi.org/10.1177/01461672002612012

MacLeod, C. M. (2007). The concept of inhibition in cognition. In Inhibition in cognition. (p. 5). American Psychological Association. https://doi.org/10.1037/11587-001

Martin, L. L., & Tesser, A. (1996). Some ruminative thoughts. In Ruminative thoughts. (pp. 1–47). Lawrence Erlbaum Associates, Inc.

Meiran, N., Diamond, G. M., Toder, D., & Nemets, B. (2011). Cognitive rigidity in unipolar depression and obsessive compulsive disorder: Examination of task switching, Stroop, working memory updating and post-conflict adaptation. Psychiatry Research, 185(1), 149–156. https://doi.org/10.1016/j.psychres.2010.04.044

Michel-Kröhler, A., & Berti, S. (2023). Experimental induction of state rumination: A study evaluating the efficacy of goal-cueing task in a sample of athletes. Cogent Psychology, 10(1), 2205252. https://doi.org/10.1080/23311908.2023.2205252

Mitchell, R. L., & Phillips, L. H. (2007). The psychological, neurochemical and functional neuroanatomical mediators of the effects of positive and negative mood on executive functions. *Neuropsychologia*, *45*(4), 617-629.

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The Unity and Diversity of Executive Functions and Their Contributions to Complex "Frontal Lobe" Tasks: A Latent Variable Analysis. Cognitive Psychology, 41(1), 49–100. https://doi.org/10.1006/cogp.1999.0734

Mosak, H. H. (2005). Adlerian psychotherapy. In Current psychotherapies, 7th ed., instr. Ed. (pp. 52–95). Thomson Brooks/Cole Publishing Co. https://doi.org/10.1177/009318530403200411

Moulds, M. L., Kandris, E., Williams, A. D., Lang, T., Yap, C., & Hoffmeister, K. (2008). An Investigation of the Relationship Between Cognitive Reactivity and Rumination. Behavior Therapy, 39(1), 65–71. https://doi.org/10.1016/j.beth.2007.05.001

Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta earthquake. Journal of Personality and Social Psychology, 61(1), 115–121. https://doi.org/10.1037/0022-3514.61.1.115

Nolen-Hoeksema, S., Parker, L. E., & Larson, J. (1994). Ruminative coping with depressed mood following loss. Journal of Personality and Social Psychology, 67(1), 92–104. https://doi.org/10.1037/0022-3514.67.1.92

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking Rumination. Perspectives on Psychological Science, 3(5), 400–424. https://doi.org/10.1111/j.1745-6924.2008.00088.x

Philippot, P., & Brutoux, F. (2008). Induced rumination dampens executive processes in dysphoric young adults. Journal of Behavior Therapy and Experimental Psychiatry, 39(3), 219–227. https://doi.org/10.1016/j.jbtep.2007.07.001

Roberts, H., Watkins, E. R., & Wills, A. J. (2017). Does rumination cause "inhibitory" deficits?. *Psychopathology Review*, *4*(3), 341-376.

Segal, Z. V., Gemar, M., & Williams, S. (1999). Differential cognitive response to a mood challenge following successful cognitive therapy or pharmacotherapy for unipolar depression. Journal of Abnormal Psychology, 108(1), 3–10. https://doi.org/10.1037/0021-843X.108.1.3

Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination Reconsidered: A Psychometric Analysis. Cognitive Therapy and Research, 27(3), 247–259. https://doi.org/10.1023/A:1023910315561

Vălenaș, S., & Szentágotai-Tătar, A. (2017). The relationship between rumination and executive functions: A meta-

analysis. Journal of Evidence-Based Psychotherapies, 17(2), 23–52. https://doi.org/10.24193/jebp.2017.2.2

Van Der Does, W. (2002). Cognitive reactivity to sad mood: Structure and validity of a new measure. Behaviour Research and Therapy, 40, 105–120. https://doi.org/10.1016/S0005-7967(00)00111-X

Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. Psychological Bulletin, 134(2), 163–206. https://doi.org/10.1037/0033-2909.134.2.163

Whitmer, A. J., & Gotlib, I. H. (2012). Switching and backward inhibition in major depressive disorder: The role of rumination. Journal of Abnormal Psychology, 121(3), 570–578. https://doi.org/10.1037/a0027474

Whitmer, A. J., & Gotlib, I. H. (2013). An attentional scope model of rumination. Psychological Bulletin, 139(5), 1036–1061. https://doi.org/10.1037/a0030923

Willem van der Does & J. M. G. Williams. (2003). Leiden Index of Depression Sensitivity—Revised. PsycTESTS Dataset. https://doi.org/10.1037/t43634-000

Yang, Y., Cao, S., Shields, G. S., Teng, Z., & Liu, Y. (2017). The relationships between rumination and core executive functions: A meta-analysis. Depression and Anxiety, 34(1), 37–50. https://doi.org/10.1002/da.22539

Zetsche, U., Bürkner, P.-C., & Schulze, L. (2018). Shedding light on the association between repetitive negative thinking and deficits in cognitive control—A meta-analysis. Clinical Psychology Review, 63, 56–65.