

Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

Journal of Behavior Therapy and Experimental Psychiatry

journal homepage: www.elsevier.com/locate/jbtep

Rumination: Cognitive consequences of training to inhibit the negative

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ARTICLE INFO

Article history:

Received 28 April 2014

Received in revised form

17 November 2014

Accepted 27 January 2015

Available online xxx

Keywords:

Rumination

Inhibition

CBM

Interpretation

ABSTRACT

Background and Objectives: To explore cognitive factors in ruminative thinking, we assessed the effect of a single-session of inhibition training on subsequent biases in attention and interpretation.

Methods: We randomly assigned participants to either inhibit or attend to negative stimuli. Inhibition was assessed by using assessment trials embedded throughout the training, and interpretation bias was assessed following the training.

Results: Trait rumination moderated training effects on both measures. Low ruminators in the inhibition-training condition maintained their level of inhibition of negative stimuli, but those in the attention-training condition showed a non-significant trend for decreased inhibition. Participants also showed a transfer-congruent tendency in interpretation bias, with reduced bias by those trained to inhibit negative stimuli, compared to those trained to attend to negative stimuli. In contrast, high ruminators in the inhibition training condition showed a training-incongruent decrease in inhibition of negative stimuli, but no change in inhibition when trained to attend to negative stimuli. No effects of the training on interpretation bias were observed among high ruminators. Finally, the training did not affect subsequent measures of mood or state rumination, even when trait rumination scores were taken into account.

Limitations: This study used a single session of inhibition training rather than a multi-session training, and this may explain the null effects among high ruminators.

Conclusions: Findings highlight the critical role that trait rumination plays in moderating the effect of inhibition training. Our results suggest that inhibition training may provide an effective technique to change inhibition bias and later interpretation bias.

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People who ruminate think repetitively about why they feel sad and about the possible consequences of feeling sad (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Rumination is characterized by a variety of cognitive biases, sometimes examined in an attempt to delineate mechanisms responsible for this maladaptive thinking style. Ruminators manifest cognitive inflexibility that undermines their ability to shift from one line of thinking to another (Davis & Nolen-Hoeksema, 2000; Yee Lo, Lau, Cheung, & Allen, 2012). Specifically, deficient inhibition is thought to play a main role in the inflexible style observed in ruminators. As we use the term in this report, inhibition refers to the process of suppressing, resisting, and ignoring interference from task-irrelevant

information (Friedman & Miyake, 2004). Difficulty inhibiting irrelevant negative information makes ruminators stuck on negative thoughts and can possibly prevent them from changing the way they think (Davis & Nolen-Hoeksema, 2000; Joormann, 2006).

Although difficulty inhibiting negative information has been associated with rumination (Joormann, 2006; Zetsche & Joormann, 2011), the nature of this relationship is unclear. One possibility is that this difficulty is a causal factor in the tendency to ruminate. Fundamental difficulty in disregarding negative aspects of a situation may interfere with effective regulation of negative affect and thereby initiate a vicious cycle of ruminative thoughts and sustained negative mood. This possibility can be examined by utilizing a cognitive bias modification (CBM) procedure that targets inhibition and can assess its effect on rumination. CBM procedures encourage one or another emotional bias in attention, interpretation, or memory before assessing the effects of such training on a variety of transfer tasks (see Hertel & Mathews, 2011). Until now,

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most CBM research has not targeted rumination. In addition, no studies have trained inhibition of negative material until our recent work (Daches & Mor, 2013) in which we developed an inhibition training procedure for ruminators based on the negative affective priming task (NAP; see Joormann, 2006). Compared to those who were trained to attend to negative content, ruminators who were trained to inhibit negative content showed improved inhibition of irrelevant negative content and reduced rumination. These findings support the hypothesis that inhibition plays a causal role in ruminative thinking.

Following this initial work on inhibition training in rumination, several questions remain unanswered. First, we included only participants who reported high levels of trait rumination. This inclusion criterion does not allow the examination of individual differences in the effect of inhibition training. Although it has been suggested that samples with higher levels of symptoms have greater room for change and thus may benefit from training more than healthy individuals (Hallion & Ruscio, 2011), findings are inconclusive. For example, attention training reduced depressive symptoms among people with mild depression, but not those with moderate to severe depression who experienced an increase in depressive symptoms following the training (Baert, De Raedt, Schacht, & Koster, 2010). In contrast, Arditte and Joormann (2014) found that only individuals high in trait rumination benefited from attention training designed to teach individuals to shift their attention toward positive as opposed to neutral stimuli. Therefore, a central aim of the current research was to examine whether the effects of inhibition training are moderated by trait rumination.

In our prior research (Daches & Mor, 2013), we used multiple training sessions, but an important question is whether a single session of training can change ruminative thinking, and what conditions are required for obtaining training effects in a single training session. A recent meta-analysis found that multiple training sessions produced larger symptom reduction than did a single training session (Hallion & Ruscio, 2011), but this difference was non-significant. Although rumination-related outcomes were obtained in both multiple-session (e.g., Daches & Mor, 2013; Wells & Beevers, 2010) and single-session (e.g., Arditte & Joormann, 2014) protocols of attention and inhibition training, these studies cannot be easily compared because they used different training procedures and targeted different mechanism of change. Uncertainty therefore remains regarding the optimal 'dose' of training. In line with previous work, it is possible that trait rumination moderates the effect of inhibition training, and that varying amounts of training are needed to obtain an effect, depending on levels of trait rumination. Thus, a second aim of this study was to examine the effect of a single session of inhibition training, in a sample of high and low ruminators.

Our work demonstrated that the training was effective in modifying inhibition, but we did not assess the effect of the training on additional rumination-related cognitive biases. A perspective taken by Hirsch, Clark, and Mathews (2006) suggests that cognitive biases influence each other and can interact to maintain a psychological disorder. However, only few studies have examined such transfer effects of training one cognitive process on another. The majority of this work has demonstrated that training people to modify the way they interpret ambiguous information can affect the sort of information to which they attend and that they later remember (e.g., Amir, Bomyea, & Beard, 2010; Lange et al., 2010; Salemink, Hertel, & Mackintosh, 2010; Tran, Hertel, & Joormann, 2011). Investigating anxiety-related processes, Amir et al. (2010) showed that training individuals to make benign interpretations of ambiguous information improved their ability to disengage attention from negative stimuli. In examining the opposite causal direction, White, Suway, Bar-Haim, Pine and Fox (2011) showed that participants who were trained to attend to threat displayed an

increase in anxiety-related negative interpretations of ambiguous events. Everaert, Tierens, Uzieblo, and Koster (2013) have found, using a non-depressed and sub-clinically depressed sample, that a negative bias in attention indirectly affects memory via its effect on negative interpretation bias. To the best of our knowledge, the transfer of rumination-related training effects from one bias to another has not been examined. The exploration of these possible transfer effects was therefore the third goal of the current research.

Effects of training on interpretation biases can reasonably be expected. We now have experimental evidence regarding the correlation of rumination and interpretation bias (Mor, Hertel, Ngo, Shachar, & Redak, 2014). Participants performed a lexical decision task in which target letter strings were preceded by homographs that had both benign and ruminative meanings. Higher trait rumination was linked to response times to targets related to the ruminative meaning of these homographs that were faster than to targets related to the benign meaning. Although both inhibition and interpretation biases are implicated in rumination, the link between these biases—particularly possible causal pathways between them—has not been explored. We propose that difficulty inhibiting negative information can influence the resolution of meaning in ambiguous situations that permit a negative interpretation. Thus, the third aim of the present study was to explore the link between inhibition and interpretation biases by examining whether a trained inhibition bias affects interpretation bias on a subsequent lexical decision task.

In the current study we used a single session of training to encourage participants to either inhibit or attend to negative stimuli (IN vs. AN, respectively). In training trials, we presented a negative and a neutral word simultaneously. Participants in the IN condition were trained to ignore the negative word, whereas those in the AN condition were trained to attend to it. Unlike our previous work (Daches & Mor, 2013), in which we examined the effect of such training on inhibition by using a pre-post assessment design, in this study we distributed inhibition assessment trials randomly throughout the training phase. We chose this assessment strategy (for a similar procedure see Hayes et al. 2010) because presenting an assessment task in which emotional and neutral stimuli are targets in equal probability at the end of a single session of training may influence training effectiveness (as suggested by Bar-Haim, 2010). Similarly, because participants underwent only a single training session, we expected that the training would have an effect on state rather than trait measures of rumination and negative affect. Moreover, in all of these tasks, we examined whether individual differences in trait rumination moderate the effect of inhibition-bias training.

The paucity of prior research examining moderating effects of trait rumination on transfer of training precluded specific predictions. However, two contrasting hypotheses arise from the literature. On the one hand, due to their initial difficulty in inhibiting negative information, high ruminators might profit more from IN training than would low ruminators (Arditte & Joormann, 2014). Indeed, based on our prior findings with high ruminators, it is likely that high ruminators in the IN condition would maintain, and possibly improve, their ability to inhibit negative stimuli whereas high ruminators in the AN condition would become worse at inhibiting negative stimuli.¹ By the same

¹ This prediction is based on findings from our previous study. Because the index of inhibition bias is calculated as the difference between RT to control and inhibition trials, and "good" inhibition is indicated in slower responses to inhibition trials compared to control trials, it is difficult to obtain improved inhibition on the task. Overall, people become faster as the task progresses, and therefore, increased inhibition would require people to actually become slower on inhibition trials.

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