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The origins of repetitive thought in rumination: Separating cognitive style from deficits in inhibitory control over memory

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ABSTRACT

Background and objectives: Rumination is a major contributor to the maintenance of affective disorders and has been linked to memory control deficits. However, ruminators often report intentionally engaging in repetitive thought due to its perceived benefits. Deliberate re-processing may lead to the appearance of a memory control deficit that is better explained as a difference in cognitive style.
Methods: Ninety-six undergraduate students volunteered to take part in a direct-suppression variant of the Think/No-Think paradigm after which they completed self-report measures of rumination and the degree to which they deliberately re-processed the to-be-suppressed items.
Results: We demonstrate a relation between rumination and impaired suppression-induced forgetting. This relation is robust even when controlling for deliberate re-processing of the to-be-suppressed items, a behavior itself related to both rumination and suppression. Therefore, whereas conscious fixation on to-be-suppressed items reduced memory suppression, it did not fully account for the relation between rumination and memory suppression.
Limitations: The current experiment employed a retrospective measure of deliberate re-processing in the context of an unscreened university sample; future research might therefore generalize our findings using an online measure of deliberate re-processing or within a clinical population.
Conclusions: We provide evidence that deliberate re-processing accounts for some – but not all – of the relation between rumination and suppression-induced forgetting. The present findings, observed in a paradigm known to engage top-down inhibitory modulation of mnemonic processing, provide the most theoretically focused evidence to date for the existence of a memory control deficit in rumination.

1. Introduction

Cognitive control plays an important role in maintaining good mental health. For example, it allows us to direct attention away from thoughts that might otherwise upset us, and focus instead on more productive activities. However, when such control fails, we may instead find ourselves doing the opposite: Dwelling on negative thoughts, sometimes with dire consequences (although, see Andrews & Thompson, 2009).[1] The tendency to perseverate on past negative experiences has been termed 'depressive rumination'

[1] It is worth noting that whereas rumination is generally viewed negatively, this is not universally true: Rumination is sometimes viewed as an adaptive process aimed at ameliorating an aversive environmental or emotional challenge. For example, Andrews and Thompson (2009) have argued that brain regions affiliated with sustained attention (e.g., the left ventrolateral prefrontal cortex) become more active during depression. Viewed from this light, rumination could reflect an emergent property of a neurobiological mechanism that encourages a fixation on current problems and could – perhaps with the help of psychotherapy – lead to resolution. Because the current experiments deal with the control of rumination rather than its adaptive potential, we do not address this possibility further, but rather direct the interested reader to Andrews and Thompson (2009).

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(Nolen-Hoeksema, 1991, 2000) and has been found to predict the development of affective symptomatology such as suicidal ideation (e.g., Surrence, Miranda, Marroquin, & Chan, 2009). More recently, rumination has been recognized as a transdiagnostic process that is present in many anxiety and affective disorders (Ehring, Kleim, & Ehlers, 2011; McLaughlin & Nolen-Hoeksema, 2011), and appears to have a causal impact on the development of intrusive memories (Ball & Brewin, 2012). For this reason, it is perhaps no surprise that there has been growing interest in the cognitive and biological factors that predispose certain individuals towards rumination (for reviews, see Joormann, 2010; Whitmer & Gotlib, 2013).

In recent years, rumination has been linked to meta-cognitive beliefs concerning the utility and uncontrollability of repetitive thought (Papageorgiou & Wells, 2003). Whereas the belief that rumination is an adaptive cognitive strategy predicts the onset of rumination, the belief that rumination is uncontrollable or related to poor interpersonal or social outcomes has been found to mediate the relationship between rumination and depressive symptomatology. Perhaps lending credibility to beliefs concerning its uncontrollability, rumination has also been associated with executive dysfunction across a range of cognitive tasks, even after controlling for depression (e.g., De Lissnyder, Derakshan, De Raedt, & Koster, 2011; Joormann, 2005; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Whitmer & Banich, 2007). For example, rumination has been found to predict impairments in the ability to disengage attention in an antisaccade task (De Lissnyder et al., 2011) and also in the ability to inhibit previous task sets in a task-switching paradigm using either emotional or non-emotional materials (De Lissnyder, Koster, Derakshan, & De Raedt, 2010; Whitmer & Banich, 2007). Such dysfunction has been shown to precede (as opposed to follow) the onset of rumination, suggesting a critical role in the emergence of this behaviour (De Lissnyder et al., 2012; Whitmer & Gotlib, 2012). In fact, some theorists have argued that it is a general impairment in the ability to disengage attention from distracting or unwanted information that predisposes certain individuals towards ruminating in the first place (Koster, De Lissnyder, Derakshan, & De Raedt, 2011). Accordingly, the ability to focus on relevant information and suppress irrelevant information — either internally or externally — is critical in avoiding repetitive thought cycles, and "… individuals who are characterized by a difficulty to exercise attentional control in response to negative thoughts are likely to experience persistent rumination" (p. 139, Koster et al., 2011). Despite some accounts (e.g., Joormann, 2010), these impairments do not appear to be limited to emotional material — at least in the absence of depression (Whitmer & Gotlib, 2013).

1.1. Rumination and memory suppression

The clear linkage between rumination and inhibitory control deficits in attention tasks (for reviews, see Koster et al., 2011; Whitmer & Gotlib, 2013) raises the possibility that such deficits extend to disordered control over thoughts and memories. Although persistent thoughts and unwanted memories may appear to differ in many ways, most psychological disorders are characterized by attempts to avoid both (Brewin, Gregory, Lipton, & Burgess, 2010). Moreover, the two often occur simultaneously and are reciprocally connected (Newby & Moulds, 2012; Pearson, Brewin, Rhodes, & McCarron, 2008). Thus the notion that individual differences in the efficacy of cognitive control could predict ruminative tendencies has also led to work addressing the link between rumination and memory suppression. Memory suppression refers to the ability to suppress retrieval of an unwanted memory when faced with a reminder and is typically measured using the think/no-think (TNT) paradigm. In this paradigm, participants learn cue-target word pairs until the cue reliably activates the associated target. They then undergo a series of trials in which a subset of the studied cue words is sequentially presented and participants must either retrieve (Think trials) or suppress (No-Think trials) the associated target word. This process is repeated multiple times for each cue word, resulting in some target words that are repeatedly retrieved and others that are repeatedly suppressed. The typical finding is that memory for the retrieved (Think, or Respond) items is significantly *better* than memory for baseline items that were neither retrieved nor suppressed (the *positive control effect*) whereas memory for the suppressed (No-Think, or Suppress) items is significantly *worse* than memory for baseline items that were neither retrieved nor suppressed (the *negative control effect*, or *suppression-induced forgetting*). These effects are robust as demonstrated in cued-recall (e.g., Anderson & Green, 2001), recognition memory (e.g., Waldhauser Lindgren, & Johansson, 2012) and indirect memory measures (e.g., Gagnepain, Henson, & Anderson, 2014). Suppression is also evident in neural indices of implicit memory such as neural priming (Gagnepain et al., 2014). Importantly, the effects of retrieval suppression arise even when an independent probe cues retrieval instead of the original cue with which the target item was studied (e.g., Anderson & Huddleston, 2012). The cue independence of suppression-induced forgetting excludes interference as a possible explanation, establishing the role of inhibition in producing the phenomenon (Huddleston & Anderson, 2012).

We propose that memory suppression as measured using the TNT paradigm reflects the action of the same underlying control processes required when mitigating the intrusions associated with a ruminative thought: just as the retrieval of a no-think target must be suppressed when it intrudes in response to its cue word, an unwanted thought or memory concerning a negative event must likewise be controlled using similar processes, lest it perseverate in awareness and re-emerge in response to reminders. Suppression in the TNT paradigm substantially reduces the frequency of intrusive memories with repetition, purging intrusions from awareness via inhibitory control mechanisms that down-regulate hippocampal activity (Benoit, Hulbert, Huddleston, & Anderson, 2014; Levy & Anderson, 2012). If so, the TNT paradigm represents a theoretically focused means of evaluating the executive deficits thought to predispose individuals towards symptomatology such as rumination — with the prediction that ruminative tendencies should be associated with impaired suppression and therefore reduced suppression-induced forgetting (Levy & Anderson, 2008). Two studies already support this hypothesis. First, Hertel and Gerstle (2003) used the TNT paradigm with positively or negatively valenced word pairs to measure suppression in dysphoric and nondysphoric populations. They found that rumination was associated with both (a) greater recall of the no-think items, and (b) a smaller difference in recall between think and no-think items. This finding remained even when accounting for dysphoria. Dieler, Herrmann, and Fallgatter (2014) extended these findings. Using pairs of neutral faces and either negative or neutral target images, they demonstrated a correlation between ruminative brooding and reduced suppression-induced forgetting, but only for negative targets.

1.2. The current experiment

The negative correlation observed between rumination and suppression-induced forgetting is consistent with the theoretical argument that impaired control processes predispose individuals towards ruminative tendencies. However, this relationship may not reflect an inability to implement control, but rather a tendency not to do so. For example, whereas impaired memory suppression might predispose individuals towards rumination, we speculate