



# Rumination is characterized by valence-specific impairments in switching of attention

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## ABSTRACT

The ability to flexibly switch attention between emotional and non-emotional information in working memory is considered important in stress-resilience and is impaired in mood disorders. A recent theory claims that this component of attention is specifically related to ruminative thought. To further investigate this claim we report two new experiments using the internal shift task (IST). In Experiment 1 ( $N = 27$ ) we examined the stability of switching ability measured using the IST through examination of internal consistency (stability within the task) and test-retest-reliability (stability over time) over two weeks. Results indicate relatively high stability of switching ability measured with the IST. In Experiment 2 the IST was administered to a pre-selected undergraduate sample of high ( $N = 20$ ) and low ruminators ( $N = 20$ ). The main findings were that rumination was related to attentional switching impairments, specifically in the context of emotional information. The switching impairments were most pronounced when negative information was held in working memory. The attentional switching impairments were most strongly related to the depressive brooding component of rumination. The results of this study lend further support to the proposed link between rumination and switching abilities.

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## 1. Introduction

Persistent negative thought is considered a hallmark feature of affective disorders (Nolen-Hoeksema, Wisco, & Luybomirsky, 2008; Watkins, 2008). A well-investigated form of persistent negative thought – which is related to negative affect and depression – is *rumination*. Rumination is defined as “behaviors and thoughts that focus one’s attention on one’s depressive symptoms and on the implications of those symptoms” (Nolen-Hoeksema, 1991, p. 569). Two distinct subtypes of rumination are distinguished (Treyner, Gonzalez, & Nolen-Hoeksema, 2003). The first, *reflective pondering*, is considered a more adaptive form of rumination and reflects the degree to which individuals engage in cognitive problem solving to improve their mood. The second, *depressive brooding*, is considered a more maladaptive form of rumination and reflects the degree to which individuals passively focus on symptoms of distress and the meaning of those symptoms (Nolen-Hoeksema et al., 2008). The brooding component is proposed to be most closely related to depression risk (Treyner et al., 2003). In general, it has been shown that rumination, especially brooding, has detrimental effects on affect and cognition and acts as a crucial vulnerability factor for depression (Nolen-Hoeksema et al., 2008).

An important question is why individuals persist in this thinking style despite its negative consequences. Recently, several authors have proposed that impaired attentional control contributes to ruminative thinking (Hertel, 1997; Joormann & D’Avanzato, 2010; Koster, De Lissnyder, Derakshan, & De Raedt, 2011; Linville, 1996). The latter proposal has generated a wealth of research examining different aspects of attentional control in relation to persistent negative thought, negative mood, and psychopathology (e.g., Joormann, Yoon, & Zetsche, 2007; Whitmer & Banich, 2007). Remarkably, depression-related research is suggesting that attentional impairments and biases are more proximally related to rumination than to the broad construct of depression (Koster et al., 2011).

Research on depression and rumination has widely examined attentional processes in the processing of neutral and affective information. In the context of depression, attentional impairments in the processing of neutral material are mainly observed in individuals with severe levels of depression (e.g., Rokke, Arnell, Koch, & Andrews, 2002). Interestingly, when processing mood-congruent information attentional impairments, mainly at the level of attentional disengagement, can also be observed in subclinically depressed samples (De Raedt & Koster, 2010). Rumination has also been linked to attentional impairments. Davis and Nolen-Hoeksema (2000) showed using the Wisconsin Card Sorting Test that ruminators are characterized by cognitive inflexibility. At the level of attention, in an antisaccade task containing neutral material, where participants are instructed to generate a saccade to the mirror position of an abrupt peripheral cue, ruminators showed impaired

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inhibition as indicated by slower antisaccade latencies (De Lissnyder, Derakshan, De Raedt, & Koster, 2011). These inhibition impairments were specifically related to depressive brooding. In the context of emotional stimuli, rumination has been linked to biased attention towards negative words (Donaldson, Lam, & Mathews, 2007). This study was conducted in a sample of depressed patients and showed that trait rumination was associated with an attentional bias for negative words, even when depressive symptoms were statistically controlled for.

Recently, Chun, Golomb, and Turk-Browne (2011) proposed a distinction between external and internal attentions, where external attention refers to processing of external information and internal attention refers to processing information or mental operation on stimuli that are held in memory. It is noteworthy that both in depression and rumination, studies have mainly examined attentional processing of external information (pictures, faces, or words), whereas depression and rumination may be characterized by impaired internal attention over negative thoughts and memories. In this context, Garavan (1998) and Gehring, Bryck, Jonides, Albin, and Badre (2003) developed a paradigm to investigate switching between objects held in working memory. Recently, Chambers, Lo, and Allen (2008) developed an affective version of this paradigm using words as stimuli. We further modified this task to include emotional facial expressions and refer to this task as the Internal Shift Task (IST; De Lissnyder, Koster, & De Raedt, 2012). In the IST individuals are required to perform a mental count based on the emotional expression of a face (i.e., count the number of negative and neutral faces) in one block (referred to as emotion condition) or on non-emotional features of a face (i.e., count the number of males and females) in another block (referred to as gender condition). Interestingly, the IST allows examining differential switching capacity<sup>1</sup> in relation to specific task settings (emotion versus gender condition), valence-specific impairments (within the emotion condition: switching from negative to neutral or vice versa) and general switching capacity (across both emotion and gender conditions).

In previous research in dysphoric participants using the IST we observed that attentional control impairments were not related to depression scores but were related to rumination scores (De Lissnyder et al., 2012). Similar effects were obtained by, among others, Whitmer and Banich (2007) who investigated inhibition as well as set shifting related to different types of rumination. In a task switching paradigm that distinguished inhibition and set shifting impairments in the context of non-emotional information, they found that brooding, but not depression, scores were specifically associated with impaired inhibition. Since then, similar findings have been obtained in a variety of task suggesting that rumination is more strongly correlated with attentional impairments than depression scores (for a review, see Koster et al., 2011). Moreover, a recent study measuring event-related potentials during the IST (containing words) indicates that ruminators need to exert more effort in switching when they are in a negative mood state (Yee Lo, Lau, Cheung, & Allen, 2012).

### 1.1. Present study

Internal attention appears to be strongly correlated with rumination, where the research using the IST to investigate whether the ability to switch between (affective) mental representations is associated with the ability to control (negative) thoughts in rumination seems particularly relevant. However, there are important drawbacks of previous research. First, little is known about the stability of the switching ability

<sup>1</sup> We use the term switching here in the context of switching between objects and working memory and not task switching. The term switching is also often used in the context of executive functions and cognitive control and is sometimes distinguished from other mental operations such as inhibition and updating. Note that we do not claim that the IST is a "pure measure" of switching as performance is dependent on a number of specific cognitive operations (Greve, Stickle, Love, Bianchini, & Stanford, 2005). Therefore we describe the IST in relation to its most crucial functional operation, the internal shifting of attention, which maps onto the taxonomy of internal vs. external attention provided by Chun et al. (2011).

scores obtained in the IST. Generally, in this research it is assumed that switching abilities obtained at a single time point represent a stable trait related to attentional control in general. However, at present there is little data to support this claim. As little information is available on affective modifications of attention paradigms, with the processing of emotional information being potentially more susceptible to state influences, research on this issue is imperative. Therefore, in a first experiment, the IST was administered to an unselected undergraduate sample ( $N = 27$ ) to examine the internal consistency (stability within the task) and test-retest reliability (stability over time) over two weeks of the IST.

Second, in our previous research using the IST (De Lissnyder et al., 2012) we selected dysphoric individuals and included analyses based on depression as well as rumination scores based on a median split procedure for rumination. In that research it was found that rumination was associated with impaired switching in the emotional task condition of the IST (where individuals had to categorize angry and neutral facial expression). However, we failed to find the expected valence-specific differences in switching away from angry versus neutral faces. This is in contrast to much attentional research where impaired disengagement was found for negative information (for a review, see De Raedt & Koster, 2010). Provided that individuals were pre-selected on depression scores and individuals were allocated to a high and low ruminations through median-split, it may be better to examine attentional control in pre-selected high and low rumination groups. Thus, in Experiment 2, we sought to replicate and extend our investigation into valence-specific switching impairments in an undergraduate sample of high ruminators ( $N = 20$ ) and low ruminators ( $N = 20$ ).

In sum, the following hypotheses were tested in each of the respective experiments:

- (1) If switching ability between mental representations indeed is a stable individual difference variable, scores on the IST should show high internal consistency and high test-retest reliability in Experiment 1;
- (2) If rumination is related to valence-specific switching impairment, high ruminators should show longer RT to switch from angry to neutral faces in the emotional task condition compared with low ruminators.

## 2. Experiment 1: Stability of IST performance

### 2.1. Method

#### 2.1.1. Participants

The initial sample included 30 undergraduates, three participants were excluded from analysis due to missing retest data (failure to show up). The final sample included 27 participants (9 males, 18 females) ranging in age from 18 to 26 years ( $M = 20.63$ ,  $SD = 1.78$ ). Participants were paid (8 euro) for their contribution. The study was approved by the ethical committee at Ghent University.

#### 2.1.2. Materials

##### 2.1.2.1. Self-report questionnaires

**2.1.2.1.1. Rumination.** The Ruminative Response Scale (RRS-NL) was used to measure rumination (Nolen-Hoeksema & Morrow, 1991; Raes et al., 2009). The RRS-NL is a 26-item self-report measure and consists of items that describe responses to a depressed mood that are focused on the self, symptoms, or consequences of depressed mood. Participants are requested to indicate how often they engage in these responses using a four-point Likert scale ranging from 1 (almost never) to 4 (almost always). Total rumination scores range from 26 to 104. A factor analysis of the RRS has identified two separate subscales that are differentially related to depressive symptoms, reflective pondering and depressive brooding. The RRS is a reliable and valid measure of rumination with good psychometric properties (Treyner et al., 2003).

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