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Interpretation bias characterizes trait rumination

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ABSTRACT

Background and objectives: Rumination, a maladaptive cognitive style of responding to negative mood, is thought to be maintained by a variety of cognitive biases. However, it is unknown whether rumination is characterized by interpretation biases.

Methods: Two experiments examined the link between rumination and interpretation biases, revealed in lexical-decision tasks (LDT). A homograph with both benign and ruminative or otherwise negative meaning was presented on each trial and followed by a letter string, to which participants responded by judging whether it was a word or a non-word. Letter strings were non-words or words related or unrelated to one meaning of the homograph.

Results: In both experiments, faster latencies to respond to targets related to the ruminative meaning of the homographs were produced by students with higher scores on self-report measures of rumination. Moreover, these biases were associated with both brooding, the maladaptive form of rumination, and reflection, the more adaptive component. No measure of rumination was significantly correlated with general biases toward negative meaning (Experiment 1) or with threatening interpretations of homographs (Experiment 2).

Limitations: The paucity of available rumination-related homographs dictated the use of non-fully randomized stimuli presentation (Experiment 1) or the use of only one set of the meanings associated with the homographs (Experiment 2).

Conclusions: Rumination is associated with a tendency to interpret ambiguous information in a rumination-consistent manner. This tendency may exacerbate ruminative thinking and can possibly be a target for future intervention.

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Rumination, a cognitive habit of repetitively analyzing one's problems, concerns, and negative feelings (Nolen-Hoeksema, 1991), is a particularly maladaptive form of self-focus (Mor & Winquist, 2002). Rumination predicts depression both prospectively and concurrently (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008), and is considered a transdiagnostic factor in psychopathology (e.g., Nolen-Hoeksema & Watkins, 2011) because measures of rumination predict symptoms of anxiety, eating disorders, substance abuse and alcohol abuse. (See Aldao, Nolen-Hoeksema, & Schweizer, 2010; for a recent meta-analysis.)

Although originally construed as a unitary construct, later research identified two subtypes of ruminative thinking: brooding and reflection (Burwell & Shirk, 2007; Schoofs, Hermans, & Raes, 2010; Treynor, Gonzalez, & Nolen-Hoeksema, 2003; Whitmer & Gotlib, 2011). Whereas brooding is a perseverative, passive, and

judgmental focus on one's mood, reflection is a contemplative, intentional pondering of one's mood in order to engage in problem solving. Brooding is considered the maladaptive aspect of rumination and is the form of rumination that is most associated with psychopathology (e.g., Nolen-Hoeksema, Stice, Wade, & Bohon, 2007; Watkins, 2009).

It has been argued that rumination exerts its negative effects by making negative content more accessible (Nolen-Hoeksema et al., 2008). Indeed, ruminators, and particularly brooders, exhibit a variety of cognitive biases that maintain negative emotional states. Specifically, recent research has shown that brooding is associated with preferential attention to negative and self-related information and to difficulty ignoring, inhibiting, or forgetting such information (Bernblum & Mor, 2010; Daches, Mor, Winquist, & Gilboa-Schechtman, 2010; Joormann, Dkane, & Gotlib, 2006), as well as with memory deficits such as decreased specificity of autobiographical memory (Debeer, Hermans, & Raes, 2009).

Although interpretation biases play a central role in theories of depression and anxiety (Beck, 1976), they have so far not been

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examined in relation to rumination. Interpretations are thought to maintain negative emotional states by strengthening negative self-beliefs and reinforcing negative memory biases (e.g., Hertel, Brozovich, Joormann, & Gotlib, 2008). Interestingly, several recent studies have failed to find evidence for interpretive biases in depression (e.g., Bisson & Sears, 2007; Lawson & MacLeod, 1999; Mogg, Bradbury, & Bradley, 2006). Indeed, self-referential processing may be necessary for these biases to emerge (e.g., Hindash & Amir, 2012; Wisco & Nolen-Hoeksema, 2010), and ruminative thinking may thereby provide the link between depression and the tendency to infuse ambiguous stimuli with negative meaning.

Negative interpretations of an ambiguous event can exacerbate the tendency to ruminate by fueling future thoughts of its now disambiguated meaning; in this way interpretation biases can contribute to the spiraling relation between rumination and negative mood states (Nolen-Hoeksema et al., 2008). Interpretation biases have also been related to worry (Hayes, Hirsch, Krebs, & Mathews, 2010; Hirsch, Hayes, & Mathews, 2009), a repetitive and negative cognitive style similar to rumination but focused on the future instead of the past. (For a review see Nolen-Hoeksema et al., 2008.) Moreover, dysphoric individuals who were induced to ruminate showed an interpretation bias, favoring negative interpretations of emotionally ambiguous content (Hertel & El-Messidi, 2006). However, despite the importance of interpretation biases in understanding psychopathology and the indirect evidence concerning their relation to ruminative thinking, there is to date no research showing that trait ruminators hold negative interpretation biases.

In two experiments, we investigated the link between rumination and interpretation biases. Several questions guided our research. We explored whether rumination is specifically associated with interpretation biases instead of merely with a tendency to respond quickly to stimuli with negative meaning, as depressed individuals have been shown to do (see Mathews & MacLeod, 2005). We further examined whether interpretation biases are specific to brooding or are also linked to overall rumination and reflection. Finally, we evaluated the content specificity of the biases. To answer these questions, we used a paradigm developed by Richards and French (1992) to document interpretation biases in anxiety. In the original paradigm, participants performed a lexical decision task in which they were presented with a priming word followed by a target to be judged as a word or non-word. On critical trials, the primes were homographs with both threatening and benign meanings. Targets were words related to either the benign or the threatening meaning of the prime, unrelated benign and threatening words, and non-word letter strings. Richards and French found that anxious participants made faster decisions in response to targets that were related to the threatening meaning of the prime. In the current experiments, we were interested in whether the use of homographs with benign and ruminative meanings (e.g., *bitter*, *finished*) would invite a similar bias on the part of individuals with the habit of ruminating.

Experiment 1 used a design identical to that of Richards and French (1992). In this study, benign and negative homograph-related and unrelated targets were used to contrast an interpretive-bias account with a general-negativity account. We predicted that rumination, and brooding in particular, would be characterized by faster latencies to respond to the target denoting the ruminative meaning of the homograph, compared to the target denoting its benign meaning. This facilitation was expected for the negative targets that were related to the preceding homographs (denoting an interpretation bias) but not for negative but unrelated targets (denoting a negativity bias). In Experiment 2, to examine the specificity of the interpretation bias to rumination-related material, homographs with negative meanings that were either

ruminative or threatening were used. We predicted that rumination would be associated with speeded responding to related as compared to unrelated targets denoting ruminative meanings but not when the targets denoted threatening meanings.

1. Experiment 1

1.1. Method

1.1.1. Participants and design

Participants were 27 female and 22 male students at the Hebrew University of Jerusalem, who took part in the study in return for course credit or payment. Participants' mean age was 25 ($SD = 2.70$). All participants were native Hebrew speakers.

1.2. Materials

1.2.1. Lexical decision task

The task consisted of 80 trials, with each trial presenting a prime and a target. Primes were Hebrew homographs that each had a benign meaning as well as a negative, rumination-related meaning. Targets were non-words on half of the trials and words on the other half. Word targets belonged to one of four categories: words related to the negative meaning of the homograph (related-negative, e.g., *bitter-resentful*), words related to the benign meaning of the homograph (related-benign, e.g., *bitter-chocolate*), benign words that were unrelated to either of the homograph meanings (unrelated-benign, e.g., *bitter-branch*), and negative words that were similarly unrelated (e.g., *bitter-dirt*).

Because no homograph norms are available in Hebrew, we followed the procedure outlined by Richards and French (1992) in pretesting homographs and targets. Thus, student volunteers listed associations for an initial pool of 140 negative/benign homographs. Homographs were selected if the benign and negative associations were similarly frequent. Subsequently, the valence of the two possible meanings of the selected homographs was rated in a new sample of volunteers. Rating was provided using a visual analog scale, on a 100-mm horizontal line whose ends were labeled "extremely negative" and "not negative at all". The final set of 80 homographs, included homographs for which negative and benign associates were listed with similar frequency, and the selected associates for the homographs differed significantly in their valence. Non-word targets were created by changing one letter in benign unrelated words, so that each benign word produced a pronounceable non-word.

Each homograph was presented once during the task and the order of trials was randomly determined for each participant. Because few rumination-related homographs are available in Hebrew, we did not use a fully randomized design in matching homograph primes with the four types of word targets and with non-word targets. We were most interested in differential priming of the related negative and benign meanings of the homographs (for a similar approach see Taghavi, Moradi, Neshat-Doost, Yule, & Dalgleish, 2000). Therefore, each of the 20 homographs that we considered "best" (for which negative and benign associates were generated with approximately equal frequency) was randomly matched across participants to a target that was related to either the negative or the benign meaning of the prime. Each of the 20 homographs for which the frequency of negative and benign associates was less comparable, was matched with either a benign or a negative unrelated target word. Pairing was done with caution to ensure that homographs were indeed semantically unrelated to the target words. Following this matching scheme, each participant received a unique set of homograph–target pairs, with 10 pairs of each pairing type (related-negative, related-benign, unrelated-

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