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Life is . . . great! Emotional attention during instructed and uninstructed ambiguity resolution in relation to depressive symptoms

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ABSTRACT

Attention and interpretation biases are closely involved in depression. However, it is unclear whether they reflect processing tendencies (i.e., driven by schemas) and/or ability-related processes (i.e., dependent on attentional control). This study tested depressive symptom severity, attention bias, and interpretation bias associations under both processing conditions. Fifty-two participants completed two versions of the scrambled sentences test (to measure interpretation bias) while eye movements were recorded (to measure attention bias). Participants were instructed to unscramble sentences by reporting the first sentence coming to mind (tendency version) and in a fixed, positive manner (ability version). Depressive symptom severity was correlated with attention bias under both conditions. Attention bias acted as an intervening variable in the relation between depressive symptoms and interpretation bias during ability processes. These findings suggest that attention biases reflect both processing tendencies and ability dysfunctions, with attentional control as a relevant mechanism in the interpretation of emotional material.

1. Introduction

A wealth of empirical research has provided evidence for depression-related emotional biases in attention and interpretation. Whereas healthy people are biased toward positive material, depressed people allocate attention disproportionally more to negative compared with positive or neutral material (De Raedt & Koster, 2010; Peckham, McHugh, & Otto, 2010) and draw more negative than positive meanings on ambiguous information (Wisco, 2009). These biases in attention and interpretation seem closely related. Attention biases modulate encoding (Everaert, Duyck, & Koster, 2014) and retrieval (Everaert & Koster, 2015) of emotional interpretations drawn on ambiguous material. At present, however, the nature of attention and interpretation biases is not well-understood.

Some theoretical models of depression (Clark, Beck, & Alford, 1999; Ingram, 1984; Williams, Watts, MacLeod, & Mathews, 1997) assume that emotionally biased cognitive processes[1] reflect processing tendencies driven by schemas. Schemas refer to a coherent set of memory representations gravitating around beliefs about the self and others (e.g., "I am a failure"). The knowledge represented in these schemas could be recruited in automatic and goal-driven or strategic ways to guide attention allocation and interpretation while processing new emotional information. In support of this hypothesis, some studies have shown that prior learning experiences can shape attention allocation toward emotionally congruent material (Anderson, Laurent, & Yantis, 2011; Fulcher, Mathews, Mackintosh, & Law, 2001; Hickey & van Zoest, 2013; Rohner, 2004; Schmidt, Belopolsky, & Theeuwes, 2014).

Other cognitive views on depression (Hertel, 1997; Joormann, 2010; Joormann, Yoon, & Zetsche, 2007) propose that cognitive biases reflect regulatory deficits in cognitive or attentional control. Attentional control refers to a person's ability to exert top down control to focus attention on task-relevant stimuli and to inhibit attention toward task-irrelevant stimuli. Here, emotional biases in

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[1] Terms as cognitive bias, emotionally biased cognitive process, emotional bias are used interchangeably to denote the category of emotional biases in cognitive processes of which attention bias and interpretation bias are concrete examples.

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attention toward negative material would reflect deficits in cognitive control processes, such as deficient cognitive inhibition of negative material in working memory. In support of this notion, research has demonstrated such depression-related difficulties in inhibition and attentional control (De Lissnyder, Koster, Derakshan, & De Raedt, 2010; Derakshan, Salt, & Koster, 2009; Goeleven, De Raedt, Baert, & Koster, 2006; Joormann, 2004).

While schema-based and impaired cognitive control accounts of depression differ with respect to their prediction regarding the nature of emotional biases in attention and interpretation, both theoretical perspectives have received some empirical support. At present, however, a direct test comparing how tendency versus ability processes are involved in the interplay between attention and interpretation biases during elaboration on emotional material has yet to be conducted. This lingering issue motivated the current study.

1.1. This study

To illuminate the nature of attention and interpretation biases related to depression, empirical tests could be derived from defining features of tendency-driven versus ability-driven processes with respect to the malleability of the cognitive biases in attention and interpretation. If attention and interpretation biases reflect processing tendencies, then these biases could be overridden by verbal instruction and/or top-down control (Hertel, 1994). Alternatively, if these biases are related to a reduced ability to control or regulate emotion processing, than they would be less malleable via verbal instruction and thus require more sophisticated interventions to modify the processing biases (Calkins, McMorran, Siegle, & Otto, 2014; Siegle, Ghinassi, & Thase, 2007).

The present study aimed to investigate relations between depressive symptom severity, attention bias, and interpretation bias while distinguishing between processing tendency and ability processes based on assumptions regarding their malleability. We adapted a recently designed method to model attention–interpretation relations (Everaert et al., 2014) to tap into tendency and ability processes. The original study design involved the use of eye tracking (to measure attention bias) while participants performed a scrambled sentences test (to measure interpretation bias). This test requires participants to create self-referent statements using five of the six presented words (e.g., "I am a born winner" derived from the item "born I winner am loser a"). In this study, participants with varying depressive symptom levels took part in two different lab sessions in which they completed a processing tendency (session 1) or ability (session 2) version of the scrambled sentences test. In the tendency version, participants were asked to report the first unscrambled sentence that came to mind (i.e., to assess individual differences in the *tendency* to interpret ambiguous information in a negative or positive manner). In the ability version, participants were asked to unscramble all emotional sentences in a positive manner (i.e., to assess individual differences in the *ability* to draw positive meanings on ambiguous information). Modeling relations between depressive symptom severity, attention bias, and interpretation bias, several cognitive models (Ingram, 1984; Joormann et al., 2007; Williams, Watts, MacLeod, & Mathews, 1988) and prior research (Everaert et al., 2014; Everaert, Tierens, Uzieblo, & Koster, 2013) point out that depression-related biases in attention can regulate the process of interpretation. Therefore, we hypothesized that attention bias (indexed by the relative fixation time on positive versus negative words in a scrambled sentence) would mediate the relation between depressive symptom severity and interpretation bias (indexed by the number of positively versus negatively unscrambled sentences). We expected such an indirect effect for both tendency and ability processes.

2. Method

2.1. Participants

Fifty-two undergraduate students (39 women; age range: 17–27) with a broad range of Beck Depression Inventory – II (BDI-II) (Beck, Steer, & Brown, 1996; Van der Does, 2002) scores were recruited. All participants were native Dutch speakers with normal or corrected-to-normal vision. They provided informed consent and were paid 15 euro. The study was approved by the faculty review board at Ghent University.

2.2. Depressive symptom severity

The BDI-II assessed depressive symptom severity. On 21 items rated on a four-point scale, respondents indicated the extent to which they suffered from depressive symptoms in the past two weeks. This measure has good reliability and validity in both healthy and depressed samples (Beck et al., 1996; Van der Does, 2002). The internal consistency was $\alpha = .94$ in this study. At testing, a mean score of 9.85 ($SD = 9.39$; range: 0–37) was observed, with 38 individuals reporting minimal, 5 mild, 6 moderate, and 3 severe symptom levels.

2.3. Stimuli

A total set of 43 Dutch scrambled sentences (24 emotional, 19 neutral sentences) was drawn from the stimulus pool designed for a prior study (Everaert et al., 2014). All scrambled sentences were self-referent and six words long. Each emotional scrambled sentence presented one positive and one negative target word (e.g., "winner" and "loser" in "am winner born loser a I"). Target words were matched between valence categories on word length, word class, and CELEX-based word frequency using WordGen (Duyck, Desmet, Verbeke, & Brysbaert, 2004).[2] There were no differences between negative and positive target words on these lexical variables ($Fs < 1$). To control for parafoveal processing of adjoining words (Schotter et al., 2012) and wrap-up effects (i.e., differential reading times for sentence-final versus sentence-internal words; Rayner, Kambe, & Duffy, 2000), word position within each scrambled sentence was randomized with the constraint that emotional words occurred neither next to each other nor as the first or last word within a scrambled sentence. In addition, the positive word was presented before the negative word in exactly half of the emotional scrambled sentences. Criteria employed for the emotional scrambled sentences were also applied to neutral target words (e.g., "cinema" and "theatre" in "the I theater visit cinema often") in the neutral sentences.

2.4. Assessment of cognitive biases

The experimental task design was modeled after Everaert et al. (2014) who used a combination of an interpretation task (a computerized version of the Scrambled Sentences Test; SST; Wenzlaff & Bates, 1998) with online measurement of attention bias (via eye tracking).

2.4.1. The basic experimental design

Each trial of the SST started with the presentation of a fixation cross at the left side of the screen until participants fixated the point for 200 ms. The following *stimulus display* presented either a neutral or an emotional scrambled sentence. Each scrambled sentences occurred at the center of the screen on a single line in black mono-spaced lowercase Arial (font size 25 pt) against a white background. Participants were instructed to mentally unscramble the sentences to form a grammatically correct and meaningful statement using five of the six words (e.g., "I often visit the theatre" in a neutral trial; "I am a born winner", in an emotional trial), as quickly as possible. Upon completion, participants pressed a button to continue to the *response trial part*. Here, each word of the scrambled sentence was presented with a number prompting participants to report their unscrambled solution to the experimenter using the corresponding numbers (to reduce socially desirable responding). The response display was presented until response or for maximum of 8000 ms. Fig. 1 provides an example of a trial sequence.

After a 3-trial practice phase with only neutral scrambled sentences, participants started the test phase. The test phase presented 40 scrambled sentences dispersed over 5 blocks with 3 blocks of only emotional sentences and 2 blocks of only neutral scrambled sentences. The neutral blocks were always presented between emotional blocks to reduce priming effects (i.e., emotional–neutral–emotional–neutral–emotional). Each block randomly presented

[2] Word length: *M* negative words = 8.79 (*SD* negative words = 1.71), *M* positive words = 8.58 (*SD* positive words = 1.97); Word frequency (log frequency per million): *M* negative words = 1.02 (*SD* negative words = 0.47), *M* positive words = 1.04 (*SD* positive words = 0.62).