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Research paper

Specificity and overlap of attention and memory biases in depression

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ABSTRACT

Background: Attentional and memory biases are viewed as crucial cognitive processes underlying symptoms of depression. However, it is still unclear whether these two biases are uniquely related to depression or whether they show substantial overlap.

Methods: We investigated the degree of specificity and overlap of attentional and memory biases for depressotypic stimuli in relation to depression and anxiety by means of meta-analytic commonality analysis. By including four published studies, we considered a pool of 463 healthy and subclinically depressed individuals, different experimental paradigms, and different psychological measures.

Results: Memory bias is reliably and strongly related to depression and, specifically, to symptoms of negative mood, worthlessness, feelings of failure, and pessimism. Memory bias for negative information was minimally related to anxiety. Moreover, neither attentional bias nor the overlap between attentional and memory biases were significantly related to depression.

Limitations: Limitations include cross-sectional nature of the study.

Conclusions: Our study showed that, across different paradigms and psychological measures, memory bias (and not attentional bias) represents a primary mechanism in depression.

1. Introduction

Depression is a common mental disorder with substantial individual and societal burden (Cuijpers et al., 2012; Gustavsson et al., 2011), including reduced well-being, impaired global functioning, and increased mortality (Lépine and Briley, 2011). These issues are not limited to depressed patients, but are often present to a lesser extent in individuals with mild depressive symptoms who do not meet full criteria for major depression (Cuijpers et al., 2014). In fact, studies show that subclinical depression is not only highly prevalent (Cuijpers et al., 2004), but also characterized by significant psychosocial disability (Judd et al., 2000) and higher risk of future major depression (Cuijpers and Smit, 2004). Therefore, investigating the structure of the depressotypic characteristics during the subclinical phase is of paramount importance to understand depression and, potentially, prevent the development of its clinical form (Munoz et al., 2012; Munoz and Bunge, 2016).

In an attempt to gain insight into the network of depressotypic characteristics, an extensive body of research has focused on emotional biases in basic cognitive processes, also known as *cognitive biases* (Gotlib and Joormann, 2010). Cognitive biases refer to a tendency to process emotional information so as to favor certain types of emotional valence or meaning (Mathews and MacLeod, 2005). In the context of depression, these biases primarily include increased processing of negative information at the expense of neutral and positive information (Gotlib and Joormann, 2010; Winer and Salem, 2016). That is, whereas asymptomatic individuals show a preference for positive stimuli (Pool et al., 2016), subclinically depressed individuals have been shown to allocate more attention to negative stimuli (Koster et al., 2005) and recall more negative memories (Hertel, 1998). Importantly, research shows that attention and memory biases predict the course of depressive symptoms over time (Disner et al., 2017; Everaert et al., 2015; Goldstein et al., 2015; Johnson et al., 2007; Osinsky et al., 2012). Therefore, cognitive biases can be considered as risk factors for symptoms of depression (Kraemer et al., 2001).

One important limitation that characterizes most previous research is that basic processes, such as attention and memory biases, were considered in isolation. Typically, studies have examined the association of depressive symptoms with *one single bias* at a time (Gotlib and Joormann, 2010; Mathews and MacLeod, 2005). On the contrary,

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investigators are increasingly arguing that cognitive biases function in concert to detrimentally impact emotional well-being and lead to full-blown depression (Beck and Bredemeier, 2016; Everaert et al., 2012). As such, studies need to examine *multiple cognitive biases* in order to scrutinize their *unique* as well as *common* association with depressive symptoms. By doing so, it would be possible to cast new light on how biased information-processing mechanisms, either individually or in combination, influence depressive symptoms.

Research on the interplay among attentional bias, memory bias, and depressive symptoms in subclinical samples has so far yielded interesting but mixed findings. On the one hand, studies show that across different methods attentional and memory biases are correlated with depressive symptoms with variable magnitude, ranging from negligible to moderate (De Voogd et al., 2014; Everaert et al., 2014, 2013; Platt et al., 2015; Reid et al., 2006; Sanchez et al., 2015). On the other hand, although previous research provided some indications that attentional bias may predict subsequent memory bias (Ellis et al., 2011; Koster et al., 2010), a fine-grained examination of how these two cognitive biases are simultaneously related to depression severity has yet to be conducted.

For all these reasons, it is timely to examine the unique and common contributions (i.e., the association structure) of these biases that are putatively important to the severity of depression (Cumming, 2012; Everaert et al., 2012; Kraemer et al., 2001). Several scenarios are possible. For example, if attentional bias and memory bias are highly correlated (i.e., multicollinearity), then most of the variance explained in depressive symptoms by one bias would interchangeably be explained by the other bias (i.e., *overlap* or the area represented as 'C' in Fig. 1). Alternatively, if the association between these two biases is weak or modest then one would expect that different biases mostly have unique associations with depressive symptoms (*specificity* or the areas represented as 'U1' and 'U2' in Fig. 1). It is worth mentioning that by closely investigating the association structure, it is possible to detect effects that would otherwise go undetected with standard analytic approaches (i.e., zero-order correlations and regression beta weights), such as suppression (Friedman and Wall, 2005; Kraha et al., 2012). Therefore, the first goal of this study is to quantify the association structure (i.e., unique and common partitions) of attentional bias and memory bias with respect to subclinical depression.

Attentional bias and memory bias are likely to play an important role in disorders other than depression. In fact, not only is depression often comorbid with anxiety (Borsboom et al., 2011; Crawford and Henry, 2003), but also these two phenomena share partially similar underlying processes, such as negative affectivity (Mineka et al., 1998). In keeping with this, the Research Domain Criteria of the National Institute of Mental Health (RDoC; Insel et al., 2010) frames attentional bias and memory bias as components of the psychobiological systems responsible for negative affect and characterizing both depression and anxiety (Negative Valence Systems; Sanislow et al., 2010). Therefore, our second goal is to quantify the degree of specificity and overlap of attentional bias and memory bias for negative stimuli in relation to anxiety symptoms, as compared to depressive symptoms.

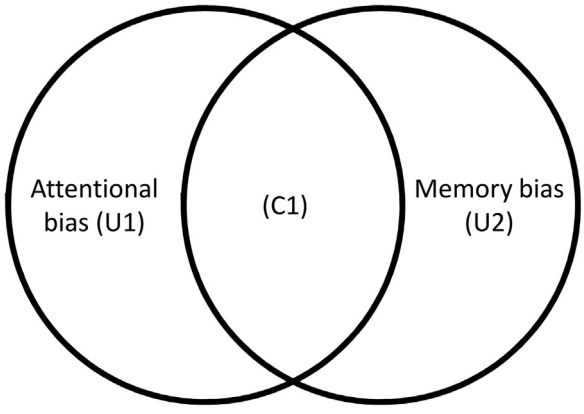

Fig. 1. Commonality analysis with attentional bias and memory bias used as predictors and either depressive symptoms or anxiety symptoms as outcome. U1 and U2: variance explained uniquely (i.e., *specificity*) by attentional bias (U1) and memory bias (U2), respectively. C1: variance explained interchangeably (i.e., *overlap*) by attentional bias or memory bias.

Third, recent research stresses the heterogeneity of the depressive syndrome (Fried and Nesse, 2015), by showing that individual depressive symptoms vary on their genetic (Myung et al., 2012) or etiological (Fried et al., 2014) background and their impact on psychosocial functioning (Fried and Nesse, 2014). Moreover, Marchetti et al. (2016) showed that major cognitive risk factors for depression (e.g., dysfunctional attitudes, rumination, and hopelessness) are differently related to depressive symptoms. Hence, in order to explore the scenario by which cognitive biases may be distinctively associated with individual depressive symptoms, we investigate the association structure of attentional and memory bias with each single depressive symptom. By doing so, we are able to detect links between biases and symptoms that would otherwise be unexplained when dealing with total scores.

With these three goals in mind, we analyzed four previously collected datasets, consisting of both student and community samples. In order to fully capture the depressive spectrum, we made sure that our samples showed substantial variability in depressive and anxiety symptoms (Haslam et al., 2012). In all four datasets, standard paradigms for attentional bias (e.g., spatial cueing task, dot-probe task, and eye movements for emotional words) and memory bias (i.e., retrieval of emotional sentences and retrieval of emotional self-attributed adjectives) were used, along with measures of depressive symptoms and anxiety symptoms. Importantly, the attentional and memory biases were considered with respect to depression-congruent material, such as stimuli featuring themes of sadness, loss, self-worthlessness, etc. (Peckham et al., 2010). Next, we analyzed the association structure (i.e., specificity and overlap) for each single study, with attentional and memory bias entered as predictors and either depression severity or anxiety severity serving as outcome. Then, in line with recent statistical guidelines promoting meta-analytic thinking (Cumming, 2012), we ran a fixed-effect meta-analytic commonality analysis for every tested model so as to obtain method/sample-independent results. Finally, we investigated the association structure of cognitive biases with each single depressive symptom.

2. Methods

The present research presents data from four independent studies: Study #1 (Everaert et al., 2013), Study #2 (Everaert et al., 2014), Study #3 (Everaert et al., 2017), and Study #4 (Pearson et al., 2016).

2.1. Participants

Study #1 included 64 undergraduate students (mean age: 19.79 ± 4.52, range: 17–48, 88.52% female). Study #2 included 70 undergraduate students (mean age: 20.31 ± 2.73, range: 17–33, 87.32% female; from the original 71 participants, 1 was excluded due to missing data on the memory bias task). Study #3 included 109 undergraduates (mean age: 21.65, 84.82% female; from the original 112 participants, 3 participants were excluded due to missing data on the memory bias task). Students in these three studies were from Ghent University (Belgium). In Study #4, 220 individuals from the community of Austin, TX (US) were recruited (mean age: 25.05 ± 4.3, range: 18–35, 58.18% female; 61.36% were Caucasian, 20% Asian, 4.55% African American, 8.09% multiracial, and 6% did not endorse race) and were assessed with Mini-International Neuropsychiatric Interview (Sheehan et al., 1998) to determine the absence of any current Axis I disorders.