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Double attention bias for positive and negative emotional faces in clinical depression: Evidence from an eye-tracking study

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ABSTRACT

Background and objectives: According to cognitive models, attentional biases in depression play key roles in the onset and subsequent maintenance of the disorder. The present study examines the processing of emotional facial expressions (happy, angry, and sad) in depressed and non-depressed adults.
Methods: Sixteen unmedicated patients with Major Depressive Disorder (MDD) and 34 never-depressed controls (ND) completed an eye-tracking task to assess different components of visual attention (orienting attention and maintenance of attention) in the processing of emotional faces.
Results: Compared to ND, participants with MDD showed a negative attentional bias in attentional maintenance indices (i.e. first fixation duration and total fixation time) for sad faces. This attentional bias was positively associated with the severity of depressive symptoms. Furthermore, the MDD group spent a marginally less amount of time viewing happy faces compared with the ND group. No differences were found between the groups with respect to angry faces and orienting attention indices.
Limitations: The current study is limited by its cross-sectional design.
Conclusions: These results support the notion that attentional biases in depression are specific to depression-related information and that they operate in later stages in the deployment of attention.

1. Introduction

According to cognitive models (Beck, 1967, 1976; Bower, 1981), biases in the processing of emotional information have a crucial role in the onset and maintenance of depressive symptoms. These theories predict that depressed individuals can be characterized as displaying negative biases in all aspects of information processing, including interpretation, memory, and attention.

Depressed individuals have been found to have attentional biases in some cognitive reaction-time tasks; however, evidence for this negative bias is mixed (Mogg & Bradley, 2005). In the emotional Stroop color-naming task, researchers have observed an increase in the interference by negative words in individuals with depression. However, this interference was only found in conditions when relatively long stimuli exposure durations of 1 s or more were used (Gotlib & Cane, 1987; Segal, Gemar, Truchon, Guirguis, & Horowitz, 1995). Studies in which words were presented for shorter durations have typically obtained null findings (Bradley, Mogg, Millar, & White, 1995; Mogg, Bradley, Williams, & Mathews, 1993). Similar results have been found with the dot-probe task. For example, Donaldson, Lam, and Mathews (2007) presented 72 pairs of words (36 words each at 500 ms and 1000 ms durations) to a sample of depressed patients. They found that individuals with clinical depression were faster than non-depressed controls in detecting dot-probes that appeared in the same location as a negative word when it was presented for 1000 ms. Both groups were observed to equally attend to stimuli presented for 500 ms durations. Given this pattern of findings, some authors have suggested that depression is characterized by elaborative, rather than automatic processing, in contrast to anxiety disorders (Mogg & Bradley, 2005). According to this notion, Teachman, Joormann, Steinman, and Gotlib (2012) have concluded that attentional biases in depression are conscious and intentional, while those observed in anxiety disorders are unconscious and unintentional. In accordance with this view, other researchers have proposed that depressed individuals may not necessarily be quicker at directing their attention to negative information than control participants, but that once negative stimuli capture their attention they experience difficulties disengaging their focus (Gotlib & Joormann, 2010). Unfortunately, the reaction time tasks used in these studies are not able to directly assess whether the attentional

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biases in depression are located in the orienting components presumed to be more automatic or the maintenance components presumed to be more elaborative.

In addition to the duration of stimulus presentation, studies that used more ecological stimuli such as images or scenes instead of words were more likely to find a negative attentional bias in depression. This phenomenon has been attributed to the fact that, in general, pictures are able to convey more affective information than words (Glaser & Glaser, 1989). The majority of studies have used images of emotional facial expressions. Gotlib, Kasch, et al. (2004) found that, compared to healthy individuals, clinically depressed participants showed an attentional bias to sad faces. Similar results have been obtained in other studies using facial expressions (Fritzsche et al., 2010; Gotlib, Krasnoperova, Neubauer, & Joormann, 2004; Joormann & Gotlib, 2007). It is also important to note that, with some exceptions (Leyman, De Raedt, Schacht, & Koster, 2007; Sánchez, Vázquez, Marker, Lemoult, & Joormann, 2013), this negative attentional bias in depression tends to be specific to depression-related information and not to other types of negative stimuli, such as threatening cues (Gotlib, Kasch, et al., 2004; Gotlib, Krasnoperova, et al., 2004; Hankin, Gibb, Abela, & Flory, 2010). Oehlberg, Revelle, and Mineka (2012) recently demonstrated that attentional biases to dysphoric information appeared to only relate to depressive symptoms, while biases to anxiety-related information were associated with overall negative affect.

Additionally to greater attentional processing of negative stimuli, some studies have shown the absence of a "protective bias" in depressed participants. This bias is characterized by an attentional preference for positive information and is typically present in non-depressed individuals (McCabe & Gotlib, 1995; Shane & Peterson, 2007). The absence of a protective bias has been interpreted as evidence of insensitivity to reward, such that rewarding stimuli fail to capture attention (Armstrong & Olatunji, 2012). Reduced attention to positive stimuli could be related to deficits in positive affect, a factor that appears specific to depressive disorders (Clark & Watson, 1991; Watson & Naragon-Gainey, 2010).

The majority of studies that have already been discussed used response latency tasks, which assess attentional bias indirectly and do not differentiate between the different components of attention (e.g. orienting attention versus maintenance of attention; Yiend & Mathews, 2005). Moreover, they do not account for the possibility that attentional biases may be confounded by motor retardation in depressed individuals (Mathews, Ridgeway, & Williamson, 1996). To overcome these limitations, researchers interested in selective attention processes have turned to eye movement recording tasks because they provide a relatively continuous and direct measure of deployment of attention. The recent meta-analysis conducted by Armstrong and Olatunji (2012) reviews the existing eye-tracking research on depression and anxiety. In their review they included nine eye-tracking studies with depressed participants but only two of them were conducted with clinical samples. Results from these studies have revealed that analogue participants maintain longer gazes with negative stimuli (Caseras, Garner, Bradley, & Mogg, 2007; Leyman, De Raedt, Vaeyens, & Phillipaerts, 2011) and shorter gazes with positive ones (Ellis, Beevers, & Wells, 2011; Sears, Thomas, LeHuquet, & Johnson, 2010) compared with control participants. However, orienting biases to negative information have yet to be found, except by Sears, Newman, Ference, and Thomas (2011) who found a bias in the initial orientation to depression-related images.

Regarding the studies conducted with clinically depressed participants, the results are not conclusive because the two existing studies use very different experimental methodologies. Kellough, Beevers, Ellis, and Wells (2008) designed a 2 × 2 matrix with dysphoric, aversive, positive, and neutral images. These authors found that depressed participants spent more time viewing dysphoric images relative to positive, aversive, and neutral ones in comparison to healthy controls. No orienting biases to negative information were found. On the other hand, Mogg, Millar, and Bradley (2000) designed an attentional task with pairs of images comprising an emotional and a neutral facial expression that were displayed for a relatively short period (i.e., 1000 ms). In this study, orienting components of attention were assessed (i.e., initial orientation and latency for the first orientation), but maintenance components were not. The data revealed that clinically depressed patients did not show orienting biases to negative information.

Despite these initial findings, further research using eye-tracking technology is necessary to clarify the role of attentional biases in depression. To better elucidate the mechanisms underlying attentional biases in depression, our study improved several methodological domains found in current literature. Firstly, our research builds upon existing literature by including participants with clinical depression rather than analogue samples. Secondly, unlike in earlier studies, we included in the same design orienting and maintenance measures to assess both components of attentional biases simultaneously. Another improvement of our study over previous research is that we included two different parameters to assess orienting and maintenance components. More specifically, we assessed orienting response by direction and latency of initial gaze, similar to Mogg et al. (2000), whereas we measured maintenance response by duration of the first fixation and total fixation time (see procedure below). Also, to enhance the detection of maintenance components (Gotlib & Joormann, 2010) we used a relatively long exposure time for the stimuli (i.e., 3000 ms). Therefore, the current study was designed to assess the different components of visual attention in depressed and non-depressed participants when presented with negative, positive, and neutral facial expressions in a free viewing paradigm. The advantage of using emotional faces is that they are more likely to be ecologically valid than words (Gross, 2005) and are better at attracting attention due to their higher interpersonal relevance. Based on previous studies of eye movement (Eizenman et al., 2003; Kellough et al., 2008) and reaction time tasks (Gotlib, Kasch, et al., 2004; Gotlib, Krasnoperova, et al., 2004), we hypothesized that depressed participants would show a negative bias in the maintenance of gaze specifically with regards to sad facial expressions (i.e. duration of the first fixation and total fixation time) but not in the orientation of gaze (i.e. direction and latency of initial gaze). With respect to happy expressions, our second hypothesis was that the depressed group would show an absence of positive bias in comparison with the control group in the maintenance of gaze indices (Ellis et al., 2011). Finally, in accordance with Oehlberg et al. (2012), we hypothesized that the severity of depression would be related specifically to the magnitude of attentional biases to sad facial expressions but not angry ones.

2. Method

2.1. Participants

A sample of 16 participants diagnosed with current MDD and 34 never-depressed controls (ND) took part in the study. Depressed patients were recruited from an outpatient university psychology clinic before therapy had begun. Trained interviewers administered the Structured Clinical Interview for the DSM–IV (SCID; First, Spitzer, Gibbon, & Williams, 1996) to patients during their first session in the study and those with a primary diagnosis of MDD were included in the depressed group. Individuals with current or lifetime diagnosis of Bipolar Disorder, psychotic symptoms, and