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Attentional capture by emotional scenes across episodes in bipolar disorder: Evidence from a free-viewing task

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ABSTRACT

We examined whether the initial orienting, subsequent engagement, and overall allocation of attention are determined exogenously (i.e. by the affective valence of the stimulus) or endogenously (i.e. by the participant's mood) in the manic, depressive and euthymic episodes of bipolar disorder (BD). Participants were asked to compare the affective valence of two pictures (happy/threatening/neutral [emotional] vs. neutral [control]) while their eye movements were recorded in a free-viewing task. Results revealed that the initial orienting was exogenously captured by emotional images relative to control images. Importantly, engagement and overall allocation were endogenously captured by threatening images relative to neutral images in BD patients, regardless of their episode—this effect did not occur in a group of healthy controls. The threat-related bias in BD, which occurs even at the early stages of information processing (i.e. attentional engagement), may reflect a vulnerability marker.

1. Introduction

Bipolar disorder (BD) can be characterised by successive episodes of mania, euthymia (i.e. lack of symptoms) and frequently depression that entail an impaired emotional processing which is persistent even during symptomless states (Leyman, De Raedt, & Koster, 2009). It has been suggested that cognitive biases towards emotionally/socially relevant stimuli in BD patients may affect the onset and maintenance of illness, as well as their psychosocial functioning (Green, Cahill, & Malhi, 2007). Indeed, attentional orienting towards emotional information is one of the main cognitive functions that are biased in individuals with severe mood dysregulation (Rich et al., 2007). Investigations on attention-orienting biases may provide important insights into the psychological vulnerability in BD patients. In the present experiment, BD patients in their different episodes (mania, euthymia, depression) were asked to attend to emotional images (i.e. happy, threatening, neutral) in a free-viewing task while the participants' eye movements were recorded.

To examine the relation between different subprocesses of attentional orienting (engagement, disengagement, and attentional allocation; see Posner & Petersen, 1990) and mood state in BD patients, most previous research has employed behavioural paradigms. To examine the effect of emotional information on attentional orienting, double- or simple-cueing tasks have frequently been employed. In the double-cueing tasks, BD patients showed an attentional bias away from positive words in their depressive episode relative to healthy controls (Jabben et al., 2012), while the bias towards threatening faces was correlated with manic symptoms in BD children (Brotman et al., 2007). Importantly, the simple-cueing task (Posner, Snyder, & Davidson, 1980) allows disentangling attentional engagement from attentional disengagement. In this task, both depressed and hypomanic BD patients exhibit greater attentional engagement towards threatening faces than healthy individuals (see Leyman et al., 2009; Putman, Saevarsson & Van Honk, 2007). In addition, Leyman et al. (2009) found that depressed BD patients had more difficulties disengaging their attention away from threatening and happy faces relative to healthy individuals. Taken together, these behavioural experiments reveal that biases in attentional orientation are associated with affective symptomatology of manic (Brotman et al., 2007; Putman et al., 2007) and depressed episodes (Jabben et al., 2012; Leyman et al., 2009) in BD patients.

At a theoretical level, Mansell, Morrison, Reid, Lowens, and Tai (2007) suggested that melancholic symptoms such as the lack of motivation towards positive stimuli could explain the 'anhedonic bias' in bipolar depression, while the conflicting positive and negative appraisals in mania could account for the absence of clear trend

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towards sad stimuli. Additionally, the presence of an attentional bias towards threatening stimuli is consistent with recent theoretical proposals that emphasise the distinctive features of BD relative to other affective disorders (Mansell et al., 2007). In particular, Mansell et al. (2007) indicated that (i) BD patients usually manifests more psychotic and paranoid features—therefore, threatening information could be emotionally relevant; and (ii) BD patients are not only characterised by a ruminative cognitive style, but also by impulsivity and vigilance abnormality—therefore, they could show both an increased sustained attention (i.e. overall attentional allocation) and an earlier hypervigilance (i.e. attentional engagement) towards mood-relevant information.

Although behavioural experiments offer useful information on underlying affective/cognitive processes, there is an inherent limitation in the main dependent variable: In each trial, response times provide one data time at the end of processing (i.e. response times do not inform us about the time course of the underlying attentional processes). The recording of the participants' eye movements can be considered a useful tool to assess attentional orienting to simultaneous visual stimuli that compete for the observer's attention (Hermans, Vansteenwegen, & Eelen, 1999). Eye movements are related to attentional processes during visual tasks because shifts in gaze position are guided by shifts in attentional focus (see Rayner, 2009, for review). Particularly, eye-tracking methodology is ideally suited for measuring the following: (i) temporal and spatial parameters of initial orienting by the latency and duration, and the location of an initial fixation, respectively; and (ii) the subsequent orientation processes, which are reflected in the fixation sequences (where one looks) and in the fixation duration (for how long one looks), offering an online measure of emotional processing. To the best of our knowledge, only two published studies have monitored the participants' eye movements to examine the emotional processing in BD patients across their different episodes (García-Blanco, Perea, & Salmerón, 2013; García-Blanco, Salmerón, Perea, & Livianos, 2014).

In the García-Blanco et al. (2013) experiment, participants were presented with prosaccade blocks which required an automatic orientation response (i.e. facilitating the initial orienting toward a peripheral stimulus), and participants were also presented with antisaccade blocks which involved a controlled inhibition of orientation response (i.e. inhibiting the automatic prosaccade toward a target and voluntarily generating an antisaccade to the mirror position; see Mueller et al., 2010, for review). They found that patients in their manic episodes committed more antisaccade errors in response to happy faces, while patients in their depressive episodes tended to have more antisaccade errors with sad faces. Furthermore, prosaccade latency was only affected by the valence of stimulus (i.e. latencies for happy faces were faster than for sad faces). One possible explanation for the absence of mood effect on initial orienting could be that prosaccades reflect an automatic orientation response that is mainly influenced by bottom-up processes (i.e. stimulus-driven attention) rather than top-down processes (i.e. the participant's mood; see Yiend, 2010).

In another recent experiment, García-Blanco et al. (2014) employed a free-viewing task to examine the initial orienting (by the location of the initial fixation), the subsequent engagement (by the mean of first-pass fixations), and the overall allocation of attention (as measured by the total fixations). BD patients were required to scan/re-scan four images (happy, sad, threat and neutral) presented simultaneously for 20 s. The initial orienting and the attentional engagement were not affected by participants' mood but only by the emotional image (participants' initial orienting were directed more toward happy images than toward the other types of images). However, the overall allocation of attention toward mood-relevant images in BD patients was mood-dependent. Particularly, BD patients (regardless of their episode) showed an increase in attention to threatening images relative to the healthy controls, while BD patients in their depressive episode showed a decrease in attention to happy images compared to healthy individuals.

Thus, the existing eye-tracking literature has reported that: (i) the initial orientation is stimulus-dependent (see García-Blanco et al., 2013, as evidenced by the prosaccade task; and García-Blanco et al., 2014, as evidenced by the location of the initial fixation in a free-viewing task); (ii) the attentional engagement is also stimulus-dependent (see García-Blanco et al., 2014, as evidenced by the mean duration of first-pass fixations); and (ii) the overall attentional allocation is mood-dependent (see García-Blanco et al., 2014, as indicated by the total number of fixations). That is, similar to behavioural paradigms (Jabben et al., 2012; Leyman et al., 2009), there is an attentional bias away from happy stimuli in BD depression (García-Blanco et al., 2014). And last, but not least, an attentional bias towards threatening stimuli has been found in BD even in asymptomatic states (García-Blanco et al., 2014).

In the present experiment, we employed a free-viewing task similar to that of Nummenmaa, Hyönä, and Calvo (2006), in which a target scene (threatening, happy or neutral) was presented simultaneously with a neutral control scene. In this task, participants were instructed to compare the emotional content of the scenes; this guaranteed that each image was inspected at least once. Importantly, the present experiment allowed us to examine in detail the effects of several emotional stimuli (happy or threatening) on the different components of attentional orienting (initial/engagement/overall allocation) in BD patients depending on their different states (i.e. mania, depression and euthymia). What we should note here is that the above-cited eye-tracking experiments suffered from two limitations at assessing the emotional bias in attentional orienting. First, the prosaccade task used by García-Blanco et al. (2013) only offered an indicator (in terms of errors and latency) of initial orienting, but not of other orientation components (i.e. subsequent engagement of attentional focus). Second, in the simultaneous free-viewing task (García-Blanco et al., 2014), the concurrent presentation of multiple emotional stimuli on each trial reduced the independent effects of each type of stimuli, and this could have contributed to the lack of an overall mood effect–in the current experiment there are only two images on each trial, a neutral [control] image and an emotional image (positive, negative, or threatening).

The predictions are as follows. First, according to Yiend (2010), the initial fixation would be influenced by the stimuli's valence but not by the patients' mood. The rationale is that automatic processes (such as initial orienting) seem to be mostly affected by bottom-up processes. Therefore, higher and faster initial fixations on happy images were expected because their content could be more effective in capturing initial attention than other content (see García-Blanco et al., 2013, 2014). Second, according to Mansell et al. (2007), threatening images would be more attended to by BD patients in terms of engagement and attentional allocation. The idea here is that psychotic symptoms and both hypervigilance and rumination are inherent features of BD. Thus, higher and longer fixations were expected on threatening images in BD patients in their depressive, manic and euthymic state (see Leyman et al., 2009, for BD patients in their depressive episode; see Putman et al., 2007, for individuals with hypomanic traits; and see García-Blanco et al., 2014, for BD patients, regardless their episode). Finally, given that anhedonic symptoms and conflicting positive and negative appraisals are characteristic of bipolar depression and mania, respectively (see Mansell et al., 2007), happy images would be less attended to by depressed BD patients and more attended to by manic BD patients. Thus, lower and shorter fixations were expected on happy images in BD patients in their depressive episode (see