Biological Psychology 80 (2009) 251–255

Contents lists available at ScienceDirect

Biological Psychology

journal homepage: www.elsevier.com/locate/biopsycho

Brief report

Attentional control in dysphoria: An investigation using the antisaccade task

Nazanin Derakshan [a,*], Maureen Salt [a], Ernst H.W. Koster [b]

[a] School of Psychology, Birkbeck University of London, UK
[b] Ghent University, Belgium

ARTICLE INFO

Article history:
Received 1 June 2008
Accepted 19 September 2008
Available online 2 October 2008

Keywords:
Dysphoria
Antisaccade
Attentional control
Emotional faces

ABSTRACT

We examined inhibitory mechanisms in dysphoria using direct measures of attentional control. Dysphoric and non-dysphoric participants performed standard and delayed versions of the antisaccade and prosaccade tasks with facial expressions as stimuli. Results showed higher error rates in the standard antisaccade task than in the delayed tasks, with the dysphoric group having higher error rates in response to emotional facial expressions, in particular happy expressions. Our findings indicate impaired attentional processing in response to emotional facial expressions, in particular happy expressions, in dysphoria. Implications for understanding the mechanisms underlying attentional control in dysphoria are discussed.

1. Introduction

Cognitive models of depression postulate that biased processing of emotional information plays an important role in the aetiology and maintenance of depressive symptoms (Teasdale and Barnard, 1993; Williams et al., 1997). Recently, it has been argued that deficient inhibition of emotional information may underlie the hallmark feature of depression, i.e., sustained negative affect, through its association with rumination and impaired mood regulation (Joormann et al., 2007). In some paradigms (e.g., negative affective priming, modified Sternberg task) although large overall inhibition impairments were not found, depressed individuals showed marked inhibitory deficiencies when processing negative material (Goeleven et al., 2006; Joormann and Gotlib, 2008).

In most of these tasks, however, the main dependent variable is reaction time which does not provide a direct measure of attentional processes and is susceptible to alternative explanations. The measurement of eye-movements in visual attentional processing is becoming increasingly important (see Weierich et al., 2008, for a review). Eye-movements have the advantage of being distinguishable in terms of their temporal and spatial characteristics thus providing increased precision in understanding the mechanisms of visual attentional processing. Caseras et al. (2007) measured eye-movements in dysphoric and non-dysphoric groups for negative and positive scenes that were paired with control (neutral) pictures. While the two groups did not differ in terms of orienting towards emotional pictures, relative to control pictures, the dysphorics had longer gaze durations on the negative pictures, indicating sustained attention for negative material. Thus eye-movements provided information on temporal characteristics of attentional processing that would not be obtainable through reaction times alone.

Saccadic eye movement tasks can provide us with a precise assessment of some aspects of top-down cognitive control processes that influence attention allocation (Munoz and Everling, 2004; Ridderinkhof et al., 2004). In relation to attentional control, the antisaccade task (Hallet, 1978) offers a promising way forward. In this task participants are required to inhibit the reflexive tendency to look towards a sudden-onset cue, presented peripherally to one side of fixation, and generate a correct saccade to its mirror position as quickly as possible. Antisaccade performance involves competition between the reflexive saccade and voluntary initiation of the antisaccade, with errors occurring when activation in neural systems underlying the antisaccade cannot successfully compete with the prosaccade reflex (Massen, 2004; see Hutton and Ettinger, 2006, for a review). Recent work has used the antisaccade task to examine inhibitory control in anxiety (Derakshan et al., in press; Ansari et al., 2008; Hardin et al., 2007; Jazbec et al., 2006). There is also evidence from the antisaccade task on attentional control in depression (e.g., Sweeney et al., 1998; Jazbec et al.,

* Corresponding author at: Affective and Cognitive Neuroscience Lab, School of Psychology, Birkbeck University of London, Malet Street, London WC1E 7HX, UK. Tel.: +44 7968173484.
E-mail address: n.derakhshan@bbk.ac.uk (N. Derakshan).

0301-0511/$ – see front matter. Crown Copyright © 2008 Published by Elsevier B.V. All rights reserved.
doi:10.1016/j.biopsycho.2008.09.005

2005). Sweeney et al. (1998) found that depressed participants made more reflexive errors in the antisaccade condition when the abrupt stimulus was an oval-shaped cue (for similar results see Jazbec et al., 2005).

The neural structures involved in antisaccade performance show interesting overlap with the neural impairments observed in depression. Recent neuroimaging findings suggest the major involvement of prefrontal brain areas such as the dorsolateral prefrontal cortex (DLPFC) implicated in attentional control using the antisaccade task (Ettinger et al., 2008). Such areas are considered to have substantial involvements in the top-down regulation of emotional processing in anxiety and depression (Davidson et al., 2002; Bishop, 2007). We aimed to examine inhibition in relation to negative and positive emotional information, since depression has been associated both with enhanced attention and impaired inhibition for negative material (see Joormann et al., 2007) and reduced attention and processing deficiencies for positive information (e.g., Cavanagh and Geisler, 2006).

To our knowledge, the present antisaccade study is the first to examine inhibitory control in relation to depression using facial expressions of emotion as stimuli. Using the standard anti- and prosaccade tasks (SA; SP) with stimuli comprising angry, happy and neutral facial expressions, we investigated the effects of subclinical depression (dysphoria) on attentional control processes. As this is the first study to investigate antisaccade performance in response to facial expressions of emotion a dysphoric sample was chosen to minimise possible impairments in antisaccade performance attributable to some cognitive deficits typically observed in clinically depressed individuals. We hypothesised that dysphorics, compared to non-dysphorics, would show impaired performance when the to-be-inhibited stimuli are emotional expressions and this would be evident in the standard antisaccade task where top-down attentional control is needed for the effective inhibition of reflexive prosaccades towards the emotional face. Impaired antisaccade performance can reflect deficits in inhibitory control *and* volitional saccade generation (Reuter et al., 2007). To allow investigation of both processes, in addition to the standard tasks we also administered delayed versions of the anti- and prosaccade tasks (DA; DP) (cf. Reuter et al., 2007). In delayed tasks the demand to inhibit an erroneous prosaccade is not simultaneous with the requirement to generate a volitional saccade. The isolation of the initiation of a volitional response means that the generation of the saccade takes place during the delay period, reducing the competition between stimulus-driven and top-down processes required for the inhibition of the prosaccade. We hypothesised that dysphoria would be associated with impaired inhibition but not impaired volitional saccade generation.

2. Method

2.1. Participants

Participants were fifty-nine volunteers (42 female) from the University of London (for group characteristics see Section 3). They had normal or corrected to normal vision (wearing glasses or contact lenses when necessary) and normal hearing. Participants were not paid for their contribution to the experiment. Participants were treated in accordance with Birkbeck's ethical code of conduct. Upon arriving at the laboratory and reading the relevant instruction sheet they signed a consent form and were given the opportunity to leave the experiment at any point without explanation. Upon completion of the experiment they were fully debriefed.

2.2. Materials and procedure

2.2.1. Self-report measure

The Beck Depression Inventory-II (BDI-II) (Beck et al., 1996) was used to classify participants as dysphoric or non-dysphoric. This questionnaire consists of 21 items related to the occurrence of depressive symptoms over the past two weeks. Scores range from 0 to 63 with higher scores indicating higher depression severity. We followed the cut-off scores for dysphoria proposed by Beck et al. (1996; 14–19 mild, 20–28 moderate, and >29 severe) to classify participants.

2.2.2. Visual stimuli

18 faces (half female) depicting angry, happy and neutral facial expressions (6 of each valence) were taken from the Pictures of Facial Affect (Ekman and Friesen, 1976) and the NimStim Face Stimulus Set (Tottenham et al., 2002). Non-facial features were removed and faces were resized to 45 mm $\times$ 70 mm ($4.3^\circ \times 6.7^\circ$) and presented in grayscale against a black background.

The experiment involved four blocks (SA, SP, DA, DP) each comprising 90 trials, totalling 360 trials. Each block of 90 trials included 30 angry, 30 happy, and 30 neutral trials. For each of the angry, happy, and neutral facial expressions 6 faces were shown and each face was repeated 5 times per valence. The order of standard (A) and delayed (B) tasks was counterbalanced in an AB-BA design. The order of antisaccade and prosaccade tasks was counterbalanced within each of the standard and delayed tasks, with half of the participants randomly assigned to order of set SA, SP, DP, DA or set SP, SA, DA, DP and the other half to DA, DP, SP, SA, and DP, DA, SA, SP tasks. This ensured that the presentation of standard/delayed as well as anti- and prosaccade tasks was counterbalanced. A complete randomisation of tasks was not done in order to avoid large error variance due to very different temporal characteristics of the tasks. The inter-trial interval varied between 700 ms and 1300 ms.

Each trial began with a central fixation cross ($1.15^\circ \times 1.15^\circ$) for 1600 ms. A face then appeared with equal probability to the left or right side of the cross at 11° (800 ms). A 440 Hz tone was presented (50 ms) simultaneously with, (on SA and SP trials) or 800 ms after, (on DA and DP trials) presentation of the face. Participants fixated the cross, then as soon as the face appeared, directed their gaze as quickly as possible away from the face, to its mirror position on the screen (SA) or towards the face (SP). In delayed tasks participants continued fixation and made an antisaccade (DA) or prosaccade (DP) when the tone sounded (Fig. 1a and b).

2.3. Eye-tracking

Eye-movements were tracked using the LC Technologies "Eyegaze" system (LC Technologies, 2003), which uses the Pupil-Centre Corneal Reflection method (PCCR; Mason, 1969; Merchant and Morrisette, 1973). The gaze-point position is estimated at 60 Hz, with a typical root mean square error of less than 6.35 mm. Eye-movements were extracted using the R programming environment (Venables and Smith, 2005). Visual stimuli were presented on a 17 in. LCD (refresh rate of 16.6 ms) controlled by the DMDX programme (Forster and Forster, 2003), which ensures millisecond timing accuracy.

2.4. Procedure

Participants were tested individually in a dimly lit room. Half completed the BDI-II before completing the task and half afterwards (with a distractor task in between to control for possible confounding effects). As questionnaires may prime a mood state that subsequently influences antisaccade performance, this