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Research report

Intact anger recognition in depression despite aberrant visual facial information usage

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ABSTRACT

Background: Previous literature has indicated abnormalities in facial emotion recognition abilities, as well as deficits in basic visual processes in major depression. However, the literature is unclear on a number of important factors including whether or not these abnormalities represent deficient or enhanced emotion recognition abilities compared to control populations, and the degree to which basic visual deficits might impact this process.

Methods: The present study investigated emotion recognition abilities for angry versus neutral facial expressions in a sample of undergraduate students with Beck Depression Inventory-II (BDI-II) scores indicative of moderate depression (i.e. ≥ 20), compared to matched low-BDI-II score (i.e. ≤ 2) controls via the Bubbles Facial Emotion Perception Task.

Results: Results indicated unimpaired behavioural performance in discriminating angry from neutral expressions in the high depressive symptoms group relative to the minimal depressive symptoms group, despite evidence of an abnormal pattern of visual facial information usage.

Limitations: The generalizability of the current findings is limited by the highly structured nature of the facial emotion recognition task used, as well as the use of an analog sample undergraduates scoring high in self-rated symptoms of depression rather than a clinical sample.

Conclusions: Our findings suggest that basic visual processes are involved in emotion recognition abnormalities in depression, demonstrating consistency with the emotion recognition literature in other psychopathologies (e.g. schizophrenia, autism, social anxiety). Future research should seek to replicate these findings in clinical populations with major depression, and assess the association between aberrant face gaze behaviours and symptom severity and social functioning.

1. Introduction

In addition to the mood and cognitive symptoms classically associated with major depression, the disorder has also been associated with abnormalities in the ability to infer emotional states from facial expressions. However, consensus regarding the specific nature of these abnormalities remains elusive. Recent meta-analyses have pointed to general deficits in emotion recognition abilities in depressed patients relative to healthy controls (Kohler et al., 2011; Demenscu et al., 2010). However, several individual studies report contrary results indicative of unimpaired performance in depressed individuals (Gessler et al., 1989; Archer et al., 1992; Gaebel and Wolwer, 1992; Ridout et al., 2003), and other studies have found *facilitated* emotion recognition abilities in depression, suggestive of a kind of global hypervigilance regarding emotional stimuli (Harkness et al., 2005, 2010; Wu et al., 2012).

In addition to differences in facial emotion recognition, depressed individuals have shown abnormalities in visual processing (e.g. Bubl et al., 2009). To further elucidate the nature of facial emotion recognition abilities in depression, the present study investigated the impact of basic visual processing on the discrimination of angry versus neutral facial expressions in a sample of individuals with high Beck Depression Inventory-II (BDI-II; Beck et al., 1996) scores (indicative of moderate depression) relative to a minimal depressive symptom sample.

Further complicating the present state of the emotion recognition in depression literature, investigations that indicate deficits in depressed samples relative to controls remain largely split on a number of important issues including: (1) whether depressed persons exhibit deficits in the *identification* of facial emotions (Langenecker et al., 2005, 2007; Leppänen et al., 2004), or the *differentiation* of facial affect intensities (Asthana et al., 1998; Suslow et al., 2001), or both (Kohler et al., 2011); (2) whether deficits reflect problems in detecting/perceiving emotion visually, or alternatively from incorrectly reasoning about otherwise correctly perceived emotional stimuli (Harkness et al., 2005);

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(3) whether deficits reflect trait (Bouhuys et al., 1996) or state (Mikhailova et al., 1996; Bouhuys et al., 1999) manifestations of depressive symptomatology; and (4) whether depressed individuals interpret all facial emotions more negatively than controls (Bourke et al., 2010), or perhaps exhibit deficits for certain emotions only (Mandal and Palchoudhury, 1985; Rubinow and Post, 1992; Mikhailova et al., 1996). Thus, at present, the facial emotion recognition in depression literature remains unclear on a myriad of factors (and even more so on interactions among these factors), most importantly including whether or not deficits in emotion recognition exist in depression at all.

In an attempt to reconcile these results, Harkness et al. (2005) suggest that observed empirical results are largely contingent on the particular empirical methodology employed. For example, the authors note that asking participants to freely name or rate emotional stimuli results in an overall negatively biased pattern of responding, likely due to the reliable association between depression and selective recall of negative information (see Dalgleish and Watts, 1990). Similarly, when patients are asked to match facial expressions to emotional words or other similar expressions, deficits are observed perhaps due to raw visuospatial pattern matching relative to controls. Finally, and in contrast to the deficits observed in depression via the above two methodologies, Harkness et al. (2005) suggest that paradigms using 'true recognition' tasks that do not rely on free recall, verbal processes, or visuospatial discrimination skills (e.g. Gessler et al., 1989; Gaebel and Wolwer, 1992) reliably show no difference between depressed individuals and healthy controls in emotion recognition. Wu et al., 2012 suggest a similar reason for divergent results in the literature, noting that emotion recognition tasks involving selective attention and memory may be measuring deficits in higher-order cognitive processes rather than emotion recognition per se. Thus, within this framework, persons with major depression can be expected to perform similarly to controls in emotion recognition tasks, so long as the task is free of components requiring skills which are known to be deficient in depression.

An additional complicating factor in the facial emotion recognition in depression literature is the possibility of basic visual perceptual deficits in depressed individuals, which may influence or otherwise account for the observed abnormalities in emotion recognition. In contrast to comparatively well documented deficits in neuropsychological functioning in depressed populations (e.g. immediate/delayed recall, recognition memory; Brand et al., 1992), far less research has been conducted to date on basic perceptual processes in depression. However, a small number of studies in recent years have supported the association between depression and aberrant basic visual perceptual processes. For example, Zomet et al. (2008) found that under certain conditions, hospitalized depressed patients evinced abnormalities in the perceptual process of 'filling-in'. Where control participants were more likely to falsely endorse the presence of an intermittently missing stimuli, hospitalized patients with major depression were found to be more conservative in their judgments, resulting in fewer false alarms, but also fewer correct detections. While it would appear that depressed patients are in some ways outperforming the control group on this perceptual task, Zomet and colleagues interpret these findings as indicative of deficient filling-in perceptual processes in depressed individuals. Specifically, they suggest that this absence of the filling-in process in depression may reflect reduced excitation between neurons directly stimulated in the visual cortex, and those accounting for the nearby visual area to be filled-in.

Similarly, Bubl et al. (2009, 2010) have conducted a number of studies demonstrating abnormal perceptual processes in depression, including reduced contrast sensitivity (i.e. depressed persons require a greater disparity between light versus dark elements of stimuli in order to detect the difference), as well as lower levels contrast gain (i.e. depressed persons are less able to perceptually adjust to new ranges of contrast). By assessing contrast gain directly via the retina using pattern electroretinogram (PERG), Bubl et al. (2010) were able to bypass several potentially confounding psychological variables in their sample (e.g. memory/attention/motor deficits), and as a result, were able differentiate between control and depressed participants with a high degree of specificity and sensitivity. Interestingly, a follow-up study by Bubl et al. (2012) found a normalization of this psychophysical process of contrast gain in individuals whose depression was successfully treated with antidepressant medication.

Consistent with these findings in basic visual processes, Douglas et al. (2011) found social-cognitive and neuropsychological markers that significantly differentiated depressed treatment responders from non-responders. Specifically, successful recognition of angry faces (though not other basic facial emotions), as well as improvements in simple reaction time and verbal working memory were found to significantly differentiate depressed treatment responders from non-responders. Douglas and colleagues suggest that each of these domains might be used as a proxy of treatment response in future research. Taken together, these results are strongly suggestive of state-dependent basic visual processing abnormalities in depression, and further that these abnormalities co-occur with poorer performance on a variety of cognitive tasks including facial emotion recognition, specifically for the facial expression of anger.

In summary, while the emotion recognition in depression literature strongly suggests abnormalities in the way depressed individuals respond to emotional facial stimuli, it leaves a number of questions unanswered including, perhaps most importantly, the degree to which basic visual deficits may impact emotion recognition processes in depression. If it is the case that depressed individuals utilize facial information differently than controls, any deficits in emotion recognition performance may lie, at least in part, at the level of basic visual processing. If however, depressed samples utilized visual facial information in the same manner as controls, any deficits in emotion recognition performance might then be attributed to higher-order processes associated with depression *despite* associated basic visual deficits.

To investigate this issue, the present study utilized the Bubbles Facial Emotion Perception Task (Gosselin and Schyns, 2001) in a young sample with high self-rated scores on the Beck Depression Inventory (BDI-II) compared to an age and gender matched group with low self-rated scores on the BDI-II. The Bubbles task has previously been used in samples with high functioning autism (Spezio et al., 2007a), high social anxiety (Langner et al., 2009), bilateral amygdala damage (Adolphs et al., 2005), and schizophrenia (Lee et al., 2011; Clark et al., 2013), and offers unique insights into not only emotion recognition proficiency for the differentiation of two chosen emotions, but also the basic visual channels through which participants achieve their observed level of proficiency. Based on Douglas et al. (2011) finding that recognition of angry faces specifically was a significant differentiator of treatment response, we chose angry and neutral facial stimuli. We had three hypotheses: (1) the high self-rated depression symptoms group would not require more visual facial information than the low self-rated depression symptoms group in order to discriminate between angry and neutral facial stimuli; (2) we expected the high and minimal depressive symptom groups to have equal reaction times, and (3) that the high depressive symptoms group would evince abnormal usage of visual facial information compared to the minimal depressive symptom group.

2. Method

2.1. Participants

A total of 202 undergraduate students participated from the University of Calgary Psychology Undergraduate Research Participation