CORTEX 48 (2012) 1027–1034

Available online at www.sciencedirect.com

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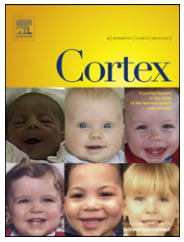
Journal homepage: www.elsevier.com/locate/cortex



Research report

# Modality-specific alterations in the perception of emotional stimuli in Bipolar Disorder compared to Healthy Controls and Major Depressive Disorder

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ARTICLE INFO

*Article history:*
Received 6 November 2010
Revised 12 January 2011
Accepted 24 March 2011
Action editor Henry Buchtel
Published online 11 May 2011

*Keywords:*
Bipolar Disorder
Major Depressive Disorder
Affect perception

ABSTRACT

*Objectives:* Affect identification accuracy paradigms have increasingly been utilized to understand psychiatric illness including Bipolar Disorder (BD) and Major Depressive Disorder (MDD). This investigation focused on perceptual accuracy in affect identification in both visual and auditory domains among patients with BD, relative to Healthy Controls (HC) and patients with MDD. Demographic and clinical variables, in addition to medications were also investigated.

*Method:* The visual Facial Emotion Perception Test (FEPT) and auditory Emotional Perception Test (EPT) were administered to adults with BD ($n = 119$) and MDD ($n = 78$) as well as HC ($n = 66$).

*Results:* Performance on the FEPT was significantly stronger than on the EPT irrespective of group. Performance on the EPT did not significantly differentiate the groups. On the FEPT, BD samples had the greatest difficulty relative to HC in identification of sad and fearful faces. BD participants also had greater difficulty identifying sad faces relative to MDD participants though not after controlling for severity of illness factors. For the BD (but not MDD) sample several clinical variables were also correlated with FEPT performance.

*Conclusions:* The findings suggest that disruptions in identification of negative emotions such as sadness and fear may be a characteristic trait of BD. However, this effect may be moderated by greater illness severity found in our BD sample.



## 1. Introduction

Difficulties in emotion processing, or affect perception, are potential risk factors in the development of psychiatric illness but paradoxically may also be a result of the illness. Despite a large number of neuroimaging studies investigating emotion processing deficits among patients with mood disorders, less is known about specific performance alterations on affective

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http://dx.doi.org/10.1016/j.cortex.2011.03.017

processing tasks associated with Bipolar Disorder (BD). Further, it is unclear whether disruptions in perceptual accuracy of specific emotions are moderated by current symptoms of depression. Finally, it is unknown whether emotion processing decrements are influenced by perception modality (i.e., auditory or visual). Investigation of performance differences between patients diagnosed with BD, Major Depressive Disorder (MDD), and controls, accounting for modality and valence, will inform the development of further neuroimaging and behavioral research into the pathophysiology of the mood disorders, as well as approaches to diagnosis and treatment.

### 1.1. *Auditory and visual emotion processing*

In both auditory and visual domains, processing of emotion involves both perception and recognition of the meaning embedded in affective stimuli (Adolphs et al., 1994). Adolphs (2002) suggested that recognizing emotions from auditory prosody cues are more difficult than from facial expressions. In support of this, some models suggest that picture–word categorization activates sensory features and affective content simultaneously, whereas words first activate lexical concepts and only later access affective features (De Houwer and Hermans, 1994; Viswanathan and Childers, 2003). Other investigators have found that emotional pictures are processed more rapidly than are emotion words (De Houwer and Hermans, 1994). It is further suggested that processing pictures rapidly activate both semantic and affective networks. In contrast, verbal material must pass through lexical cognitive systems before being assessed for salience and affective properties. The implication of slower processing speed and the distinct neuroanatomy for visual and auditory stimulus processing is that there need not necessarily be processing impairment in multiple modalities if the problem occurs earlier within a particular sensory network.

Exploration of the neuroanatomical pathways involved in emotion processing offer insight into the specific processing of different emotional stimuli. Recognition of auditory emotion prosody has been found to involve right frontoparietal regions with possible basal ganglia involvement (Hornak et al., 1996; Breitenstein et al., 1998; Buchanan et al., 2000; Adolphs et al., 2002). Processing auditory emotional material not involving prosody is noted to involve orbital prefrontal areas (Blood et al., 1999; Frey et al., 2000). Adolphs (2002) suggests that although recognizing emotions from auditory prosody cues are globally more difficult than from facial expressions, this effect is more pronounced for certain emotions like disgust. The implication from these and similar data is that not only does the brain process affective stimuli in discrete anatomical pathways depending on sensory modality but also affect category (fear, disgust, etc.).

### 1.2. *Individual emotions*

Further evidence linking distinct neural circuitry to distinct emotional material is provided by double dissociation studies utilizing facial emotion perception tasks. One prior study demonstrated that individuals with amygdala lesions are impaired in recognizing fear relative to perception of emotions such as disgust (Adolphs et al., 1994). Conversely, individuals with Huntington's disease have been reported to show deficits in perception of disgust relative to fear (Sprengelmeyer et al., 1996), which is supported by evidence of activation in the basal ganglia following presentation of disgust expressions in Healthy Controls (HC) (Phillips et al., 1997).

A meta-analysis by Phan et al. (2002) reviewed 55 positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) activation studies that investigated response to specific emotional stimuli among healthy volunteers. Their findings suggest that fear induction was strongly associated with activation in the amygdala, sadness with activation in the subgenual cingulate, and happiness and disgust with activation in the basal ganglia. Activation of the medial prefrontal cortex was not specific to any one emotion. Rather, the prefrontal cortex appears to be involved in the voluntary control and/or suppression of emotions and emotional displays (Beauregard, et al., 2001; Ochsner et al., 2002; Woolley et al., 2004).

Thus the extant literature suggests that emotion processing in the brain takes place in distributed networks with both generalized and specific functions. How the functioning of these systems may be disrupted among psychiatric populations remains unclear, and further understanding would aid in the differentiation of their distinct pathophysiological mechanisms.

### 1.3. *Emotion processing in psychiatric illness*

Emotion processing inaccuracies and biases in MDD have been demonstrated in studies of perception of facial expressions (Langenecker et al., 2005; Deldin et al., 2001). Langenecker et al. (2005) reported that healthy adult women were more likely to incorrectly identify an expression as happy (positive bias) compared to women with depression, though biases in response to neutral stimuli were equivalent between the groups.

Other groups have shown a general pattern of impairment in MDD in the recognition of positive facial expressions (Suslow et al., 2001; Surguladze et al., 2004) that may persist even following treatment. In contrast, other studies have found that adults with MDD were more likely than healthy adults to classify sad faces incorrectly and were no different from healthy adults in identifying neutrally posed expressions (Mikhailova et al., 1996). Still others have found no evidence that depressed adults perform more poorly than healthy individuals in recognizing any particular type of emotional expression (Persad and Polivy, 1993). Thus there has been substantial variability in the findings across studies comparing HC and MDD on tasks of affect perception, and comparisons of MDD and BD are at present underrepresented in the literature. There have also been a number of fMRI studies investigating neural correlates of facial emotion processing among individuals with mood disorder. Individuals with MDD have been shown to have increased response within the left amygdala to fearful (Sheline et al., 2001) and sad facial stimuli (Fu et al., 2004).

For the purpose of our investigation we examined performance in tasks of affect recognition in a sample of BD individuals and compared their performance to both HC as well as a sample of individuals with MDD. Some studies on emotion processing in BD suggest that emotion perception accuracy is mood dependent, such that a bias toward negative emotions