Research report

Biased emotional recognition in depression: Perception of emotions in music by depressed patients ☆

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ABSTRACT

Background: Depression is a highly prevalent mood disorder, that impairs a person's social skills and also their quality of life. Populations affected with depression also suffer from a higher mortality rate. Depression affects person's ability to recognize emotions. We designed a novel experiment to test the hypothesis that depressed patients show a judgment bias towards negative emotions.
Methods: To investigate how depressed patients differ in their perception of emotions conveyed by musical examples, both healthy (n = 30) and depressed (n = 79) participants were presented with a set of 30 musical excerpts, representing one of five basic target emotions, and asked to rate each excerpt using five Likert scales that represented the amount of each one of those same emotions perceived in the example.
Results: Depressed patients showed moderate but consistent negative self-report biases both in the overall use of the scales and their particular application to certain target emotions, when compared to healthy controls. Also, the severity of the clinical state (depression, anxiety and alexithymia) had an effect on the self-report biases for both positive and negative emotion ratings, particularly depression and alexithymia.
Limitations: Only musical stimuli were used, and they were all clear examples of one of the basic emotions of happiness, sadness, fear, anger and tenderness. No neutral or ambiguous excerpts were included.
Conclusions: Depressed patients' negative emotional bias was demonstrated using musical stimuli. This suggests that the evaluation of emotional qualities in music could become a means to discriminate between depressed and non-depressed subjects. The practical implications of the present study relate both to diagnostic uses of such perceptual evaluations, as well as a better understanding of the emotional regulation strategies of the patients.

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1. Introduction

Impairments in the ability to recognize and discriminate other people's affective states have repercussions on a

person's social and interpersonal relations. This is very clearly a problem with patients suffering from mood disorders such as depression, which is one of the leading causes of disability, affecting approximate 121 million people worldwide (WHO, 2010). The most common treatment for this is medication, even though many patients suffering from mild, moderate or severe depression do not benefit from antidepressants (Turner et al., 2008; Fournier et al., 2010).

Depression is most commonly a disorder that affects the representation and regulation of mood and emotion (Davidson et al., 2002). It manifests itself through a variety of symptoms: hopelessness, loss of mood reactivity, inability to

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experience pleasure, suicidal thoughts and psychosis (Kalia, 2005). Previous studies have shown that depression affects a person's ability to recognize facial emotions (George et al., 1998). These include emotionally neutral faces (Leppänen et al., 2004), sad and happy faces (Gur et al., 1992) as well as more subtle changes in other's facial expressions (Surguladze et al., 2004). More specifically, these recognition problems are characterized by a systematic, negative attentional bias. For example, patients with a major depressive disorder paid more attention to sad facial expressions, than to neutral facial expressions when presented with them at the same time (Gotlib et al., 2004). In other studies they specifically shifted their attention away from happy facial expressions (Suslow et al., 2004); and showed a reduction in perceptual sensitivity to happy facial expressions (Surguladze et al., 2004; Hayward et al., 2005). Individuals with depression have shown prolonged involuntary processing for negative information— shown by sustained bilateral amygdala activation for negative rather than positive words—when compared with healthy controls (Siegle et al., 2002). According to Joormann (2004) patients with depression tend to recall a higher proportion of negative words than positive ones of those previously presented, when compared to healthy controls. In a study by Kan et al. (2004), depressed patients interpret neutral prosodic emotive stimuli, such as surprise, in a more negative light than healthy control patients. There are also early indications that such a bias might occur when evaluating stimuli in other domains such as music (Bodner et al., 2007; Al'tman et al., 2000). The underlying causes for these problems with processing emotional information can be linked to malfunctions in different parts of the brain.

Malfunctions characteristic of depression include an increased activity in the anterior cingulate cortex (ACC) and limbic brain regions, and decreased connectivity between ACC and limbic regions during negative emotional stimuli (Anand et al., 2005); unbalanced physiological activity (asymmetry) in the frontal lobes of both left and right hemispheres (Rotenberg, 2008); or an imbalance in several brain neurotransmitter systems, such as serotonin, norepinephrine, and dopamine (Kalia, 2005), all of which may contribute to an inability to recognize emotions. Of all these potential mechanisms, the notion of asymmetry provides the most intelligible theoretical framework, and it provides non-invasive research methods suitable for behavioural investigation.

EEG-studies have established that, relative to healthy controls, depressed participants demonstrate hypoactivation in the left frontal, and hyperactivation in the right frontal lobes (e. g. Allen et al., 1993; Henriques and Davidson, 1991; Field et al., 1995). Such asymmetry has been linked with the elicitation and recognition of emotions, namely left-sided prefrontal hypoactivation leads to diminished positive affects and right-sided hyperactivation to increased negative affects (Wheeler et al., 1993). In other words, depressed patients are more occupied with negative emotions than healthy controls, which would explain their difficulties to recover from negative affects (Teasdale, 1988), their tendency to use rumination and expressive suppression as emotion-regulation strategies, and their lack of inhibition when processing negative material (Joormann and Gotlib, 2010). Because of the frequent comorbidity of depression, anxiety (Cassidy et al., 2005; Aina and Susman, 2006), and alexithymia (Honkalampi et al., 2000), the present study also explores these conditions. According to Fawcett and Kravitz (1983), anxiety symptoms like worry, panic attacks and psychosomatic anxiety are quite common in patients with major depression. In the US, the National Comorbidity Survey found comorbid depression and anxiety in up to 60% of patients with major depressive disorders, and it was also typical that an anxiety disorder preceded the development of a major depressive disorder (Kessler et al., 2003).

There is some evidence that depression is associated with alexithymia in the general population (Hendryx et al., 1991; Honkalampi et al., 2000). Alexithymia was originally defined as a person's inability to recognize and verbalize emotions (Sifneos, 1973) and it has since been proposed that alexithymia reflects general deficits in the cognitive processing of emotions (Taylor et al., 1991). Recently Bagby et al. (2006) have shown that alexithymia is a combination of reduced affective awareness and increased operative thinking, which results in socially avoidant behaviour (Spitzer et al., 2005).

According to a recent Cochrane review about music therapy treatment for depression, positive mood-related effects have been consistently observed in conjunction with musical activities (Maratos et al., 2008). Music has been linked with deep brain structures involved in emotional processing (e.g., Salimpoor et al., 2009; Blood and Zatorre, 2001), it provides one of the most effective non-intrusive mood induction techniques (Västfjäll, 2002), and it has been shown to play a central role in the self-regulation of emotions in everyday contexts (Saarikallio and Erkkilä, 2007). The underlying mechanisms, which cause asymmetry in the frontal and prefrontal cortices, when processing music-induced emotions, have also been identified in previous studies (Altenmüller et al., 2002, Sammler et al., 2007). Yet in spite of its prevalence and beneficial effects, such aspects of music have rarely been explored among clinical populations. Nevertheless, in two noteworthy studies where they were explored, depressed patients were shown to make quite different emotional evaluations of music, compared to healthy controls (Bodner et al., 2007; Al'tman et al., 2000). Such promising findings warrant more controlled investigations to explore these differences further, and across a larger sample of the population.

The aim of the present study is twofold. Firstly we establish the hypothesis that depressed patients do in fact evaluate emotions in music differently from a control group. Secondly we seek to refine the sources of this difference by focusing on the levels and types of clinical condition. In other words we propose the four following hypotheses:

1. Depressed patients demonstrate a marked negative bias in evaluating perceived emotional qualities of music (i.e., higher ratings for sadness, fear and anger and lower ratings for happy and tender emotions) when compared to non-depressed controls.
2. The degree of this negative bias correlates with the severity of depression.
3. The degree of negative bias also correlates with the severity of an anxiety problem, if there is one (comorbidity).
4. Depressed patients with alexithymia will repeatedly underestimate the perceived emotional qualities of