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Internal shifting impairments in response to emotional information in dysphoric adolescents

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ABSTRACT

Background and Objectives: Previous studies have suggested that internal cognitive control impairments may play an important role in the development of depression. Despite a growing body of research in adults, the ability to shift internal attention between mental representations in working memory has received little attention in younger populations. This study investigated internal shifting capacity between emotional and non-emotional information in dysphoric and non-dysphoric adolescents.
Methods: Twenty dysphoric and 34 non-dysphoric adolescents (10–17 years) completed an Internal Shifting Task, with pictures of angry and neutral faces, to measure the ability to shift attention between information held in working memory.
Results: Dysphoric adolescents showed specific shifting impairments when processing emotional material relative to non-dysphoric adolescents. Valence-specific analyses revealed that shifting was particularly impaired when shifting from negative to neutral information. By comparison, relative to non-dysphoric adolescents, dysphoric adolescents did not show shifting impairments when non-emotional features of the pictures had to be processed.
Limitations: The study is limited by the absence of a structured clinical interview as dysphoria was determined dimensionally. Furthermore, a comparison of the effects of different negative stimuli on shifting could not be made since sad stimuli were not included in the stimulus set.
Conclusions: The results confirm the link between depressive symptoms and emotion-specific shifting impairments in adolescents and indicate that targeting shifting ability in response to emotional stimuli may be a promising avenue for prevention programs. Longitudinal research is needed to replicate results and to explore the role of internal shifting impairments in the etiology and maintenance of depression.

1. Introduction

Depressive symptoms in adolescents are common (Balazs, 2013) and have a variety of negative consequences, such as impaired social relationships and an increased risk for suicide (Birmaher et al., 1996; Horowitz & Garber, 2006). Moreover, adolescent depressive symptoms are highly predictive for chronic and severe depressive episodes in adulthood (Lewinsohn, Rohde, Seeley, Klein, & Gotlib, 2000), which indicates the need to study underlying cognitive processes in dysphoric adolescents before a chronic course emerges.

Cognitive theories have mainly focused on the *content* of depressive cognition and assigned a crucial role to negative schemas of the self, world, and future in the development and persistence of depression (Beck, 1976). The proposition that cognitive schemas have a major influence on the processing of information stimulated research on the relationship between cognitive *processes* and depressive symptoms. Results of these studies provided evidence for depression-related information processing biases (Neshat-Doost, Taghavi, Moradi, Yule, & Dalgleish, 1998; Timbremont, Braet, Bosmans, & Van Vlierberghe, 2008) and indicated a better memory for negative information and an attentional bias towards negative information among adolescents who are currently depressed or at risk for depression (Gibb, Benas, Grassia, & McGeary, 2009; Hankin, Gibb, Abela, & Flory, 2010). It is assumed that these negative processing biases lead to repetitive negative thoughts (i.e. rumination) and sustained negative affect, which in

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turn contribute to and intensify depressive symptoms (Clark & Beck, 2010). Despite the interesting findings regarding depressogenic information processing, so far it is still unclear to what extent adolescent depressive symptoms are associated with impairments on the level of fundamental cognitive control processes, which refer to executive functions such as working memory. Yet, the investigation of such processes is of particular interest since it has been shown that the capacity to cognitively control incoming information positively impacts one's ability to deal with stressful events and to manage emotional responses (Ochsner & Gross, 2005).

1.1. Depressive symptoms and cognitive control impairments

Cognitive control refers to the ability to selectively attend to relevant stimuli, select and maintain relevant goals, and inhibit the processing or response to irrelevant or previously relevant stimuli (Brydges, Anderson, Reid, & Fox, 2013; Ridderinkhof, Ullsperger, Crone, & Nieuwenhuiss, 2004). This ability is related to three important executive functions: shifting between tasks or mental sets (*shifting*), inhibiting dominant responses or irrelevant information (*inhibition*), and monitoring and updating the contents of working memory (*updating*) (Miyake et al., 2000). Recently, it has been proposed that impaired cognitive control may be an important component for understanding prolonged negative affect and recurrent negative thoughts in depression (Joormann & D'Avanzato, 2010; Koster, De Lissnyder, Derakshan, & De Raedt, 2011). The majority of the past studies on cognitive control in depressed or dysphoric adolescents have used cognitive control tasks including non-emotional information and provided mixed results with only a few studies indicating a clear group difference (for a review see Vilgis, Silk, & Vance, 2015). The little research that demonstrated group differences regarding cognitive control ability showed that depressed adolescents were less accurate (i.e., higher error rates) and responded more slowly (i.e., higher response times) compared to healthy adolescents (Bloch et al., 2013; Gunther, Konrad, De Brito, Herpertz-Dahlmann, & Vloet, 2011; Hardin, Schroth, Pine, & Ernst, 2007). However, multiple studies on cognitive control functions yielded mixed or no results (Han et al., 2012; Kyte, Goodyer, & Sahakian, 2005; Wilkinson & Goodyer, 2006). For instance, previous studies investigating general shifting, determined by tests such as the Wisconsin Card Sorting Test (WCST; Grant & Berg, 1948), were inconclusive showing either no difference between depressed adolescents and healthy controls (Favre et al., 2009) or a lower score on shifting in the depressed group (Gunther et al., 2011; Holler, Kavanaugh, & Cook, 2014). By contrast, studies examining inhibition, with an antisaccadic eye movement task (Hardin et al., 2007) or a go/no-go task (Gunther et al., 2011) provided some support for impaired inhibition in depressed or dysphoric adolescents, yet, empirical evidence is far from being consistent (Vilgis et al., 2015).

Given prior inconclusive results regarding general cognitive control impairments, one possibility is that cognitive control in dysphoric or depressed adolescents might be particularly disturbed when processing emotional information (Joormann, Yoon, & Zetsche, 2007; Koster et al., 2011; Vilgis et al., 2015). Although research using cognitive control tasks including emotional stimuli in pediatric mood disorders and dysphoric adolescents is rather scarce (for a review see Mueller, 2011), a few studies have provided such evidence. Ladouceur et al. (2005) and Tavitian et al. (2014) administered an Emotion *N*-back task and found evidence for working memory impairments in the presence of emotional and neutral information in depressed youngsters compared to healthy controls. Furthermore, results from the Affective go/no go task also support impaired processing of negative stimuli in adolescents suffering from depression (Kyte et al., 2005; Ladouceur et al., 2006; Maalouf et al., 2012). Finally, a study using the Negative Affective Priming task showed a higher interference and inhibition of negative stimuli in dysphoric adolescents compared to healthy controls (Wante, Mueller, Demeyer, De Raedt, & Braet, 2015). Although the aforementioned studies provide initial evidence for dysfunctional cognitive control over emotional stimuli, it has recently been proposed that depressed people might experience specific difficulties with *internal* cognitive control rather than with *external* cognitive control processes (Koster, De Lissnyder, & De Raedt, 2013).

1.2. Depressive symptoms and internal shifting ability

Whereas *external* cognitive control refers to the selection and modulation of external information, such as perceptual attributes of cues or targets, *internal* cognitive control can be described as the ability to process and modulate internally generated information, such as mental sets in working memory (Chun, Golomb, & Turk-Browne, 2011; Wager, Jonides, & Smith, 2006). Impaired internal control over negative thoughts may result in difficulties regulating negative affect and thus might be of particular relevance in the development of depressive symptoms (Koster et al., 2013). An interesting paradigm to explore shifting between mental representations in working memory is the Internal Shifting Task (IST; Chambers, Lo, & Allen, 2008; De Lissnyder, Koster, & De Raedt, 2012), which is an affective variant of the shifting task of Garavan (1998) and Gehring, Bryck, Jonides, Albin, and Badre (2003). The IST used in this study includes pictures of faces and consists of an emotional and a non-emotional condition. In the emotional condition, participants are asked to perform a silent mental count of the number of negative and neutral faces. In the non-emotional condition, participants are instructed to mentally count the amount of male and female faces. The IST design allows to measure efficiency of general shifting (across emotional and non-emotional condition), condition-specific shifting (emotional condition vs. non-emotional condition), and valence-specific shifting (shifting from negative to neutral or vice versa). Results of a study in depressed adolescents and young adults using an IST with neutral and affective words revealed greater shifting difficulties in the emotional condition compared to healthy controls (Lo & Allen, 2011). Moreover results of prospective studies in adults using a pictorial IST indicated that emotion-specific shifting impairments are associated with increased rumination in response to stress (De Lissnyder, Koster, Goubert, et al., 2012) and play an important role in the prediction of depressive symptoms at one year follow up (Demeyer, De Lissnyder, Koster, & De Raedt, 2012).

1.3. The current study

Despite the increased risk for an adult depressive episode in adolescents with depressive symptoms (Pine, Cohen, Cohen, & Brook, 1999), research on the role of internal cognitive control in response to emotional stimuli in dysphoric adolescents remains scarce. The present study aimed to examine internal shifting ability in dysphoric adolescents with the use of the IST including pictures of angry and neutral faces (De Lissnyder, Koster, & De Raedt, 2012). In line with prior shifting studies in adults (De Lissnyder, Koster, Derakshan, & De Raedt, 2010; De Lissnyder, Koster, Everaert, et al., 2012; De Lissnyder, Koster, Goubert, et al., 2012; Demeyer et al., 2012; Koster et al., 2013), we included angry faces as negative target stimuli in that these kind of emotional stimuli are thought of bearing direct personal relevance to adolescents suffering from depressive symptoms and can be associated with depression-related interpersonal difficulties and schemas of social