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Updating emotional content in recovered depressed individuals: Evaluating deficits in emotion processing following a depressive episode

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ABSTRACT

Background and objectives: Previous research has demonstrated that depressed individuals have difficulty both disengaging from negative information and maintaining positive information in working memory (WM). The present study was conducted to examine whether the tendency for depressed individuals to maintain negative content in WM and to experience difficulties maintaining positive content in WM is due to negative mood (in)congruency effects during a depressive episode, or whether these tendencies are evident outside of a depressive episode.
Methods: Individuals who had recovered from a depressive episode and never disordered controls performed emotion 0-back and 2-back tasks designed to assess biases in updating emotional content in working memory.
Results: Similar to currently depressed individuals in previous studies, recovered depressed participants disengaged from happy stimuli more quickly and from sad stimuli more slowly than did their never-depressed counterparts.
Limitations: Despite the extension of a depression-specific finding to recovered depressed individuals, the present study does not test whether the identified emotion updating biases predict long-term relapse or recovery.
Conclusion: The obtained results suggest that a decreased ability to disengage from negative content and to maintain positive content in WM represents a trait-like cognitive style that impairs adaptive emotion regulation and may contribute to the recurrent nature of depression.

1. Introduction

Investigators have documented biases in the processing of emotional information that may impair emotion regulation and maintain episodes of Major Depressive Disorder (MDD). Recently, using an eye-tracking task, Duque and Vázquez (2015) found that individuals diagnosed with MDD fixated longer on sad faces and spent less time looking at happy faces. Similarly, Levens and Gotlib (2010) found that depressed individuals have difficulty both disengaging from negative information and maintaining positive information in working memory (WM). Theorists have postulated that the preferential processing of negative information impairs the ability of depressed individuals to effectively regulate their affect (Bistricky, Atchley, Ingram, & O'Hare, 2014; Gotlib & Joormann, 2010; MacCoon & Newman, 2006). Less is known, however, about the persistence of emotion processing biases beyond the depressive episode. The goal of the present study is to address this gap by examining biases in emotion updating that have been found to characterize currently depressed persons in a sample of individuals who have recovered from a depressive episode.

WM is at the intersection of attention, executive functioning, short-term memory, and long-term memory (Dudai, 2002), each

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of which has been implicated in emotion processing biases in depression. WM principally reflects the focus of individuals' attention and cognitive resources, representing what people are aware of and thinking about at any given moment (Baddeley, 1986; Miyake & Shah, 1999). Importantly, WM has been implicated in the regulation of emotion; indeed, maintaining emotional content in WM has been found to affect both positive and negative mood (Isen, 1984; Russell, 2003). Therefore, it is critical to elucidate how emotion processing may interact with specific executive functions in WM as a function of a depressive state.

Updating is an executive process that involves modifying existing representations in WM to accommodate new information (Morris & Jones, 1990). Specifically, updating monitors and codes incoming information for relevance to the task, and appropriately reviews items held in WM by replacing old, no-longer-relevant information with newer, more relevant information (Morris & Jones, 1990). For example, when an individual begins a new task, the contents of WM are updated and representations or information relevant to the new task become active, while representations/information central to the previous task become less active and fall out of WM. Importantly, when a representation enters WM, it interacts with the existing content in WM, forming associations and possibly modifying the existing content in relation to the new content (Dudai, 2002). Given that updating continually codes new and existing WM content for task relevance, it is an important executive process that might be related to more complex executive functions like goal pursuit, planning, and adaptively responding to environmental demands (Harvey et al., 2004).

In addition to updating, set-shifting and inhibitory control have also been examined in the context of depression (e.g., Grant, Thase, & Sweeney, 2001; Harvey et al., 2004; Merriam, Thase, Haas, Keshayan, & Sweeney, 1999). Importantly, confirmatory factor analyses indicate that set-shifting, inhibition, and updating are clearly separable (Miyake et al., 2000), suggesting that each contributes differentially to the execution of complex tasks such as goal pursuit and emotion regulation. In this context, Harvey et al. (2004) documented concurrent deficits in set-shifting, inhibition, and updating in depressed individuals, yet found that only deficits in updating were correlated with the number of hospitalizations and the longitudinal course of the depressive illness.

Because updating involves modifying existing information to accommodate new input, the influence of new information on existing content may be particularly salient when the new content is emotional, or valenced. For example, when updating processes admit sad content to WM, this content interacts with, forms associations with, and modifies the existing content already in WM. Neutral content in WM that becomes associated with sad content may become negatively valenced, and/or the intensity of sad content already in WM may become heightened by the additional sad content. Similarly, when sad content enters WM, it may interact with positive content already in WM to dampen the salience or arousal of the positive content. A tendency to more readily admit sad (or happy) content to WM that occurs consistently would represent a stable bias that could facilitate the formation and maintenance of negative (or positive) moods that underlie individual differences in emotion regulation.

Levens and Gotlib (2010), Yoon, LeMoult, and Joormann (2014), and Joormann and Gotlib (2008) examined updating of emotional content in the context of depression. Levens and Gotlib (2010) investigated emotion updating in depression by modifying the commonly used n-back task to include emotional content. In their study, diagnosed depressed and never-disordered controls performed an emotion 2-back task in which they were presented with a series of happy, sad, and neutral faces and were asked to indicate whether the current face had the same emotional expression as that presented two faces earlier (which required that participants match set) or a different emotional expression as that presented two faces earlier (which required that participants integrate new content or break a previously matched set). Participants also performed a 0-back task with the same emotional stimuli to serve as a control for perceptual processing. Levens and Gotlib found that depressed and nondepressed participants exhibited biases in updating emotional content that reflected the tendency to keep negative and positive information active in WM. Compared with controls, depressed participants were both slower to disengage from sad stimuli and faster to disengage from happy facial expressions. In contrast, nondepressed controls took longer to disengage from happy than from neutral or sad stimuli.

Critically, Levens and Gotlib's (2010) findings implicate executive processing biases in WM as an important factor in the maintenance and, possibly, the recurrence of depression. Attenuated maintenance of positive information in WM would result in less elaboration and dedication of fewer cognitive resources to the processing of positive stimuli, leading to weaker representations in long-term memory, difficulty replacing negative stimuli with positive material, and difficulty using WM resources adaptively to regulate mood. It is not clear, however, whether these maladaptive biases in emotion updating are mood-congruent aspects of a depressive episode, or alternatively, reflect stable individual differences and/or scar effects that are present outside of a depressive episode and increase the likelihood that an individual will experience a recurrence of depression.

The present study was designed to examine whether these biases in emotion updating operate outside the depressive episode. Recovered depressed and never-depressed participants performed the emotion n-back task; they were presented with happy, neutral and sad faces for which they were required to indicate whether each face in a series of faces has the same or a different emotional expression as the expression on the face that was presented two trials before, matching the two expressions into a conceptual set on 'same' trials, and breaking or determining the absence of a conceptual set on 'different' trials. Although MDD is often characterized by recurrent depressive episodes (Boland & Keller, 2009), there are fewer studies examining emotion processing in persons who have recovered from a depressive episode. Previous studies have demonstrated that remitted depressed individuals have significant impairments in executive function and attention (Paelecke-Habermann, Pohl, & Leplow, 2005; Weiland-Fiedler et al., 2004). Researchers have also found that attentional biases for negative stimuli persist beyond depression (Ehring, Fischer, Schnülle, Bösterling, & Tuschen-Caffier, 2008; Joormann & Gotlib, 2007). In addition, investigators have documented that recovered depressed patients focus less attention on positive faces (Sears, Newman, Ference, & Thomas, 2011) and dampen positive emotion (Werner-Seidler, Banks, Barnaby, & Moulds, 2013). Based on this research and on the recurrent nature of depression, we predicted that the updating biases identified by Levens and Gotlib (2010) reflect stable emotion-cognitive biases that persist beyond the depressive episode rather than depression related mood (in)congruence effects. Specifically we predicted that, as we found in currently depressed individuals, recovered depressed individuals would exhibit longer reaction times to disengage from negative content and shorter reaction times to disengage from positive content in WM.