



Moving towards the benign: Automatic interpretation bias modification in dysphoria



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ABSTRACT

Automatic cognitive biases are important to theories of depression and reducing such biases may contribute to therapeutic gains. The present study examined (1) whether it was possible to reduce automatic interpretation biases (AIB) in a single session among dysphoric subjects and (2) whether the effects of modifying AIB generalized to other measures of cognition and emotion. 76 dysphoric students completed a modified semantic association paradigm in which they were randomized to receive active or random-feedback-based training. Groups did not differ on AIB at baseline. Compared to the placebo group, the active training group demonstrated decreased endorsement of negative AIB, faster endorsement of benign AIB, and slower rejection of benign AIB. AIB modification generalized to a separate measure of interpretation bias. Further, greater reductions in AIB predicted a more resilient emotional response pattern to a laboratory stressor. Implications of AIB modification for basic and clinical research are discussed.

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1. Moving towards the benign: automatic interpretation bias modification in dysphoria

1.1. Cognitive biases in depression

As depression becomes more prevalent and burdensome (Ferrari et al., 2013; WHO, 2012), there is growing urgency to understand risks for developing and maintaining depression to curtail its personal (Kessler & Bromet, 2013) and societal costs (Greenberg, Fournier, Sisitsky, Pike, & Kessler, 2015). Cognitive theories emphasize biased information processing in the etiology of depressive disorders, particularly at the automatic processing level (Beck & Haigh, 2014; Beevers, 2005; Williams, Watts, MacLeod, & Mathews, 1988). Depressed persons have repeatedly demonstrated biased processing of negative and ambiguous environmental information, including biased attention (Teachman, Joormann, Steinman, & Gotlib, 2012) and memory (Mathews & MacLeod, 2005; Teachman et al., 2012).

Although interpretation biases have been less studied in depression (Hirsch, Meeten, Krahe, & Reeder, 2016; Wisco, 2012),

theorists have highlighted automatic negative interpretations in the etiology of depression (Beck, 1987; Beck & Haigh, 2014; Beevers, 2005; Williams et al., 1988). In these theories, automatic biases cause a cascade of processing distortions which exacerbate depression. Difficulty disengaging attention from negative information and perseverative negative thinking may lead to greater encoding of negative environmental information into memory. Similarly, negative interpretations of ambiguous environmental material may lead to ambiguous information being encoded into memory as negative. Thus, negative memories are formed more often and become implicit memories guiding behavior (Beck & Haigh, 2014; Beevers, 2005; Everaert, Duych, & Koster, 2014).

1.2. Interpretation biases in depression

Historically, although theories of interpretation have focused on automatic processing, investigations of interpretation biases have concentrated on reflective, explicit processes (Lawson & MacLeod, 1999; Mathews & MacLeod, 2005; Teachman et al., 2012; Wisco, 2009). Reviews of interpretation biases yield substantial evidence for reflective/explicit negative interpretation biases in internalizing disorders (Hirsch et al., 2016; Mathews & MacLeod, 2005; Teachman et al., 2012) and in depression specifically (Wisco, 2012). Reflective/explicit interpretation biases are often tested via self-report instruments, including story-like vignettes in which

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participants are asked to judge the likelihood of a series of potential outcomes (Krantz & Hammen, 1979; Voncken, Bögels, & de Vries, 2003; Voncken, Bögels, & Peeters, 2007). In these paradigms, dysphoric and clinically depressed participants tend to choose the most negative outcome as most likely (Carver, Ganellen, & Behar-Mitrani, 1985; Krantz & Hammen, 1979; Voncken et al., 2003, 2007), and generate more negative interpretations of a vignette (Wisco & Nolen-Hoeksema, 2010). Further, depressed individuals are more likely to endorse negative evaluations of their own performances (Cane & Gotlib, 1985) and rate social interactions as more negative than non-depressed persons (Hoehn-Hyde, Schlottmann, & Rush, 1982).

1.3. Automatic interpretation bias in depression

Theoretically, automatic and reflective interpretive processes are distinguished based on the amount of effort required to process information (Beevers, 2005). In practice, it can be difficult to clearly distinguish these processes, since there is no absolute definition of automaticity (Varga & Hamburger, 2014) and a continuum of automatic responses may be measured across different time scales, often in conjunction. For example, evidence of automatic negative interpretation biases from startle eye-blink responses during an imagery based interpretation task (Lawson, MacLeod, & Hammond, 2002) are adduced from millisecond responses (more automatic time scale) after five seconds of processing time (more reflective time scale). By contrast, fast-paced but more reflective negative biases have been reported from sentence unscrambling under cognitive load, even when participants are allotted several seconds to process each sentence (i.e., three minutes for 20 sentences; Wenzlaff & Bates, 1998). Thus, ideally studies of AIB¹ will use tasks that do not permit extended processing time prior to responses.

Interestingly, initial studies of automatic interpretation biases (AIB) in depression failed to document AIB, with null findings using homophones (Lawson & MacLeod, 1999), ambiguous words (Lawson, MacLeod, & Hammond, 2002; Mogg, Bradbury, & Bradley, 2006), and semantic priming paradigms (Bisson & Sears, 2007; Mogg et al., 2006; Lawson & MacLeod, 1999). However, AIB was subsequently demonstrated in semantic association paradigms (Cowden Hindash & Amir, 2012; Cowden Hindash & Rottenberg, 2017; Möbius, Tendolkar, Lohner, Baltussen, & Becker, 2015; Sears, Bisson, & Lawson, 2011). Semantic association paradigms differ from semantic priming paradigms in that ambiguous information is presented prior to unambiguous, valenced information, and that extended processing of the ambiguous material is not allowed. Further, semantic association paradigms indirectly assess AIB by asking participants to make judgments regarding associations without explicitly asking about their interpretation (Everaert, Podina, & Koster, 2017).

Our work has used semantic association paradigms, repeatedly finding negative AIB in dysphoric individuals (Cowden Hindash & Amir, 2012), particularly with self-referent material (Cowden Hindash & Rottenberg, 2017). Indeed we recently demonstrated that self-relevance was critical to demonstrating AIB in dysphoric individuals: negative AIB was not observed when ambiguous stimuli referred to unknown others, but was found when ambiguous stimuli referred to participants directly (Cowden Hindash & Rottenberg, 2017). The relative success of semantic association paradigms in depression suggests these tasks are promising to target AIB modification in a depressive sample.

1.4. Automatic interpretation bias modification

Computerized bias modification paradigms have effectively modified automatic biases in non-disordered and anxiety disordered samples, including samples with clinically defined social anxiety (Amir, Bomyea, & Beard, 2010; Beard & Amir, 2008; Beard, Weisberg, & Amir, 2011; Amir & Taylor, 2012; Hoppitt et al., 2014), obsessive compulsive disorder (Beadel, Smyth, & Teachman, 2014; Clerkin & Teachman, 2011), acrophobia (Steinman & Teachman, 2014), generalized anxiety disorder (Hayes, Hirsch, Krebs, & Mathews, 2010), and mixed anxiety disorders (Saleemink, Kindt, Rienties, & van den Hout, 2014; see Cristea, Kok, & Cuijpers, 2015; Hirsch et al., 2016; and MacLeod & Mathews, 2012 for reviews). Despite promising evidence that interpretation biases can be modified in anxious samples, the effects of bias modification on symptoms are not as clear-cut, leading to calls for additional basic research before pursuing expensive clinical trials (Cristea et al., 2015; Hirsch et al., 2016).

Now that AIB has been repeatedly demonstrated in depression, one key next step is to examine whether depression-related AIB can be modified (for reviews, see Cristea et al., 2015; Hallion & Ruscio, 2011). Success manipulating slower, reflective interpretive biases within depressive samples suggests that AIB may also be malleable. For instance, an imagery-based interpretation modification paradigm has elicited interpretation bias changes (Blackwell et al., 2015; Holmes, Lang, & Shah, 2009; Lang, Blackwell, Harmer, Davison, & Holmes, 2012). Although these interventions increased positive interpretation biases, depressive symptoms were not reduced over a placebo condition (Blackwell et al., 2015; Holmes et al., 2009; Lang et al., 2012). Similarly, a thinking errors paradigm demonstrated decreased negative interpretations of scrambled sentences after a single training session in a clinically depressed sample (Yiend et al., 2014) but likewise found no decreases in depressed mood or symptoms.

1.5. What is needed in AIB going forward?

Evidence in depressive samples of AIB (Cowden Hindash & Amir, 2012; Cowden Hindash & Rottenberg, 2017; Sears, et al., 2011), modification of other cognitive biases (Joormann, Waugh, & Gotlib, 2015; Yiend et al., 2014), along with evidence that reflective interpretation biases can be modified (Blackwell et al., 2015; Holmes et al., 2009; Lang et al., 2012), set the stage for three logical next steps in the study of AIB and its modification in depression. A first step is to examine whether negative AIB can be reduced among symptomatic individuals in a single session of training. A second step is to ascertain whether reducing negative AIB will generalize to another information processing task, as has sometimes been demonstrated with reflective interpretation bias modifications (e.g., Joormann et al., 2015; Yiend et al., 2014). A third step is to examine the functional significance of reducing negative AIB, particularly examining correlates and outcomes that might plausibly relate to the therapeutic process (e.g., reactivity to stressors; Beard & Amir, 2008; Holmes et al., 2009; Joormann et al., 2015), and could speak to the clinical implications of reducing AIB (Beck & Haigh, 2014; Williams et al., 1988). Findings in one or more of these areas would provide “proof-of-concept” for larger-scale investigations of AIB in depression, including intervention studies.

1.6. Current study

We adapted a semantic association paradigm (Cowden Hindash & Amir, 2012; Cowden Hindash & Rottenberg, 2017) to try to alter AIB in dysphoric individuals during a single training session and to examine the functional consequences of AIB changes. To our

¹ AIB = Automatic Interpretation Biases. Defined as tendency to resolve ambiguity in a specific way, e.g., negative AIB is a tendency to resolve ambiguity in a negative manner.

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