Cognitive Habits and Memory Distortions in Anxiety and Depression

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Abstract

When anxious or depressed people try to recall emotionally ambiguous events, they produce errors that reflect their habits of interpreting ambiguity in negative ways. These distortions are revealed by experiments that evaluate performance on memory tasks after taking interpretation biases into account—an alternative to the standard memory-bias procedure that examines the accuracy of memory for clearly emotional material. To help establish the causal role of interpretation bias in generating memory bias, these distortions have been simulated by training interpretation biases in nondisordered groups. The practical implications of these findings for therapeutic intervention are discussed; future directions are described.

It is fitting to speak of every human cognitive reaction—perceiving, imagining, remembering, thinking and reasoning—as an *effort after meaning*.

Sir Frederick Bartlett (1932, p. 44)

When cognitive psychologists rediscovered Bartlett's work in the 1970s, they were not concerned about the implications of his writing for cognitive phenomena associated with anxiety and depression. And even though the past four decades have seen a steady stream of articles on constructive and reconstructive memory errors, memory experiments conducted with emotionally disordered samples have continued to emphasize accuracy, mainly by measuring how many emotionally positive or negative events are remembered by depressed and anxious research participants, compared to controls. Research on false memories of sexual abuse constitutes one notable exception (see McNally & Geraerts, 2009). More mundane instances of memory distortions are the topic of our research, however, and perhaps there is nothing more mundane than the occurrence of ambiguity. Other people's faces, words, and actions invite "effort after meaning"—interpretations that tend to be more emotionally negative if made by anxious and depressed individuals (see the review by Mathews & MacLeod, 2005). These cognitive habits of interpreting ambiguous events in negative ways provide the basis for distortions when the events are brought to mind subsequently. Sometimes veiled by other research methods, negative memory biases emerge when errors in remembering are examined for evidence of effort after meaning.

Cognitive Habits in Anxiety

Most anxiety disorders are typified by negatively biased attention and interpretation (Mathews & MacLeod, 2005). Potentially threatening events capture and hold the attention of anxious people more readily than do nonthreatening events. Ambiguous events are interpreted as posing threats. In contrast to these consistent findings, many reviews of the literature find little evidence for memory biases (e.g., MacLeod & Mathews, 2004), although there are a few such reports, and a close look suggests a connection between interpretation and recall. In one example, autobiographical recall showed a negative bias when the memories were rated for emotional meaning by the anxious participants themselves but not when they were rated by independent judges (Burke & Mathews, 1992). More generally, evidence for memory bias can be difficult to detect in autobiographical reports, because the meaning of ambiguous events might seem benign to independent raters but threatening to those who experienced them. These possibilities encouraged us to conduct laboratory experiments designed to reveal the dependence of memory bias on interpretation bias.

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Table 1. Invented Endings and Later Recall of Club Scenario[1] by a Control Participant and an Anxious Participant

Response type	Control participant response	Anxious participant response
Invented ending	I nod as a form of greeting, sit down quietly, and wait for the conversation to begin again.	I guess I look pretty weird in the club. I'm not the typical person you'd find at a club.
Scenario recall	While approaching the door, I hear loud conversation. When I enter the room, however, the conversation ends.	When I come in, they all stop and stare at me.
Ending recall	I sit down and wait for the conversation to begin again, and nod to the people there as a form of introduction.	I guess it looks like I don't belong in a club.

Note. [1]Scenario was: You are invited to attend a social at a local club, whose members you don't know very well. As you approach the door you hear loud conversation. When you enter the room, it stops. (Scenario from Mathews & Mackintosh, 2000.)

In Experiment 1 of this effort (Hertel, Brozovich, Joormann, & Gotlib, 2008), individuals diagnosed with generalized social phobia and controls recruited from the local community first imagined themselves as participants in various emotionally ambiguous social scenarios that could be interpreted in negative or threatening ways. After reading each scenario, they invented an ending, and these endings often reflected their resolution of the ambiguity. Table 1 contains an example of one scenario, together with endings produced by a nondisordered participant and by an anxious participant. Later, we requested recall of each scenario in response to the title and first sentence (and, separately, recall of the self-produced ending). As shown in Figure 1, the anxious participants produced a certain kind of error in recalling the scenarios: distortions that incorporated the meaning of their previous, emotionally negative endings. (In the example, the anxious participant recalled reading that, upon entering a local club, the members stopped to stare at him or her.) As is typical, the anxious participants had actually produced more negative interpretations than had the controls (e.g., "I guess I look pretty weird . . . "). Therefore, researchers who are accustomed to thinking in terms of accuracy might view the recall results as having been confounded by differential availability of negative interpretations. The Bartlettian constructivist agrees, because differential availability is actually the point. What socially anxious people recall about ambiguous social events is indeed a result of interpretation bias.

In addition to the availability of negative interpretations, other factors possibly contribute to the production of interpretation-based memory distortions in social anxiety. First, consider the possibility that the anxious participants failed to focus sufficiently on the details of the anxiety-provoking scenarios and later confabulated in attempting to comply with instructions to recall. This possibility is unsupported, because anxious and control participants recalled the same percentage of ideas from the original scenarios, on average, and because overall intrusions in recall were actually (although nonsignificantly) more frequent in the control group. A second possibility is that imagery processes exacerbate the difficulties in isolating memory for the description of the scenario from memory for one's interpretation (source monitoring confusions; see Mitchell & Johnson, 2009). To address this possibility in Experiment 2, we recruited university students who scored low or high on a self-report measure of social
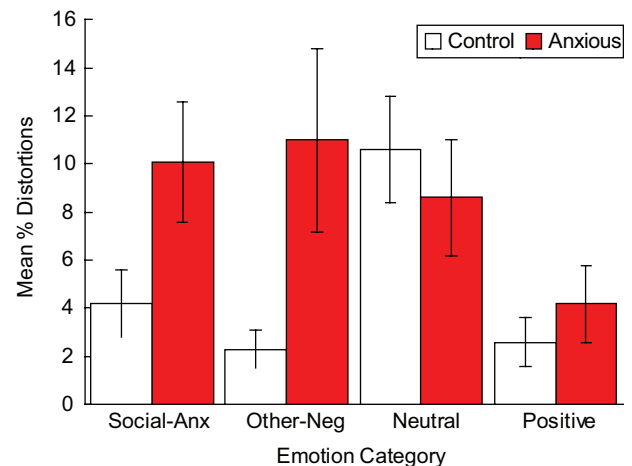
Fig. 1. Mean percentage of recall errors that corresponded to the meaning of the participant-provided endings (distortions) for anxious versus control participants, distributed according to the emotional valence (socially anxious, otherwise negative, neutral, or positive) of the endings. An error was counted when new meaning was added during scenario recall (Hertel, Brozovich, Joormann, & Gotlib, 2008, Experiment 1).

anxiety. We gave them the same task that we used in Experiment 1, with two exceptions: Instead of asking participants to construct endings, we provided negative endings that had been produced by anxious participants in Experiment 1; and we varied instructions for reading the scenarios and endings. In an imagery condition, the students tried to imagine themselves in the situations and rated the vividness of each image; in the closure condition, they considered and rated the degree to which each ending provided closure to the scenario. As seen in Figure 2, nonanxious students who performed the more abstract closure task made fewer distortions based on the negative scenario endings. Together with the previous results, these results suggest that distortions arise from the combination of available negative interpretations and self-involving imagery, operating even for nonanxious students who happen to have negative interpretations at hand and self-focused imaginations.

There is good reason to believe that the anxious students in the closure condition, in spite of their instructions, responded
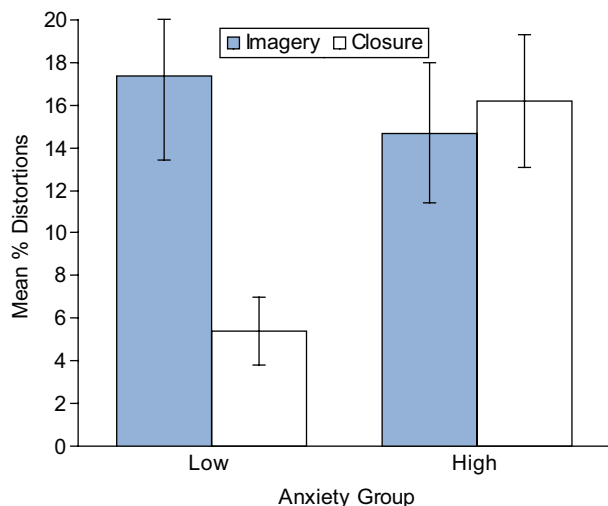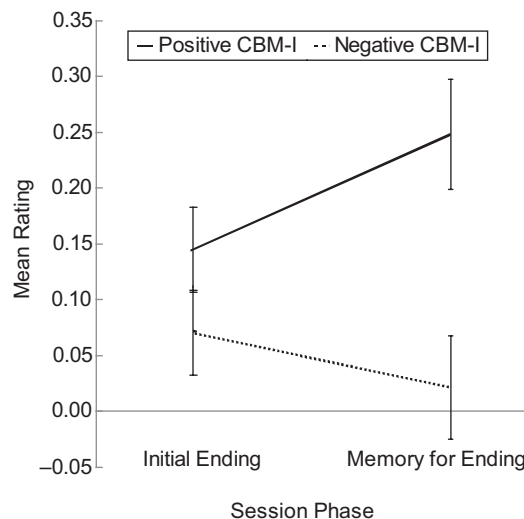
Fig. 2. Mean percentage of recall errors reflecting the meaning of experiment-provided, emotionally negative endings. Students categorized as low or high on a self-report of social anxiety read each scenario either by imagining themselves as the main actor or by deciding whether the ending provided closure to the scenario (Hertel et al., 2008, Experiment 2).

Fig. 3. Mean rating for the emotional valence of the scenario endings constructed before and recalled after training a positive or negative interpretation bias (CBM-I). Ratings could range from −1 (negative) to 1 (positive). The positive training condition produced significant change across phases (Salemink, Hertel, & Mackintosh, in press).

habitually by imagining themselves in the anxiety-provoking situations. Negative self-focused images and interpretations characterize social anxiety (Hirsch, Clark, & Mathews, 2006), and it is a combination of these habits that likely leads to memory distortions of the sort that we found in Experiment 1.

Simulations

Subsequent experiments have used a methodology called cognitive bias modification of interpretation (CBM-I) to simulate the interpretive biases found in naturally occurring emotional disorders. In a typical version of CBM-I (see Mathews & Mackintosh, 2000), nondisordered volunteers undergo a training phase, consisting of many episodes of interpreting emotionally ambiguous events. The task performed while reading about these episodes encourages either predominantly positive or predominantly negative interpretations, and there are built-in checks for the success of the training. In brief, each scenario is emotionally ambiguous until the very last word, which is presented as a fragment; in completing the fragment the participant disambiguates the scenario in a threatening or benign direction. Subsequently, the participants perform a new task, selected to reveal the effects of the bias. In experiments described in this report, the transfer task is one in which we can examine memory distortions of the sort we found for social anxiety. These simulations are important because the experimental manipulation of bias permits causal statements about the effects of interpretation bias—merely measured in anxious samples—on memory for ambiguous events, or more generally on other behaviors, mood states, and even the tendency to develop emotional disorders.

In an experiment by Tran, Hertel, and Joormann (2009), the student volunteers experienced 100 episodes of positive or negative CBM-I. Then they read 20 entirely ambiguous scenarios and rated the degree of similarity between the meaning of each scenario and both positive and negative statements expressing possible interpretations. This task was used to establish the success of interpretation training (see Mathews & Mackintosh, 2000). Finally, the titles of the 20 ambiguous scenarios were used as cues for recalling the scenarios. Independent raters decided whether each recalled scenario contained a distortion of meaning. When it did, they categorized the distortion as emotionally positive, neutral, or negative. As predicted, the pattern of these distortions was congruent with the valence of their training. Positive training produced more positive distortions, similar numbers of neutral distortions, and fewer negative distortions compared to negative training.

The outcome in the experiment by Tran et al. (2009) can be understood as proactive interference of trained interpretation on memory for the scenario, because CBM-I occurred prior to the event to be recalled, much in the same way as the development of an anxiety disorder occurs prior to events that are experienced as threatening by socially anxious individuals. From the perspective of interference paradigms, it is interesting to consider the possibility of retroactive effects of CBM-I, which can be seen as analogous to the question of whether a recently developed anxiety disorder can affect memory for events that occurred previously. If initial interpretation bias is essential to the memory distortion, then we should not expect retroactive effects. Indeed, Salemink, Hertel, and Mackintosh (in press) failed to find such evidence when they interjected

CBM-I between initial exposure to ambiguous scenarios and a subsequent test of scenario recall. On the other hand, these participants misremembered the scenario endings that they constructed in the first phase; they remembered them as having been positive or negative as a function of their CBM-I training condition (see Fig. 3).[1] And because the remembered interpretations showed emotion-related distortions, we might expect that subsequently repeated attempts to remember the scenarios could be distorted in ways that are reminiscent of Bartlett's evidence of reconstructive memory from the method of repeated reproduction. Each recall attempt itself is a new "presentation" of the scenario, and this new presentation would occur together with the biased memory for the ending; later attempts to recall might thereby produce evidence of interpretation-based distortion. This possibility awaits empirical support.

Cognitive Habits in Depression

Memory biases in depression are among the best-established phenomena in clinical cognition (see Mathews & MacLeod, 2005). Emotionally negative events are better recalled by depressed people and positive events are less well recalled, compared to controls, especially following self-referential judgments made about the material. Moreover, this pattern of accuracy is consistent with the well-documented habit of rumination about negative events related to the self (e.g., Lyubormirsky, Caldwell, & Nolen-Hoeksema, 1998). To capture the relations among rumination, interpretation bias, and subsequent recall, Hertel and El-Messidi (2006) recruited dysphoric and nondysphoric college students and asked them to perform a series of tasks. First, Nolen-Hoeksema's thought-induction task was used to establish a ruminative pattern of thinking in one condition (self-focused) and a distracting pattern in another (other-focused). Following bogus tasks to disguise the purpose of the experiment, the experimenter asked participants if they could spare a few more minutes to freely associate to words in a pilot study. Among the words were homographs with personal and impersonal meanings (e.g., "blue," "stable," "bitter"), and the speeded responses indicated the direction of interpretation (e.g., sad vs. green in response to "blue"). Finally, participants were asked to recall the cues for free association. El-Messidi scored the percentage of homographs recalled according to whether they had been interpreted personally or impersonally. Recall of impersonally interpreted homographs did not differ according to dysphoria or the thought-induction condition. But recall of personally interpreted homographs benefited from prior rumination and only in the dysphoric group (see Fig. 4). If interpretations are not taken into account, this consequence of rumination goes unnoticed. Ruminative thinking produces other effects such as the elevation of negative mood and increased recall of negative autobiographical memories—the latter perhaps aided by interpretation bias—in depressed samples only (Lyubormirsky et al., 1998). Thus, the cognitive habit of rumination has special consequences for memory in depression.

An experiment that comes close to examining depression-related distortions in memory as a consequence of
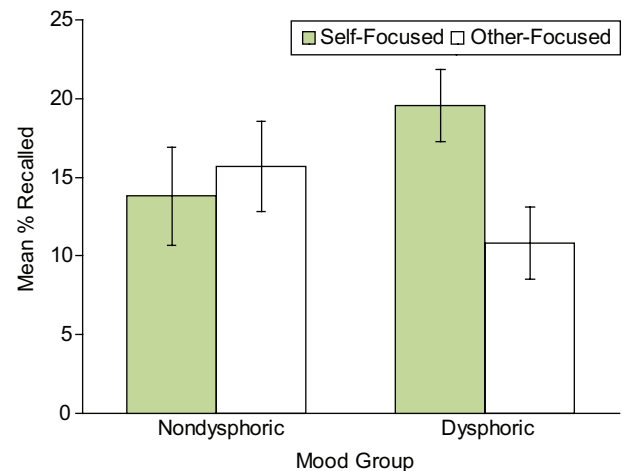
Fig. 4. Mean percentage of homographs recalled when the homographs had been previously interpreted to have personal meaning. Means are presented according to the condition of dysphoria and according to whether the thought-induction task at the outset of the session had been self-focused or other-focused. Percentages recalled when the homographs had been interpreted impersonally did not differ significantly according to presence or absence of dysphoria or according to type of thought induction (Hertel & El-Messidi, 2006).

interpretation biases was reported recently by Joormann, Teachman, and Gotlib (2009). These investigators found higher levels of false recall of emotionally negative concepts in a group of participants diagnosed with major depressive disorder. Participants falsely recalled nonpresented lures that were associated with presented words in the same conceptual category. According to our analysis, a ruminative habit should exaggerate this sort of evidence of false recall, and the thought-induction procedures invented by Nolen-Hoeksema and her colleagues offer a method for investigating this possibility. Because they direct thought patterns in ways that mimic naturally occurring rumination but permit conclusions about the effects of habit on subsequent tasks, thought-induction procedures have a lot in common with CBM procedures.

Future Directions and Clinical Implications

Most CBM-I research is conducted under the assumption that a habit is being trained and that, upon the occurrence of future ambiguous episodes, the research participant simply and without any special awareness responds automatically in the new habitual way. Clearly, this "transfer" performance itself recruits memory processes, and an important question is whether memory operates in the sort of automatic or habitual way typically assumed or whether the individual consciously considers similar past experience during the transfer task. Some of our current research uses the process-dissociation procedure (Jacoby, 1991) to estimate the separate contributions of automatic and consciously controlled processes to performance in

CBM-I transfer tasks. Knowing about the basis of the transfer has important implications for clinical application.

More generally, knowing about the causal status of cognitive habits makes it possible to propose treatment plans, considered by some researchers to be the ultimate goal of CBM investigations (see MacLeod, Koster, & Fox, 2009). Individuals with negative interpretation biases should benefit from CBM-I programs that are relevant to their idiosyncratic concerns. Repeated sessions of CBM-I training has reduced social anxiety (e.g., Beard & Amir, 2008), and this technique might be particularly helpful for clients who resist exposures in therapy. More relevant to our concerns, however, is the possibility that training efforts can facilitate neutral or positive memories by avoiding distortions related to naturally occurring biases. During cognitive behavioral therapy, clients are encouraged to use benign memories as evidence when they generate prospective thoughts and engage in proactive behaviors. In this regard, it seems important to understand the degree to which habit or reflection or both are responsible for transfer effects. Reliance on controlled reflection is ill advised for some emotional disorders (e.g., depression). In fact, concerns about deficits in cognitive control suggest that future efforts should also be focused on the training of source discrimination—the practice in telling the difference between an actual experience and one's own interpretation of that experience (see Mitchell & Johnson, 2009).

In conclusion, we note that a habit-oriented approach to understanding memory and other cognitive phenomena associated with emotional disorders might be more informative in the long run than are traditional diagnostic procedures. Various emotional disorders have similar patterns of dysfunctional cognitive habits that often can be treated in similar ways. Indeed, Barlow and colleagues (Allen, McHugh, & Barlow, 2008) have begun implementing a "unified treatment protocol" for emotional disorders to address common patterns of thoughts and behaviors across disorders. To the list of accruing similarities between anxiety and depression, our research suggests the addition of memory distortions that reflect individual habits of thought.

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Mathews, A., & MacLeod, C. (2005). (See References). A review of the literature on cognition in emotional disorders.

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Note

1. Because mood did not change significantly in the direction of the trained bias, distorted memory for prior interpretations cannot be attributed to a general affective shift.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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