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Cognition in Emotional Disorders: An Abundance of Habit and a Dearth of Control

Paula Hertel

Emotional and other psychological disorders are categories of experience identified at least in part by the goal of having treatment plans for people in distress. Because the categories exist for such purposes, research efforts are organized to discover distinctions among the categories and between disordered and nondisordered individuals. Many of these distinctions are cognitive. When clinical scientists began experimental studies, the term "cognitive" had been used to refer primarily to conscious thoughts that characterize disorders (see Beck, 1976), but in more recent decades the term signifies an experimental approach framed according to the theories and paradigms of cognitive psychology. In honor of Larry Jacoby's contributions to cognitive psychology, this essay first describes experimental evidence regarding the cognitive habits of anxious and depressed individuals—habits that are quite similar across the disorders. Attention, interpretation, and memory tasks reveal negative biases that reflect well practiced tendencies. Next, the essay briefly reviews the results of recent efforts to modify negative biases. I argue that attempts to overcome habits via controlled procedures or by external constraints seem to be less successful than attempts to develop new habits. In depression, at least, habits are accompanied by difficulties in mustering opposition to them. Ultimately, the next important step in understanding cognitive contributions to emotional disorders is to take a more process-analytic approach. Toward the end of the essay I show how process-dissociation procedures (Jacoby, 1991) can be used to investigate the basis for clinically relevant change.

Cognitive Habits in Emotional Disorders

The term "habit" is least presumptively used to refer to a pattern of behavior that can be repeatedly and differentially observed in the behavior of those who are able to emit it. Some people show the pattern and others do not. We might identify a habit of going for an early-morning walk, for example, but not a habit of walking. Cognitive habits in anxiety and depression might be experienced on an individual level as habits of thinking specific, identifiable thoughts, such as the contents of rumination about a recent failure, but I use the term *habit* more abstractly to refer to tendencies to attend, interpret, and remember in ways that are qualitatively biased by the nature of the emotional disorder (see Hertel, 2004). Such habits, like the early-morning walk, are implicitly viewed as being initiated nondeliberately. One just dresses and heads out the door, although one is capable of doing otherwise. Similarly, someone who is socially anxious is inclined to interpret social ambiguity in a negative and personal way, although she can see the alternative interpretation when asked to consider it. The extent to which cognitive habits are automatic in the sense of being difficult to interrupt has been a topic of theoretical concern (see Mathews & MacLeod, 2005). However, to the extent that habits arise from practice, through different experiences they should be subject to interruption and change (see Bouton, 2000).

Biases in Attention and Interpretation

In the literature on cognition in emotional disorders, evidence of biased attention is revealed by the anxiety-specific capture of attention by threatening events—words, faces, pictures, actual spiders and snakes—and the subsequent delay in disengaging attention from those events (e.g., Fox, Russo, Bowles, & Dutton, 2001; MacLeod, Mathews, & Tata, 1986; Rinck & Becker, 2006). In a different cognitive domain, ambiguity is more often lost on the

anxious individual, who typically takes the negative view (e.g., Eysenck, Mogg, May, Richards, & Mathews, 1991). Negative interpretation biases are revealed when, for example, socially phobic individuals see an acquaintance's frown as an expression of displeasure instead of effortful thought or puzzlement, or when the ambiguity inherent in hypothetical situations is resolved in socially phobic directions (e.g., Stopa & Clark, 2000). Because alternative interpretations fail to come to mind spontaneously, such resolutions are treated as habitual when they are discussed in clinical contexts (Brozovich & Heimberg, 2008).

Biases in attention and interpretation are implicitly viewed as automatic partly because they are seen as emerging from cognitive mechanisms not readily available to introspection (MacLeod & Mathews, 2012). This point of view was expressed early on in clinically-oriented cognitive research through the emotional Stroop paradigm (see the review by Williams, Mathews, & MacLeod, 1996). In the traditional Stroop task, word reading is considered to be automatic due to practice; the reading habit slows color naming of color words when the word and its color are incongruent, and the difficulty in overriding this habit is an example of deficient cognitive control. Similarly, in the emotional variant of the task, slowed responses in naming the color of emotionally negative words is an expression of a habit to attend to meaning emerging in spite of its irrelevance and one's intention. Greater interference from spider words by spider phobics illustrates this sort of attentional bias. By reasoning that performance on any task rarely reveals the operation of a unitary process, Lindsay and Jacoby (1994) showed that different task manipulations independently affected estimates of word reading (the habitual process) and color naming (the controlled process). So too it might be true of emotionally disordered biases on the Stroop task, as well as on other tasks designed to measure interpretation biases. For example, we might examine habitual and controlled components of the interpretation of ambiguity in social

situations. Process-analytic investigations would be useful in acquiring knowledge in these domains.

There is also evidence of emotional Stroop effects in depression (e.g., Gotlib & McCann, 1984), perhaps because depressed participants are often anxious. In keeping with our common sense that anxious people are vigilant, anxiety seems more clearly associated with attentional biases. Other cognitive paradigms for investigating biases that seem "vigilant" have also revealed anxiety-related biases more clearly than depression-related biases (see Mathews & MacLeod, 2005). An early influential framework developed by Williams, Watts, MacLeod, and Mathews (1997) distinguished between anxiety-related attention and interpretation biases and depression-related biases involving more controlled procedures, such as elaboration, mainly because the most frequently observed cognitive bias in depression had emerged on tests of deliberate recall. This distinction between anxiety and depression, however, might not be best conceived as a distinction between biases in automatic and controlled processes, but instead as a reflection of the type of cognitive pattern that characterizes the phenomenology of the disorder. The nature of the pattern most frequently found in depression is rumination—a habit of repetitively attending to past events that are emotionally related to one's personal concerns (see Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). This pattern is likely to be more compatible with procedures invoked by recall and other tasks with a backward focus than with tasks sensitive to vigilance. In keeping with this analysis, rumination-related biases in maintaining attention to a variety of previously presented negative stimuli have been documented in recent years (see the reviews by Teachman, Joormann, Steinman, & Gotlib, 2012; Whitmer & Gotlib, 2012). For example, rumination is associated with difficulty in ignoring emotionally negative words that were recently attended but are no longer relevant (Joormann & Gotlib, 2008) and in

refreshing attention to neutral words previously encountered in the context of negative words (Bernblum & Mor, 2010).

Rumination is similar to worry, the self-reported repetitive thinking associated with anxiety. The difference between the two is whether attention is focused on the past (in rumination, e.g., *Why did she leave me?*) or on the present and future (*Where is the spider now? How will I ever get a job?*). In both cases, the thought is typically initiated in the absence of attention-demanding external stimuli. When the external world is uneventful, subsets of both depressed and anxious people tend to engage in repetitive thinking and often not in a deliberate, controlled fashion. Instead, like intrusive memories, the repetitive thoughts crowd consciousness without being sought and sometimes in spite of efforts to think otherwise. Thus, in a pattern similar to experimentally examined biases, the self-reported experiences of rumination and worry seem to qualify as cognitive habits (Hay & Jacoby, 1996), each time initiated no more intentionally than the capture of attention by a negative face.

Deficient Cognitive Control

The notion of a cognitive habit aligns, although imperfectly, with automaticity in cognitive operations (see Moors & de Houwer, 2006). At the other end of the automaticity continuum, cognitive control sits in opposition to habit, and it does so in the very real sense that control seems to be the way out of a maladaptive habit. A consideration of control-related aspects of cognition in emotional disorders is therefore important.

Although anxious individuals are typically not impaired on tasks requiring control, the act of worrying itself is a challenge to control especially for those who habitually worry (e.g., Hayes, Hirsch, & Mathews, 2008). In the experiment by Hayes et al., high and low worriers performed a primary task of thinking about a current worry topic or a positive topic while also

periodically pressing a "random" key on a keypad. (This is a version of the dual task method developed by Baddeley, 1966, to measure residual working memory capacity.) The high worriers who thought about the worry topic were less random in their patterns of key presses than the other three conditions, with the latter producing similar patterns. So even though worry is habitual in its manner of initiation, the engaged habit demands attention and probably enjoys precedence over other controlled procedures when temptations to worry are great.

Depression is frequently associated with impaired performance on tasks invoking controlled procedures (see Hertel, 2004; Joormann & Gotlib, 2010). We know that cognitive control is implicated, partly on the basis of corroborating neural evidence (e.g., Disner, Beevers, Haight, & Beck, 2011; Hamilton et al., 2011; Vanderhasselt et al., 2012) but also because difficult tasks can be accomplished just as well by depressed people if attention is guided and constrained to the task at hand. In fact, depression-related differences can disappear if opportunities for rumination are avoided. Perhaps the first clear evidence of these claims was obtained in a memory experiment in which I varied the task performed during a 7-min interval between study and test (Hertel, 1998). Dysphoric students (who self-report depression but are likely also anxious) performed a rumination-induction task or a distraction task, or they simply waited with nothing to do but think. The subsequent fragment-completion test used process-dissociation procedures (Jacoby, 1991) to estimate automatic and controlled components of memory for the studied words. No effects on the automatic component were found. Instead, with estimates of controlled recollection as the measure, dysphoric students who waited during the interval performed similarly to those encouraged to ruminate and less well than the nondysphoric controls in both conditions (see Figure 1). This outcome encourages the conclusion that "uninstructed" rumination occurs during unfilled periods and carries forward to disrupt

subsequent cognitive control. In this way, rumination is not merely a method of dividing attention while performing a simultaneous task; the potential consequences are ongoing. Moreover, the results of this experiment also support the hypothesis that controlled procedures are not *necessarily* impaired in depressed states, because no deficit was found in the distraction condition.

My colleagues and I have also found rumination-related deficits in the free recall of verbal material when attention during their initial exposure was not well constrained by the task; we eliminated the deficit in a condition that provided such constraint by requiring a response at the end of each learning trial (Hertel, Benbow, & Geraerts, 2012). Interference with controlled procedures also emerges in experiments on suppression-induced forgetting (e.g., Hertel & Gerstle, 2003). After learning emotionally valenced cue-target pairs by forming self-relevant images, students practiced cued recall of some targets and cued suppression of others; still other cues were reserved to serve as baseline on a final cued-recall test in which participants were encouraged to recall all targets to all cues, regardless of previous practice. Self-identified ruminators produced a smaller suppression effect on recall, regardless of their depression scores. Suppression practice in this paradigm (think/no-think; Anderson & Green, 2001) demands self-control of attention via the brute-force technique of staring at the cue while not allowing the target to come to mind. Subsequent experiments (e.g., Joormann, Hertel, LeMoult, & Gotlib, 2009) found that depression-related deficits in forgetting materials with negative meaning could be reduced or eliminated by the provision of thought substitutes to aid suppression. Thus, experimentally provided strategies or task constraints can be used successfully to overpower the habit of rumination and thereby benefit performance on tasks that typically rely on cognitive control.

Recall tasks are also affected qualitatively by cognitive habits in emotional disorders. Although negatively biased recall is rarely found in anxiety, it can emerge when the interpretation of ambiguity is taken into account. In an experiment performed with individuals diagnosed with Generalized Social Phobia (GSP) and nondisordered volunteers from the community, my colleagues and I showed that the recall of socially ambiguous scenarios contained intrusions that were consistent with the manner in which the scenarios had initially been interpreted (as revealed by their continuation sentences; Hertel, Brozovich, Joormann, & Gotlib, 2008). Intrusions were not more numerous in the GSP group; they were simply more socially anxious in meaning, and that outcome was likely a direct result of the well-documented habit for individual with social anxiety to spontaneously create distorted mental images (see Hirsch, Clark, & Mathews, 2006). In a subsequent experiment we presented the same scenarios together with continuations produced by the GSP participants in the previous experiment to nonanxious students who were instructed either to form an image of each scenario and its continuation or to judge the extent to which the continuations provided closure. Later the students recalled the scenarios separately from the continuations. Even these nonanxious students produced socially anxious intrusions in scenario recall, but only in the imagery condition. In short, the event as interpreted is the event remembered. Therefore, any controlled attempt to recall the actual scenario (and combat the habit) will not succeed if ambiguity is resolved during initial encounters and source information is lost through imagining the event combined with its interpretation. The finding of memory bias in anxiety is atypical in the lab, but interpretation-biased intrusions are probably common in the experience of the socially anxious person. Our demonstration once again illustrates the importance of considering the match between the type of

bias and the type of phenomenological habit, instead of sorting biases according to the degree of automaticity or control involved in the task.

Changing Cognitive Habits in Emotional Disorders

Cognitive biases of the sort described thus far can be considered *bad* habits, because they have undesirable consequences. Remembering (wrongly) that someone has insulted you, for example, causes you to interact with that person in ways that do not promote good will. In fact, attention and interpretation biases contribute causally to the development and maintenance of emotional disorders (see Hertel & Mathews, 2011). Some clinical psychologists therefore seek to change biases through the practice of cognitive-behavioral therapy. The directive of telling someone not to engage the habit (e.g., *quit biting your fingernails; don't think negative thoughts*) typically does not work, particularly when cognitive control is impaired. Moreover, efforts to train control generally have not been successful beyond the narrow limits of the training task (see Shipstead, Redick, & Engle, 2012). Another option, illustrated above, is to construct external supports for circumventing the effects of such habits on ongoing and subsequent tasks that typically require control. Although experimental demonstrations of the benefits of thought substitutes and task constraints are useful in understanding the phenomena, they are rarely practical from a therapeutic point of view. In a way, they are like wearing gloves to prevent fingernail biting—successful but awkward to institute. A final alternative is to consider that bad habits are modifiable by the same means that developed them in the first place: practice. If habits are conditioned by experience they can become counterconditioned by new experience, albeit with limited degrees of generalization (Bouton, 2000).

Cognitive Bias Modification

The impetus for research on cognitive bias modification (CBM) was the chance that modification would reveal the causal connection between cognitive biases and the development or maintenance of the emotional disorder in question (see reviews by Hertel & Mathews, 2011; MacLeod & Mathews, 2012). In the manner of the methodological tradition practiced in the Jacoby lab, CBM experiments are designed to understand the cognitive components by "pushing around" potential causes. A variety of training tasks provide repetitive experience to constrain attention or interpretation in either a negative or benign direction and produce training-congruent outcomes on near-transfer tasks—very similar subsequent tasks in which responding (attending or interpreting) is not constrained. If participants are trained to focus on the more negative of two simultaneously presented words, for example, by responding to a dot probe that consistently replaces the negative alternative, the transfer task might also present such words followed by probes replacing each type equally often. Shorter probe-response latencies during the transfer task typically are training-congruent. Some experiments have shown transfer effects days or even months following training. Therefore, new habits of attending and interpreting ambiguity can be achieved, and some of these have memorial consequences. For example, Tran, Hertel, and Joormann (2011) performed a CBM version of the memory-intrusion experiment described previously in this essay (Hertel et al., 2008). During training, participants were led to complete ambiguous scenarios in either consistently benign or negative directions. The transfer scenarios remained ambiguous, and participants invented endings for them. Subsequently, we observed training-congruent intrusions when we asked them to recall the transfer scenarios.

Typical CBM experiments vary the emotional valence of training, but other CBM procedures have targeted the nature of processing. Holmes, Lang, and Shah (2009) trained

positive resolutions of ambiguous situations via mental-imagery or verbal-comprehension instructions and ratings. Imagery produced better transfer. Watkins, Baeyens, and Read (2009) trained dysphoric participants to make concrete instead of typically abstract construals of potentially negative events by focusing on specific, distinctive aspects. They subsequently showed a reduction in negative interpretations, compared to control groups. These two sets of experiments, moreover, produced training-congruent effects on far-transfer tasks designed to reveal negative emotional reactions (also see Wilson, MacLeod, Mathews, & Rutherford, 2006). The imagery participants in the experiments by Holmes et al. were less affected by a later procedure for inducing negative mood; Watkins et al.'s participants with concrete training experienced reduced depressive symptoms a week later. Understanding the conditions for establishing far transfer is crucial to linking cognitive biases with emotional disorders. Even so, knowing more about the processes responsible for near transfer is also high on the agenda. In short, it is not enough to show that you can produce either type of transfer; understanding the component processes is central to a cognitive account of emotional disorders.

Cognitive Habit Modification?

The study of transfer has a long history in experimental psychology (see Ellis, 1965)—a history possibly useful in understanding the issues important to CBM. A conditioning perspective on CBM, for example, might invoke an examination of the conditions that affect generalization and discrimination in transfer. To the memory researcher, performance on near-transfer tests are like other tests of the effects of prior experience, even though the effect is not one of producing a specific response from the past, but instead a general tendency. Responses on near-transfer tasks, like memory tasks, can reveal effects of proactive facilitation or interference (Postman, 1962). Next, I describe experiments that used process-dissociation procedures (e.g.,

Jacoby, Debner, & Hay, 2001) to investigate the possible automatic and controlled bases of proactive interference established by CBM. Automaticity issues are frequently raised in research documenting biases related to emotional disorders, and they are at least as pertinent to their modification. Do training procedures truly push around habits—as is implied by typical descriptions of CBM effects—or do these effects occur by impairing recollective use of training-incongruent outcomes? Both possibilities have their clinically relevant counterparts.

The procedure used in the first two experiments (Hertel, Vasquez, Benbow, & Hughes, 2011) consisted of three main phases. Phase-1 training trials presented approximately 100 scenarios describing everyday situations with the possibility but not the certainty of negative outcomes. Each one was missing a final word that, upon completion, would resolve the ambiguity regarding negativity. Participants imagined themselves in the scenario and were instructed to have a completion word in mind before pressing the spacebar to reveal a word fragment. They were instructed to complete the fragment as quickly as possible. Here is an example:

> You are flying to Florida with your family for a holiday in the sun. You notice a man sitting alone in the row behind you, opening a package. As the paper is removed you see something that looks like a:

Depending upon the training condition (benign or negative), the fragment for this example was either *bo-k* or *bo-b* (to be completed as *book* or *bomb*). Fragments used to resolve ambiguity in the large majority of scenarios in these experiments were consistently benign or negative (or they resolved nonambiguous and nonthreatening scenarios in a control condition). This training phase duplicated the materials and procedures of many other CBM experiments. The last block, however, departed from the typical paradigm in containing 6-8 resolutions of each type

(appropriately counterbalanced). We thought of this block as Phase 2 and set it apart from the main training phase through instructions to pay careful attention, because questions would later occur. More importantly, these scenarios were unique in theme, and each one had a counterpart in the transfer test to come in Phase 3. For example, the babysitting theme was represented by the following scenarios:

> [Training]: You have agreed to baby-sit while your neighbor goes out for the evening. You have put their daughter to bed but she takes some time to settle down. An hour later you go in to check on her and find she is no longer:
>
> *cr-ing* or *c-nsc-ous* [*crying* or *conscious*]
>
> [Test]: A neighbor asks you to look after her little girl while she visits a friend in the hospital. The five year old cries when her mother leaves but then seems happy to play alone in your garden. After ten minutes you go out and she is:

The task on these test trials in Phase 3 was a choice between two completions; in the preceding example the alternatives were *fine* and *gone*. These choices in the two experiments by Hertel et al. (2011) were made according to inclusion and exclusion instructions from process-dissociation procedures (Jacoby, 1991).

On some test trials (inclusion) participants were instructed to respond in the same way as they had responded to the training counterpart within the theme, and on others (exclusion) they were instructed to remember the resolution of the training counterpart and to respond differently. Instructions were given by color coding in Experiment 1 and by the single words *same/different* in Experiment 2. Accurate responding on inclusion trials and inaccurate responding on exclusion trials were used to obtain estimates of habit and controlled recollection (Jacoby, 1991). The main outcome of both experiments—one performed with nonanxious and the other with anxious

students—occurred as a result of benign training; repeated experience in reaching benign resolutions of potentially threatening situations proactively interfered with the recollection of the more recent negative resolutions. If benign training is considered to be allegorical to the experience of nonanxious people, the moral of this story is something like: Nonanxious people are unaffected by occasional threatening experiences because they have trouble deliberately bring them to mind. This is an understandable but odd outcome, because a person's typical phenomenology is not one of trying to remember past similar outcomes in order to respond differently (although it is the case that exclusion instructions seem to capture what therapists might ask their anxious clients to do). Moreover, we found no effects of training on estimates of habit—an outcome that belied common assumptions about the underlying mechanisms of CBM. In retrospect, the effects on estimates of controlled recollection and not on estimates of habit might have occurred precisely *because* our exclusion instructions emphasized the controlled opposition to habit.

In a subsequent experiment (Hertel, Holmes, & Benbow, 2013), we took a different approach to arriving at estimates of habit and control. The general procedure was much the same as in the prior experiments, but the test phase differed. This time we instructed participants to respond as they had to a situationally similar scenario on all test trials, and we used congruence and incongruence between the Phase-1training condition and the nature of the resolutions in the final training block (Phase 2) as our method for expressing the equations used for estimates (see Jacoby et al., 2001). For example, benignly trained participants would correctly choose a benign resolution at test to the extent that they recollected the benign completion of the analog in the final block or, in the absence of recollection, to the extent that a benign habit had been trained. These same participants should incorrectly choose a benign resolution at test to the extent of

their "rose colored" habit (possibly established in Phase 1) in the absence of recollection of the actual negative resolution. (If they had recollected the negative resolution, they would choose it at test.) The equations corresponding to these two assumptions permit estimates of habit and control. We believed that this method would reveal training effects on estimates of habit because it avoids the use of exclusion instructions with their heavy emphasis on cognitive control.[1]

Figure 2 shows the mean estimates of habit and controlled recollection that contributed to responding on test trials in this new experiment. Estimates of control were much lower than in the previous experiments, although they were significantly above zero in the training conditions, and they did not differ according to training. Instead, estimates of habit in responding with benign choices were higher in the benign training condition than in the other two conditions. Benign training therefore proactively facilitated the habitual basis of benign choices on the transfer test, and because choices of negative resolutions were reciprocal to benign choices (and always are in the real world) benign training caused proactive interference with the habit of choosing threatening outcomes. Figure 2 also presents the mean proportion of responses on test trials where participants were forced to guess about how to respond on the transfer test (because situationally similar scenarios were missing from training). These trials were therefore typical of CBM transfer trials. The correspondence of habit estimates to guessing proportions bolstered our conclusions about the habitual basis of training in typical CBM experiments. Taken together, these three experiments indicated that benign training can operate on habit or controlled use of prior experience, depending upon whether control is emphasized by the transfer task. In both cases, benign training proactively interferes with a negative bias.

[1] We also assumed that procedures with exclusion instructions also place a heavy emphasis on control during inclusion trials, when exclusion and inclusion trials are randomized (see Jacoby, Shimizu, Velanova, & Rhodes, 2005).

These outcomes constitute good news for clinical applications. But they are merely the first steps to a fuller understanding that could be achieved by developing more process-analytic procedures in examining the development and maintenance of biases and their habitual bases—and the first steps in constructing new methods for modification. The experiments using process-dissociation procedures necessarily assumed that habit and control operate independently in transfer situations (see Yonelinas & Jacoby, 2012). Surely there are other assumptions about how processes combine to affect performance in clinically relevant cognitive tasks and other ways to oppose and therefore isolate the processes involved. One might surmise, however, that issues of habit and control will always be important, due to the very real fact that cognitive features of emotionally disorders are habitually maladaptive and therefore tempt clients and therapists to find methods to control them.

More generally, cognitive bias modification continues to be developed as a possible treatment plan for individuals diagnosed with emotional disorders. Clinical researchers involved in this development do not seem to believe that any one instantiation of CBM will ever stand alone. Instead, CBM research illustrates ways in which empirically based treatments—such as components of cognitive behavioral therapy—can become better informed by basic research in cognitive or behavioral psychology, not merely because there is evidence of efficacy for the treatment but because they emerge from a more fundamental understanding of the processes involved in establishing and maintaining the disorders in the first place. CBM pushes around those processes.

References

Anderson, M. C., & Green, C. (2001). Suppressing unwanted memories by executive control. *Nature, 410*, 366-369.

Baddeley, A. D. (1966). The capacity for generating information by randomization. *Quarterly Journal of Experimental Psychology, 18,*119–129.

Beck, A.T. (1976). *Cognitive therapy and the emotional disorder*. New York, NY: International Universities Press.

Bernblum, R., & Mor. N. (2010). Rumination and emotion-related biases in refreshing information. *Emotion, 10*, 423-432.

Bouton, M. (2000). A learning theory perspective on lapse, relapse, and the maintenance of behavior change. *Health Psychology, 19*, 57–63.

Brozovich, F., & Heimberg, R. G. (2008). An analysis of post-event processing in social anxiety disorder. *Clinical Psychology Review, 28*, 891-903.

Disner, S. G., Beevers, C. G., Haigh, E. A. P., & Beck, A. T. (2011). Neural mechanisms of the cognitive model of depression. *Nature Reviews, 12*, 467-477.

Fox, E., Russo, R., Bowles. R., & Dutton. K. (2001). Do threatening stimuli draw or hold attention in subclinical anxiety? *Journal of Experimental Psychology: General, 130,* 681-700.

Ellis, H.C. (1965). *The transfer of learning*. New York, NY: Macmillan.

Eysenck, M., Mogg, K., May, J., Richards, A., & Mathews, A. (1991). Bias in interpretation of ambiguous sentences related to threat in anxiety. *Journal of Abnormal Psychology, 100,* 144-150.

Gotlib, I. H., & McCann, C. D. (1984). Construct accessibility and depression: An examination of cognitive and affective factors. *Journal of Personality and Social Psychology, 47,* 427-439.

Hamilton, J. P., Furman, D. J., Chang, C., Thomason, M. E., Dennis, E., & Gotlib, I. H. (2011). Default-mode and task-positive network activity in major depressive disorder: Implications for adaptive and maladaptive rumination. *Biological Psychiatry, 70*, 327-333.

Hay, J. F., & Jacoby, L. L. (1996). Separating habit and recollection: Memory slips, process dissociations, and probability matching. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22,* 1323-1335.

Hays, S., Hirsch, C., & Mathews, A. (2008). Restriction of working memory capacity during worry. *Journal of Abnormal Psychology, 117,* 712-717.

Hertel, P. T. (1998). Relation between rumination and impaired memory in dysphoric moods. *Journal of Abnormal Psychology, 107,* 166-172.

Hertel, P. T. (2004). Memory for emotional and nonemotional events in depression: A question of habit? In D. Reisberg & P. Hertel (Eds.), *Memory and emotion (pp. 186-216)*. New York: Oxford University Press.

Hertel, P. T., Benbow, A., & Geraerts, E. (2012). Brooding deficits in memory: Focused attention improves subsequent recall. *Cognition and Emotion. 26*, 1516-1525.

Hertel, P. T., Brozovich, F., Joormann, J., & Gotlib, I. H. (2008). Biases in interpretation and memory in Generalized Social Phobia. *Journal of Abnormal Psychology, 117*, 278-288.

Hertel, P. T., & Gerstle, M. (2003). Depressive deficits in forgetting. *Psychological Science, 14,* 573-578.

Hertel, P. T., Holmes, M., & Benbow, A. (2013). Interpretive habit is strengthened by cognitive bias modification. *Memory.* DOI:10.1080/09658211.2013.820326

Hertel, P. T., & Mathews, A. (2011). Cognitive bias modification: Past perspectives, current findings, and future applications. *Perspectives on Psychological Science, 6,* 521-536.

Hertel, P. T., Vasquez, E., Benbow, A., & Hughes, M. (2011). Recollection is impaired by the modification of interpretation bias. *Journal of Abnormal Psychology, 120,* 902-910.

Hirsch, C., Clark, D., & Mathews, A. (2006). Imagery and interpretations in social phobia: Support for the combined cognitive biases hypothesis. *Behavior Therapy, 37,* 223–236.

Holmes, E.A., Lang, T.J., & Shah, D.M. (2009). Developing interpretation bias modification as a "cognitive vaccine" for depressed mood—Imagining positive events makes you feel better than thinking about them verbally. *Journal of Abnormal Psychology,118*, 76–88.

Jacoby, L.L. (1991). A process dissociation framework: Separating automatic from intentional uses of memory. *Journal of Memory and Language, 30*, 513–541.

Jacoby, L. L., Debner, J. A., & Hay, J. F. (2001). Proactive interferences, accessibility bias, and process dissociations: Valid subjective reports of memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 27*, 686-700.

Jacoby, L. L., Shimizu, Y., Velanova, K., & Rhodes, M. G. (2005). Age differences in depth of retrieval: Memory for foils. *Journal of Memory and Language, 54*, 493-504.

Joormann, J., & Gotlib, I. H. (2008). Updating contents of working memory in depression: Interference from irrelevant negative material. *Journal of Abnormal Psychology, 117*, 182-192.

Joormann, J., & Gotlib, I. H. (2010). Cognition and depression: Current status and future directions. *Annual Review of Clinical Psychology, 6*, 285-312.

Joormann, J., Hertel, P. T., LeMoult, J., & Gotlib, I. H. (2009). Training forgetting of negative material in depression. *Journal of Abnormal Psychology, 118,* 34-43.

Lindsay, D. S., & Jacoby, L. L. (1994). Stroop process dissociations: The relationship between facilitation and interference. *Journal of Experimental Psychology: General, 20,* 219-234.

MacLeod, C., & Mathews, A. (2012). Cognitive bias modification approaches to anxiety. *Annual Review of Clinical Psychology, 8,* 189-217.

MacLeod, C., Mathews, A., & Tata, C. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology, 95*, 15–20.

Mathews, A., & MacLeod, C. (2005). Cognitive vulnerability to emotional disorders. Annual Review of Clinical Psychology, 1, 167–195.

Moors, A., & De Houwer, J. (2006). Automaticity: A theoretical and conceptual analysis. *Psychological Bulletin, 132*, 297–326.

Nolen-Hoeksema, S., Wisco, B.E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science, 3*, 400–424.

Postman, L. (1962). Transfer of training as a function of experimental paradigm and degree of first-list learning. *Journal of Verbal Learning and Verbal Behavior, 1,* 109-118.

Rinck, M., & Becker, E. (2006). Spider fearful individuals attend to threat, then quickly avoid it: Evidence from eye movements. *Journal of Abnormal Psychology, 115,* 231-238.

Shipstead, Z., Redick, T. S., & Engle R. W. (2012). Is working memory training effective? Psychological Bulletin, 138, 628-654.

Stopa, L., & Clark, D. M. (2000). Social phobia and interpretation of social events. *Behaviour Research and Therapy, 38,* 273–283.

Teachman, B. A,. Joormann**,** J., Steinman, S. A., & Gotlib**,** I. H. (2012). Automaticity in anxiety disorders and major depressive disorder. *Clinical Psychology Review, 32,* 575-603.

Tran, T. B., Hertel, P. T., & Joormann, J. (2011). Cognitive bias modification: Induced interpretive biases affect memory. *Emotion*, *11*, 145-152.

Watkins, E.R., Baeyens, C.B., & Read, R. (2009). Concreteness training reduces dysphoria: Proof -of-principle for repeated cognitive bias modification in depression. *Journal of Abnormal Psychology, 118*, 55–64.

Whitmer, A. J., & Gotlib, I. H. (2012, December 17). An attentional scope model of rumination. *Psychological Bulletin*. Advance online publication. doi: 10.1037/a0030923

Williams, J. M. G., Mathews, A., & MacLeod, C. (1996). The emotional Stroop task and psychopathology. *Psychological Bulletin, 120*, 3-24.

Williams, J. M. G., Watts, F. N., MacLeod, C., & Mathews, A. (1996). *Cognitive psychology and emotional disorders* (Second edition). Chichester, England: Wiley.

Wilson, E.J., MacLeod, C., Mathews, A., & Rutherford, E.M. (2006). The causal role of interpretive bias in anxiety reactivity. *Journal of Abnormal Psychology, 115*, 103–111.

Vanderhasselt, M., De Raedt, R., Dillon, D. G., Dutra, S. J., Brooks, N., & Pizzagalli, D. A. (2012). Decreased cognitive control in response to negative information in patients with remitted depression: An event-related potential study. *Journal of Psychiatry & Neuroscience, 37*, 250-258.

Yonelinas, A. P., & Jacoby, L. L. (2012). The process-dissociation approach two decades later: Convergence, boundary conditions, and new directions. *Memory & Cognition, 40*, 663-680.

Figure Captions

Figure 1. Mean estimates of controlled recollection in fragment completion, following a period during which participants simply waited, ruminated, or were distracted (Hertel, 1998).

Figure 2. Mean estimates of control and habit to respond with the benign choice on transfer analogs and mean proportion of benign guesses on new transfer scenarios (Hertel, Holmes, & Benbow, 2013). Mean estimates of control in responding with negative choices are the same as those depicted; mean estimates of habit in responding with negative choices and mean proportion of guesses are reciprocal to those depicted.