Change in Bias Following Cognitive Therapy for Depression: An Investigation of Multiple Emotionally Engaging Judgments

THESIS

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Abstract

Prior research has shown that people with depression tend to think more negatively than people without depression. However, there is disagreement in the literature as to whether people with the highest depressive symptom severity tend to make either overly negative judgments or accurate judgments. Empirical research addressing the differences between these hypotheses is needed because the theoretical basis for one of the most successful treatments for depression, cognitive therapy (CT), is based in the assumption that people with depression tend to think in an unrealistic, pessimistic manner. Treatment-seeking adults with major depressive disorder ($N=67$) participated in a series of prediction tasks before and after a 16-week course of CT. Healthy controls matched demographically to treatment completers ($N=45$) also completed these tasks. The tasks included future life event prediction, prediction of significant others’ ratings of participants’ personality characteristics, and prediction of daily affective experiences. Outcomes were recorded, and a measure of optimistic / pessimistic bias was calculated by using participants’ predictions and outcomes. Depressed clients were pessimistically biased on a portion of their predictions of daily affective experiences, optimistically biased on the life events task and other portions of the experience sampling task, and not systematically biased on the personality rating task. Though depressed clients’ predictions and outcomes at intake were more negative than those of controls, patients and controls largely did not significantly differ in their levels of bias. Additionally, though predictions and outcomes
improved from intake to post-treatment among depressed clients, bias generally did not change. Overall, the study largely failed to identify evidence of bias among depressed clients or that bias was reduced with a course of cognitive therapy for depression. However, clients’ predictions did become more positive over the course of treatment. Further research should investigate potential moderators of pessimistic bias, such as presence of schemas in particular domains or use of specific coping strategies.
Dedicated to my parents,

Ann and Sandy Goldstein,

who have a way of making the glass seem half full.
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Introduction

Major depressive disorder (MDD) is a prevalent illness, afflicting nearly 17 percent of people across the lifetime and nearly 7 percent of people over the course of a single year (Kessler et al., 2005a, Kessler et al., 2005b). Left untreated, depression is associated with suicidal and self-harming behaviors (Angst, Angst, & Stassen, 1999) and is tied to significant economic costs for both the affected individual as well as society (Donohue & Pincus, 2007; Luppa, Heinrich, Angermeyer, König, & Riedel-Heller, 2007).

Symptoms of MDD span affective, somatic, and cognitive domains, with cognitive symptoms including thoughts of worthlessness and inappropriate guilt (American Psychiatric Association, 1994). Though occasional guilty or self-critical thoughts are common in most people and arguably adaptive in some capacity, numerous studies have found that, on the whole, people with depression tend to think more negatively than people without depression. People with depression report higher levels of hopelessness, more frequent negative automatic thoughts, and stronger beliefs in dysfunctional attitudes than people who are not depressed (Beck, Riskind, Brown, & Steer, 1988; Hollon, Kendall, & Lumry, 1986). Depressogenic thinking styles and dysfunctional attitudes predict future incidence of depression (Alloy et al., 1999; Otto, Teachman, Cohen, Soares, Vitonis, & Harlow, 2007), and dysfunctional attitudes remain elevated in women who were previously depressed, even if they are not currently
depressed (Otto et al.). Thus, negative cognition appears to be both a symptom of and risk factor for depression, and a thorough understanding of the nature of these cognitions, as well as potential ways to alter them, seems to be prudent from both a treatment and an etiological standpoint.

**Depressive Bias Versus Depressive Realism**

The literature overwhelmingly supports the observation that people with depression think more negatively relative to people without depression, but there are two competing positions regarding how people with depression think compared with reality. The depressive realism hypothesis posits that as depressive symptoms increase, judgments about events become more accurate, such that people with the highest levels of depressive symptom severity make judgments that reflect reality most accurately. The depressive bias hypothesis is in agreement with the depressive realism hypothesis in that people with very low depressive symptom levels are optimistically biased; however, the depressive bias hypothesis argues that as depressive symptoms increase, judgments become increasingly biased, such that people with the highest levels of depressive symptom severity make inaccurate, overly-negative judgments. Both theories support the idea that depressed people are more negative than non-depressed people, but the theories diverge in terms of whether depressed people are realistic or overly negative in their thoughts. Figure 1 illustrates the relationship between depressed people’s views and reality according to the two hypotheses.

The depressive realism hypothesis purports that while that people with depression may be “sadder,” they are also “wiser,” having more accurate views of themselves and
not demonstrating the optimistic cognitive errors that non-depressed people do (Alloy & Abramson, 1979). Thus, though depressed people’s perceptions of the world may be accurate, non-depressed people maintain an unrealistically positive outlook, which may be inaccurate albeit functional. This hypothesis grew out of an initial series of experiments conducted by Alloy and Abramson in which college students with various levels of depressive symptom severity were presented with a task in which they decided to press or not press a button over the course of several trials. After participants chose to press or not press the button, a green light either lit up or did not light up. The experimenters varied the amount of control participants had over the light (i.e., whether the button press would affect the light), and participants were asked to rate how much control their actions had over the light. Over the course of multiple experiments, participants with higher levels of depressive symptoms were, to some extent, more accurate in recognizing their level of control compared to participants with lower levels of depressive symptomatology. For example, in Experiment 2, participants’ button-presses exerted no control over the light turning on, and dysphoric students were more likely to correctly identify their lack of control over the light when their responses were reinforced 75% of the time, whereas non-dysphoric students over predicted the amount of control their button-presses had on the light. Dysphoric students recognized their inability to influence light onset, which the authors argued corresponds to the helplessness people with depression report (Alloy & Abramson).

Though some follow-up studies support the depressive realism hypothesis, a number of other studies support the influence of pessimistic cognitive bias in depressed
persons’ thoughts. The theory behind one of the most researched types of psychotherapy for depression, cognitive therapy (CT), rests in Beck’s supposition that people with depression have unrealistically pessimistic thoughts. Beck et al. (1967, 1979) argued that depressed people exhibit an inaccurate, negative bias in their thinking, particularly in regard to their views of themselves, their future, and their surrounding world. This pessimistic bias was hypothesized to be a key contributor to depressed mood. To evaluate this hypothesis, Strunk, Lopez, and DeRubeis (2006) asked Internet-recruited participants to estimate the probability of 40 life events occurring over the subsequent 30 days and then later report which events actually occurred over that time period. Participants with high levels of depressive symptoms displayed a pessimistic bias rather than accuracy. Though the relationship between bias and depressive symptoms was linear, dysphoric participants and non-depressed participants did not display significantly pessimistic or optimistic biases. Strunk and Adler (2009) asked participants to complete three prediction tasks: a similar life event prediction task, predictions of how a significant other would rate several of the participant’s personality traits, and scores on a vocabulary subsection of an IQ test. The participants with highest levels of depressive symptom severity exhibited a pessimistic bias on all three tasks.

Beck’s cognitive model of depression originated from his clinical observation of thoughts and beliefs endorsed by depressed clients he treated. However, the empirical support for his model is still developing. In evaluating the cognitive model of depression as hypothesized by Beck, there are several criteria that studies should aim to address in their designs but have largely failed to meet, two related to the research sample and two
addressing the method of assessing accuracy. First, the sample should adequately represent a range of depressive symptom severity, including symptom levels typical of those with a diagnosis of MDD. Previous studies in this literature have typically relied on samples consisting of participants with largely unrepresentative (i.e., minimal to mild) levels of depression symptoms. Moreover, the sample should be treatment-seeking to maximize generalizability to the depressed people therapists will see in clinical practice. It may be that there are demographic differences between people who do and do not seek treatment for depressive symptoms, and also between people who do and do not volunteer to participate in research studies, especially in terms of age and education level. For instance, the average age of participants in Strunk and Adler’s (2009) study was 18.7 years old, and all participants were students at a 4-year college. The utility of Beck’s cognitive theory of depression applies most directly to clients seeking treatment. If treatment-seekers are not represented in typical research studies, it is difficult to know if results would generalize to the clients seen most typically by practitioners. People with high depressive symptom severity who seek treatment might have different worldviews compared with those who choose not to seek treatment. Thus, to establish external validity of findings, it is prudent to assess samples of treatment-seeking adults. Further, the experimental paradigm should consist of consequential, emotionally engaging tasks. Tasks should elicit emotions and be important to participants in order to emulate the type of situations people experience in daily life in an effort to maximize ecological validity. Beck (1976) observed that people with depression tended to make negative judgments in highly emotionally-charged, self-relevant domains, such as views of oneself or one’s
future; thus, a valid test of the depressive bias hypothesis will include tasks that elicit emotionally engaging judgments. Finally, one should be able to measure the outcome of the prediction in a way that is free of systematic bias that could possibly contribute to an artificial association of bias and depressive symptoms.

Much of the research examining depressive realism and depressive bias have utilized dysphoric samples consisting of participants without MDD diagnoses, instead measuring depressive symptoms in normative samples and splitting participants into groups based on depression scores, often arbitrarily. For example, Alloy and Abramson (1979) recruited college students for both of their experiments, designating students with Beck Depression Inventory (BDI-I; Beck, 1967) scores of 8 or less as “non-depressed” and 9 or above as “depressed.” This is problematic in several ways, most seriously in its classification as the 9+ group as “depressed,” as a score of 9 is still very low on the continuum of possible BDI-I scores. At any given time, it is reasonable to expect to observe a variety of depressive symptom levels across the population, but the depressive realism and depressive cognitive bias hypotheses depart most markedly on the relative pessimism of persons with very high levels of depressive symptoms. The samples in Alloy and Abramson’s four experiments likely did not adequately represent people with very high levels of depressive symptoms. If we are to understand how cognition relates to depressive disorders, samples with assessed MDD must be used. Alloy and Abramson’s sample was not subject to diagnostic interview to confirm diagnosis, nor was stability of depressive symptomatology beyond 1 week measured, as would be necessitated when assessing depression using diagnostic MDD criteria. Further, the BDI-
I cutoff of 9 used does not map on to what we know about BDI-I scores and depression; Kendall, Hollon, Beck, Hammen, and Ingram (1987) recommended that the word “depression” be reserved for people whose BDI-I scores are over 20 and preferably have been diagnosed with depression via structured clinical interview. Kendall et al. cited a number of studies in which the mean BDI-I score among DSM-diagnosed depressed participants was around 30. However, in Alloy and Abramson’s Experiment 2, for example, the mean BDI-I score for males in the “depressed” group was 10.6, and the mean BDI-I score for females in the “depressed” group was 15. It is unlikely that a substantial portion of the participants in Alloy and Abramson’s “depressed” groups would have met criteria for MDD given their BDI-I scores. Another study that found support for depressive realism also used a BDI-II (2nd ed.; Beck, Steer, & Brown, 1996) cutoff of 9 and acknowledged that their sample could be considered “dysphoric” but not “depressed” (Blanco et al., 2009). They stated that the next logical step would be to conduct experiments with formally diagnosed depressed patients.

In a study of confidence on a face recognition task, Wood, Moffoot, and O’Carroll (1998) obtained different results when using a dysphoric (i.e., low symptom severity) sample than when using a depressed sample, finding that depressed, but not dysphoric participants, were underconfident when they made correct decisions on the task. Indeed, depressive symptom severity is a robust moderator of many findings across the depression literature, including those within the realm of depressive realism and depressive bias. Strunk and Adler (2009) split their participants into low (0-12), middle (13-19), and high (20-63) groups of depressive symptom severity based on BDI-II scores,
and only the high severity group was negatively biased on all tasks, whereas the middle (and low) severity groups were negatively biased only on the IQ task. Strunk, Lopez, and DeRubeis (2006) observed a negative correlation between bias on the life event task and BDI-II scores ($r = -.35$) in a sample representing a relatively wide range of depressive symptom severity, but when they restricted their sample to those with lower BDI-II scores to mimic the scores of those in another, earlier study (Dunning & Story, 1991), the correlation ($r = -.15$) was no longer statistically significant. Across the literature, the evidence for depressive bias tends to be present in studies where participants have high symptom severity, as would be expected in clients presenting for treatment for depression in the community.

Second, in addition to recruiting participants with an appropriate range of depressive symptom severity, participants should be treatment-seeking if we want to make generalizations about how depressed clients think and what this negativism could mean for treatment. If we conceptualize cognition as an etiological and maintaining factor in depression, this will extend to how we should conceptualize treatment, and as such, studying people seeking treatment for their depression should be a high priority. Inclusion of a treatment-seeking sample is unusual in this literature. For example, though Strunk and Adler (2009) formally assessed their sample for MDD before having participants complete three tasks designed to measure accuracy/bias, theirs was not a treatment-seeking sample. However, Carson, Hollon, and Shelton (2010) utilized a treatment-seeking sample, and in a task similar to Alloy and Abramson (1979), they found that depressed patients were generally not accurate in estimating their control.
Though the depressed participants were consistently more negative in their estimates of control than non-depressed participants, they underestimated their control on a contingent task and overestimated control on a noncontingent task.

In addition to using a clinically generalizable sample, the research task should be both internally and externally valid. If a task is not emotionally engaging and personally relevant, it lacks sufficient generalizability to everyday life and thinking. The research supporting the depressive realism hypothesis tends to be based on inconsequential tasks, as was the case in Alloy and Abramson’s original (1979) experiments. The task in Alloy and Abramson’s experiments – judging the extent to which their pressing a button controlled a light – is arguably not emotionally engaging or consequential. Alloy and Abramson intended for the task to measure participants’ judgments of how much control their actions exerted. Though perception of control may very well be a measurable, cognitively interesting task, it is unlikely to be very important to the participant if the consequence is making a light turn on in a laboratory, particularly in the absence of an incentive, such as a financial payoff. Pacini, Muir, and Epstein (1998) noted that depressive realism tended to be supported in “artificial” laboratory tasks but not in more consequential paradigms. Pacini et al. presented subclinically depressed and non-depressed students with a ratio-bias task in which participants were asked to choose from two trays that offered different odds of selecting a “winning” red jellybean. A selection was considered “optimal” if the participant’s chosen tray offered better chances of winning than the other tray. When the incentive to win was $.10 per trial, depressed participants responded more optimally. However, when the incentive to win was $2 per
trial, depressed and non-depressed participants chose similarly. Thus, through this minor manipulation – a difference of $1.90 per trial – Pacini et al. demonstrated that a task being consequential could affect experimental results. Further, given that the depressive bias hypothesis posits that negative thoughts lead to negative emotions, it is prudent to include emotionally engaging tasks in the research procedures. The most relevant situations to this hypothesis are those that, given a negative cognitive appraisal, would result in depressed mood. In a similar task to Alloy and Abramson’s, dysphoric Internet volunteers pressed the spacebar less (possibly indicating less endorsement of control) and rated their degree of control as less than nondysphoric volunteers (Blanco, Matute, & Vadillo, 2009). Again, it is questionable how personally relevant or emotionally engaging this task was to this sample. Strunk, Lopez, and DeRubeis (2006) as well as Strunk and Adler (2009) asked participants to predict whether certain desirable and undesirable life events would occur in their lives in the near future. Further, Strunk and Adler asked participants to predict how a significant other would rate them on a number of personality characteristics as well as how they would perform on a test of intelligence, all of which would be expected to be emotionally engaging and consequential to participants. Strunk and Adler’s tasks mapped onto Beck’s hypothesis that depressed people are overly negative in their views of themselves (IQ), their future (life events), and their world (significant other personality ratings). A participant will presumably care whether they experience future life events, what their friends think about them, and how intelligent they are, and findings in both these studies supported an association between
depressive symptoms and negative biases such that people with the highest depressive symptoms tended to be inaccurately and overly negative in their predictions.

Finally, the experimental task should necessarily include two elements: a prediction and an outcome. The prediction is by definition subjective, but the outcome must be able to be measured in such a way to avoid systematic bias. Ackermann and DeRubeis (1991) argued that in order to assess accuracy of predictions, the outcomes must be measured in a way that minimizes systematic reporting bias and must appropriately map onto the prediction. They noted that Lewinsohn, Mischel, Chaplin, and Barton (1980) had participants rate their social skills during an interaction and then compared these self-ratings to ratings made by trained observers. Compared to the non-depressed participants’ ratings, the depressed participants’ ratings were more closely related to the observers’ ratings, which might be considered as evidence supporting depressive realism. However, it could certainly be argued that the observers’ ratings were subjective, and that observers tend to be especially critical of others, introducing systematic bias into the assessment. Perhaps more importantly, the participants were asked to rate themselves from their own viewpoint, not how others would view them, which would more closely reflect the “outcome” variable. Among adult inpatients (with heterogeneous diagnoses) and demographically matched high school students, higher depressive symptoms were associated with more underestimation of one’s social competence compared to peer ratings of social competence (Whitton, Larson, & Hauser, 2008). However, again, participants provided self-competence ratings rather than predictions of peer ratings, and the scales for participants and peer raters were not
identical. In a sample of dysphoric college students, depressive but not anxious symptoms were associated with increased ratings of certainty in the nonoccurrence of positive future life events, though depressive and anxious symptoms were associated with certainty in the occurrence of negative events (Miranda, Fontes, & Marroquin, 2008). The paradigm involved predicting the occurrence of future life events (yes/no) and indicating one’s certainty of these events occurring over an unspecified time period. Nevertheless, there is no indication that participants later reported about the occurrence or non-occurrence of these events, which leaves this study unable to assess accuracy or bias, just relative negativity or positivity of prediction. The lack of reported outcomes becomes even more problematic when considering the possibility that people with depression may actually experience more negative life events than people without depression; the experience of stressful life events is associated with the onset of depression (Kendler, Karkowski, & Prescott, 1999). In the case of Strunk and Adler (2009), participants indicated whether the predicted life events eventually occurred. It could be argued that participants’ reports of life events could have been biased, as is possible with any self-report measure. However, the type of reporting bias one might expect to materialize from high levels of depressed symptoms actually might make it more difficult to find evidence for depressive bias. People with high levels of depressive symptoms might exhibit a negative memory bias and be more likely to under report the occurrence of positive life events and over report the occurrence of negative life events, which would make it more difficult to observe pessimistic bias. Moreover, after making predictions about life events expected over the next month, Strunk and Adler asked
participants to self-report life events on repeated (weekly) measures as well as one monthly measure and an interview evaluation at the end of one month. All three measures of life event occurrence were highly correlated, indicating that it is unlikely some systematic reporting bias was present between these methods. Further, significant others provided ratings of the participant’s personality traits, and IQ testing was done to obtain actual IQ scores for the other two tasks. In sum, the outcome measurements were comparable to the predictions made.

**Cognitive Therapy for Depression**

Though antidepressant medication is often a first-line treatment for depressive symptoms, certain kinds of psychotherapy, namely interpersonal, cognitive, and behavioral therapies, have also shown efficacy in the treatment of depression, and cognitive therapy and antidepressant medication have fared comparably well in the treatment of depression (Hollon, Thase, & Markowitz, 2002; DeRubeis et al., 2005). Among patients with moderate to severe depression, CT and antidepressant medication were associated with remission of depressive symptoms during acute treatment, but patients who participated in CT were less likely to relapse than those who completed and discontinued a course of antidepressant medication (Hollon et al., 2005). The authors proposed that learning cognitive skills in CT might have induced enduring reduction in depressive symptoms, which may not have occurred for those who had only received medication. As previously mentioned, CT for depression relies on the theory that people with depression have inaccurately negatively biases and that attaining a more realistic view is a central goal of therapy. However, it is interesting that this treatment for
depression has shown to be so effective in spite of confusion over whether depressed people are actually pessimistically biased. Given that this negative bias is the cornerstone of cognitive therapy for depression, it is necessary to determine what, if any, changes in bias might occur among those who participate in this treatment. However, no study to date has examined cognitive bias before and after treatment with CT.

Treatment with cognitive therapy is intended to teach and reinforce a number of skills in clients, and the techniques used to do so include activity monitoring, activity scheduling, breaking tasks down into manageable chunks, recording dysfunctional thoughts and challenging them, and creating experiments to test thoughts or gather more information. A main focus of cognitive therapy for depression is on the identification of negative thoughts, distancing oneself from these thoughts, treating these thoughts as hypotheses and not fact, and developing more realistic thoughts in response (DeRubeis, Webb, Tang, & Beck, 2010). Cognitive therapists strive to help clients produce alternative responses to situations that are not overly negative or overly positive; developing an accurate viewpoint, accompanied by any needed problem solving as indicated, is the goal. It is unclear what type of bias is most associated with change in depression. It also may be entirely possible that depressed clients are being taught to be optimistic; though this may not be in line with the theoretical goal of CT to strive for accuracy in ones thoughts, it is possible that clients are adopting an overly-positive viewpoint that may be functionally adaptive if not accurate.

There is considerable evidence that cognition does change following treatment with cognitive therapy, though there is less clear evidence for whether this cognitive
change is a cause or result of symptom change. Nonetheless, it is a robust effect that cognitive content has been shown to change over the course of CT (as reviewed in Jarrett, Vittengl, Doyle, & Clark, 2007). Given that a central premise of CT is assessing the accuracy of presumed overly negative automatic thoughts, and that CT is effective for many people, it is notable that no study of CT has assessed how accuracy may change following therapy thus far. Though intuitive, the theory behind this treatment requires further empirical testing, particularly because there has been some support for the depressive realism hypothesis in other contexts. In sum, it is necessary to determine if overly pessimistic thinking is related to depressive symptoms among treatment seekers, and whether developing more accurate or even more unrealistically optimistic views coincides with a decrease in depressive symptoms over the course of therapy.

**Current Study**

Ackermann and DeRubeis (2001) noted that the findings in this literature are inconsistent, and more research regarding the valence and accuracy of depressed persons’ cognitions is needed. The Ackermann and DeRubeis review is over 20 years old at this point, yet very few articles in this line of research have addressed their concerns since. They stated that the research findings supporting depressive realism could be accounted for by the method through which it was assessed, most notably by lacking outcomes in a way that is in line with predictions and free of systematic bias. They also called for using depressed participants and ecologically valid paradigms. In accord with the above-referenced criteria, the current study strives to evaluate cognitions and any biases therein of depressed clients pursuing treatment for depression. In addition, the bias measurement
tasks have been selected as those that are likely to be emotionally engaging and also are not likely to be seriously contaminated by systematic bias.

There are three primary aims of the current study. First, we aim to address the depressive realism vs. depressive bias hypotheses and examine whether treatment-seeking depressed clients exhibit cognitive biases prior to treatment with CT. Primary hypothesis 1 is that treatment-seeking depressed clients will evince inaccurate, negative biases on three emotionally engaging tasks at intake in accord with the depressive bias theory. Specifically, depressed clients will be overly negative in their prediction of life events, predictions of significant others’ rating of their personality, and predictions of their mood and performance indicators on an experience sampling task when these predictions are compared with outcomes.

Second, we compare cognitive bias in depressed clients to those of matched, healthy controls. Primary hypothesis 2 is that treatment-seeking depressed adults’ cognitions will be more negative than those of healthy, matched controls, again in support of the depressive bias hypothesis. This will be demonstrated on the same three emotionally engaging tasks. It is expected that depressed clients’ predictions and outcomes will be more negative than those of matched controls, and that depressed clients will exhibit more negative bias in their judgments than controls.

Third, we will compare cognitive bias in depressed clients at pre-treatment with cognitive bias at the end of a 16-week course of CT for depression to assess any change in bias from before to after therapy, thus being the first study in the literature to evaluate change in cognitive bias over the course of CT. Primary hypothesis 3 is that treatment-
seeking depressed adults will demonstrate a reduction in negativity of bias from intake to post-treatment. If Beck’s cognitive theory of depression is correct, a decrease in negative bias will correspond with a decrease in depressive symptoms over the course of treatment. It is also predicted that there will be a reduction in negativity of predictions and outcomes from pre-treatment to post-treatment.
Method

Study Design

Depressed participants seeking psychotherapy at a university-based clinic were recruited to complete diagnostic and bias measures before and after 16 weeks of CT. Additionally, non-depressed healthy controls were recruited to complete bias measures, to be compared to depressed clients’ bias scores at intake.

Participants

Depressed participants. Clients seeking services at the Depression Treatment and Research Clinic at The Ohio State University were recruited to the study. Common sources of hearing about the clinic and research project included the clinic website, flyers placed in the community, postings on the Internet, and advertisements in a local newspaper. Clients inquiring about treatment were given a phone screen to determine if they were experiencing at least 5 of 9 MDD symptoms and did not have a diagnosis of bipolar disorder. One-hundred fifty clients completed phone screens, yielding 118 intake appointments scheduled. Eighty-six intake assessments subsequently occurred, resulting in 67 study entrants. Trained graduate student assessors conducted the intake and post-treatment interviews. Inclusion criteria, as verified at intake for each potential participant were: (a) diagnosis of MDD as per DSM-IV-TR criteria (American Psychological
Association, 1994); (b) being at least 18 years of age; and (c) able and willing to provide informed consent for participation. Exclusion criteria, also assessed at intake, were: (a) history of bipolar disorder or psychosis; (b) another current Axis I disorder deemed to be primary; (c) history of substance dependence in the previous 6 months; (d) subnormal IQ (i.e., below 80), with testing only performed if clinically indicated; (e) indication of secondary gain; and (f) current suicide risk sufficient to preclude outpatient care. Of the 19 people deemed ineligible at intake, 13 did not meet criteria for a diagnosis of MDD, 2 had another primary Axis I disorder, 2 had bipolar disorder, 1 met criteria for substance dependence, and 1 displayed psychotic symptoms.

Among depressed study entrants, 29 (43%) were male and 38 (57%) female. Clients ranged from 18-69 years of age ($M = 36.25, SD = 13.32$). Most participants were Caucasian ($n = 56, 84$%), though 2 (3%) were Hispanic, 3 (4%) were Asian American, and 7 (10%) were African American. Most participants were not married or cohabiting ($n = 45; 67$%). A variety of education levels were represented (2% no high school diploma or equivalent; 8% high school diploma or equivalent; 35% some college; 10% 2-year college degree; 22% 4-year college degree; 11% some graduate or professional school; 12% graduate or professional degree). A range of annual family incomes was reported (19% under $10,000; 21% $10,000-19,999; 12% $20,000-29,999; 11% $30,000-39,999; 2% $40,000-49,999; 12% $50,000-59,999; 7% $60,000-69,999; 5% $70,000-79,999; 2% $80,000-89,999; 9% over $100,000). The mean BDI-II score at intake was 27.38 ($SD = 9.12$).

Non-depressed healthy participants. Healthy control participants with no
lifetime history of mood or anxiety disorders were matched on age (i.e., within 3 years),
gender, and education (high school degree or less, some college or 2-year degree, or 4-
year degree or higher) to a subset of the depressed sample that completed treatment ($n = 45$). The main methods of recruitment for this group were flyers placed in the
community, Internet advertisements, and emails to a recruitment pool on
Researchmatch.org. Interested control participants were referred to a website which
provided them with prescreening questionnaires to obtain demographic information for
matching purposes as well as measures of mood and anxiety symptomatology.
Participants who appeared to be eligible for the study were contacted for further in-
person assessment and participation.

Inclusion criteria for control participants were: (a) demographic match to
depressed treatment completer on gender, age, and education; (b) being at least 18 years
of age; and (c) able and willing to provide informed consent for participation. Exclusion
criteria were: (a) subnormal IQ; (b) current or lifetime history of mood disorder
according to DSM-IV-TR criteria; (c) current anxiety disorder; and (d) past generalized
anxiety disorder, social phobia, or posttraumatic stress disorder. As this sample was
matched to depressed completers on multiple demographic measures, most of the control
participants were predictably female ($n = 26, 58\%$) and the average age was 38.02 ($SD = 14.19$, range 18-68). Most control participants were Caucasian ($n = 40; 89\%$), with 3
(7\%) being African American, 1 (2\%) being Native Hawaiian/Pacific Islander (also
Caucasian), and 2 (4\%) Asian American. Most were single or not cohabiting ($n = 28,
62\%$). As these controls were matched to treatment completers on education levels, as
with the treatment sample, there was a variety of education levels represented in the control group (4% high school diploma or equivalent; 40% some college; 4% 2-year college degree; 33% 4-year college degree; 11% some graduate or professional school; 7% graduate or professional degree). A range of annual family incomes were reported (7% under $10,000; 4% $10,000-19,999; 13% $20,000-29,999; 7% $30,000-39,999; 9% $40,000-49,999; 4% $50,000-59,999; 11% $60,000-69,999; 9% 70,000-79,999; 9% 80,000-89,999; 4% 90,000-99,999; 18% over $100,000. The mean BDI-II score at the first research visit for controls was 1.38 ($SD = 2.18).

Measures

**Pre-screening measures specific to non-depressed, healthy participants.**

**Demographics Screening Questionnaire.** This demographic scale assessed potential control participants’ age, gender, and education, as well as psychological and medical history. Participants reporting a current or past mood or anxiety disorder were not invited to participate.

**Patient Health Questionnaire (PHQ; Kroenke & Spitzer, 2002).** This 9-item self-report measure has been used in multiple settings (including research and primary care) and is based on diagnostic criteria for major depression from the *Diagnostic and Statistical Manual, Fourth Edition (DSM-IV)*; American Psychiatric Association, 1994). A score of no more than 4 was required to qualify for an invitation to the study, as a score of 5 is the cutoff for “mild” depression severity.

**Generalized Anxiety Disorder Questionnaire – IV (GAD-Q-IV; Newman et al., 2002).** This 9-item self-report measure has been used in multiple settings to assess the
presence of diagnostic criteria for generalized anxiety disorder from the *DSM-IV* (APA, 1994). A score of no more than 5 was required to qualify for an invitation to the study, as scores above 5 are likely to be associated with the presence of current generalized anxiety disorder.

**All participants.**

**Diagnostic measures.**

*Structured Clinical Interview for DSM-IV (SCID-I; First, Spitzer, Miriam, & Williams, 2002).* Trained graduate students administered selected modules (mood episodes, psychotic and associated symptoms, psychotic disorders, mood disorders, substance use disorders, anxiety disorders, eating disorders, and detailed history of past depressive episodes section of Module J) of the SCID-I prior to treatment for depressed participants. Trained graduate and undergraduate students administered the SCID-I to control subjects. This diagnostic interview was used to determine present and past Axis I disorders. Sections of the SCID-I were also administered at post-treatment for depressed participants; criteria for MDD were assessed for all treatment completers, as well as diagnostic criteria for any other Axis I diagnoses met at intake. Study assessors double-rated 12 depression-sample SCID-I interviews for MDD diagnostic criteria (spanning both intake and post-treatment), and 100% reliability was achieved for MDD diagnosis (*kappa* = 1.00).

*Hamilton Rating Scale for Depression (HRSD; Hamilton, 1960; Williams, 1988).* This 17-item interview assesses depressive symptom severity and was administered by trained graduate students at intake, week 4, and post-treatment for depressed participants.
and by trained graduate and undergraduate students at the first research session for controls. Interviewers rated the participant’s symptoms, with higher scores indicating more severe symptoms. Among graduate student raters, fifteen HRSD interviews of depressed participants encompassing all assessment points were double-rated and demonstrated good reliability (ICC = .99).

*Beck Depression Inventory - 2nd Edition (BDI-II; Beck, Steer, & Brown, 1996).* This self-report measure was used to evaluate symptoms of depression. There are 21 items rated on a 0 to 3 scale yielding a potential total score of 0 to 63, with higher scores indicating more severe symptoms. Average scores on the BDI-II tend to be 1.54 points higher than scores on the BDI-I (Dozois, Dobson, & Ahnberg, 1998), which was typically used in studies prior to the publication of the BDI-II in 1996. The BDI-II was administered at intake and post-treatment in the depressed sample, as well as before each therapy session. The BDI-II was also completed by control participants.

*Cognitive bias measures.*

*Life Events -- Prediction and Assessment Questionnaire (LE-PAQ; Strunk, Lopez, & DeRubeis, 2006).* This measure of cognitive bias presents 40 life events and prompts participants to predict the likelihood of each event occurring in the subsequent week. These events are relevant to a general population, have varying base rates, span a range of desirability of occurrence, and span a range of controllability. Treatment participants predicted events at intake and indicated which events actually occurred over the following week at session 1. The prediction and report sequence was repeated at post-treatment. Predictions were estimated on a 0-100 probability scale, and outcomes were
reported as either occurred or did not occur.

Scoring. Similarly to prior studies (Strunk, Lopez, & DeRubeis, 2006; Strunk & Adler, 2009), variables were created to represent prediction, outcome, and bias. Prediction scores consisted of the average of participants’ probability estimates for desirable events and one minus probability estimates for undesirable events, yielding a score representing the positivity of event predictions (i.e., the occurrence of positive events occurring and non-occurrence of negative events). Predictions were re-scaled to 0 to 1, with 0 indicating zero probability of the event occurring and 1 indicating a one-hundred percent probability rating of the event occurring. Outcome scores consisted of the average of participants’ reported occurrence of events (coded for 1 for occurrence and 0 for non-occurrence) over the course of the subsequent week. For averaged outcome scores, the occurrence of undesirable events was recoded to -1 before averaging outcomes, resulting in positive scores indicating the occurrence of desirable events and non-occurrence of undesirable events. Bias scores represent the degree to which participants’ predictions were optimistic or pessimistic when considering outcomes. Bias scores were determined by calculating differences between prediction and outcomes; for desirable events, the occurrence of an event (0 or 1) was subtracted from the prediction probability (0-1) for each event; for undesirable events, the prediction was subtracted from the occurrence for each event. The average of these difference scores represented the participant’s overall bias, which could range from -1 to 1, with negative scores representing pessimism and positive scores indicating optimism. A score of 0 would indicate a lack of consistent optimistic or pessimistic bias across items. Additional
variables were created to examine separately the 20 desirable and 20 undesirable events in prediction, outcome, and bias. Bias for these events was calculated similarly. Predictions were scored in such a way that 0 represented no likelihood and 1 represented complete likelihood for both types of events, and then averages were calculated. For outcome scores for desirable and for undesirable events, the scores calculated represent the average of each participant’s sum of each set of events that occurred (for desirable and undesirable events separately).

*Ratings of Personal Characteristics – Self Version (RPC-Self; Strunk & Adler, 2009).* This 21-item measure, adapted from Lewinsohn, Mischel, Chaplin, and Barton (1980), prompts the participant to predict how a significant other would rate them on a list of 21 positive personality characteristics. Ratings are on a percentile scale (i.e., 70 on hard-working means the participant is in the 70th percentile of all people in being hard-working). This scale consists of the original 18 items used by Strunk and Adler, along with an additional 3 characteristics added for this study.

*Ratings of Personal Characteristics – Other Version (RPC-Other; Strunk & Adler, 2009).* This 21-item measure is identical to the RPC-Self except for the instructions. It prompts a significant other to rate the participant’s percentile on the same list of 21 positive personal characteristics. Significant others either completed the measure on the Internet or on paper, with the latter being mailed back to the researchers in a sealed envelope. Scores were not shared with participants completing the Self Version of the measure.

Scoring. Variables were created to represent prediction, outcome, and bias and
calculated similarly to scores for the LE-PAQ, except that responses were kept on a 0-100 scale for prediction and outcomes. The self-rated scores served as predictions, and the other-rated scores served as outcomes. Difference scores were then calculated and the average of these difference scores was taken, yielding bias scores that could range from -1 to 1.

*Experience Sampling Mood Prediction Task (ES-MPT)* – Participants were provided a Palm Pilot on which to complete surveys multiple times each day. Alarms sounded seven times daily, and participants were requested to complete surveys at least five times on the Palm Pilot each day soon after alarms. On the first survey of the day, participants were asked how sad, interested, and anxious they felt the previous day and how sad, interested, and anxious they expected to feel today. Additionally, at each survey administration, participants rated their current levels of sadness, interest, and anxiety. Responses were given on a 1-7 scale, with higher scores indicating higher responses.

Scoring. Variables were created to represent prediction, outcome, and bias. For prediction variables, average scores were created across the 3 days of responding for the sadness, interest, and anxiety predictions. Outcome scores were based on the average of responses to each question about the days’ experience of sadness, interest, and anxiety. Difference scores between predictions and outcomes were calculated and rescaled to a scale of -1 to 1 to create bias scores.

**Procedures**

**Depressed participants.** At the intake interview, several measures were
administered, including the SCID, BDI-II, and HRSD. If the client qualified for the study, he or she selected two significant others (e.g., partner, family member, friend) to complete a confidential packet containing a demographic questionnaire, a BDI-II and the RPC-Other measure. The participant also completed the prediction portion of the LE-PAQ. Finally, the client was scheduled for a first therapy session for the following week.

One week later, participants completed the second part of the LE-PAQ at the first therapy session, reporting which events actually did occur over the course of the week. He or she also completed the RPC-Self for one of his or her significant others who was given the RPC-Other to complete. Participants returned the Palm Pilot at this time.

At week 16 (post-treatment), the participant again completed the prediction part of the LE-PAQ and the RPC-Self, to be compared to the responses from the second significant other given an RPC-Other packet at the start of treatment. The participant was given a Palm Pilot to complete the ES-MPT. One week later, he or she returned to complete the event-reporting part of the LE-PAQ and return the Palm Pilot. Though the post-treatment sample consists mostly of clients who completed all 16 weeks of CT, participants who dropped out of treatment but completed several sessions of CT before doing so were invited to complete post-treatment measures, and 2 participants chose to do so.

**Intervention.** Depressed participants were offered 16 weeks of individual cognitive therapy, based on Beck et al. (1979). Therapy was provided by advanced graduate students in a PhD program in clinical psychology, supervised by a licensed clinical psychologist. Hour-long sessions were typically held on a weekly basis, though clients
with HRSD scores of 20 or greater at intake were offered twice-weekly sessions for the first several weeks of treatment.

**Non-depressed healthy participants.** Control participants attended two research sessions in person, conducted either by a trained graduate or undergraduate student. At session 1, they completed the SCID, HRSD, BDI-II, prediction portion of the LE-PAQ, and demographic questionnaire. They were given a Palm Pilot in order to complete the ES-MPT. In addition, they were given a packet with the RPC-Other, BDI-II, and demographic questionnaire to give to a significant other. One week later, participants returned to complete the event-reporting portion of the LE-PAQ. Participants also completed the RPC-Self and returned the Palm Pilot.

**Data Analytic Plan**

For all analyses, average scores on the three bias measures (LE-PAQ, RPC, and ES-MPT) were evaluated. Analyses of the LE-PAQ included overall scores that consisted of both desirable and undesirable events, but additional analyses addressed the desirable and undesirable events separately. Strunk, Lopez, & DeRubeis (2006) recommended that desirable and undesirable events be examined separately due to psychometric characteristics of the LE-PAQ. Though Strunk, Lopez, and DeRubeis did not find a different relationship between desirable and undesirable events and BDI-II, given the pessimistic bias regarding desirable occurrences in other studies (e.g., Miranda, Fontes, & Marroquin, 2008) as well as Strunk et al.’s recommendation, it is prudent to examine it in this case with a more ecologically valid sample. On the RPC, all 21 items
were considered together. On the ES-MPT, the anxiety, sadness, and interest items were considered separately.

To address whether depressed participants were biased at intake, *t*-tests were conducted to determine if bias scores were significantly different from zero. Pessimistic bias was defined as a negative bias score significantly differing from zero, whereas optimistic bias was defined as a positive bias score significantly differing from zero.

To compare depressed clients at intake with non-depressed healthy controls, three sets of *t*-tests were conducted. First, depressed clients’ predictions were compared to those of healthy controls. Then outcomes of depressed clients were compared with outcomes of healthy controls. Finally, bias between the two groups was compared.

To evaluate change following CT with depression, three sets of *t*-tests were conducted in which depressed clients’ scores at intake were compared to their scores at post-treatment. Again, predictions, outcomes, and bias were assessed separately.

Given that multiple comparisons were conducted in addressing each primary hypothesis, the Holm-Bonferroni correction (Holm, 1979) was applied to reduce the likelihood of committing a type I error. Each of the seven sets of *t*-tests described above constituted a separate family for the purposes of this adjustment. For example, comparing predictions of depressed clients with healthy controls on the overall LE-PAQ, desirable subset of the LE-PAQ, undesirable subset of the LE-PAQ, RPC, ES-MPT sadness, ES-MPT interest, and ES-MPT anxiety were considered one family of tests because they addressed the question of whether predictions differ between depressed clients and healthy controls. Tables 1-7 indicate statistical significance at the .05, .01,
and .001 level, as well as trend-level (.10) findings, though only findings that remained significant after instituting the Holm procedure at the $p < .05$ level are indicated in bold.

Secondary analyses examined the association of predictions, outcomes, and bias on the three bias tasks with depressive symptom severity as measured by the BDI-II and HRSD. Pearson correlation coefficients were calculated separately for scores at intake and then at post among depressed clients only. For descriptive purposes, a number of additional analyses were conducted among depressed clients examining men and women separately. The results of the gender analyses are presented in Appendix A. Given that the correlational analyses and gender analyses are considered exploratory, $p$-values for these tests should be interpreted with caution (Bender & Lange, 2001).
Results

Does Bias at Intake Differ from Zero?

To test whether there was evidence of significant optimistic or pessimistic bias on each task, analyses comparing bias scores to zero among depressed participants were conducted. As shown in Table 1, on the LE-PAQ, depressed clients’ bias at intake did not differ from zero after accounting for multiple comparisons. When desirable and undesirable events were examined separately, clients showed an optimistic bias about desirable events but a pessimistic bias about undesirable events, meaning they overpredicted both desirable and undesirable events. On the RPC task, depressed clients’ bias at intake did not differ from zero. On the ES-MPT, there was a trend for pessimistic bias about anxiety. Pessimistic bias on sadness was evident, and there was a non-significant tendency for depressed clients to be optimistically biased regarding the amount of interest they expected to experience.

Do Depressed Clients Differ from Controls?

Predictions. As shown in Table 2, depressed clients’ predictions were generally more negative than the predictions of control participants. On the LE-PAQ, depressed clients were less optimistic than controls in their predictions of future life events. This appears to be driven by depressed clients’ lower expectations regarding the likelihood of desirable events occurring compared to controls, as there were no differences in
predictions of undesirable life events between depressed clients and non-depressed controls. On the RPC task, controls were more positive than depressed clients in their predictions of significant others’ RPC ratings. On the ES-MPT measures, depressed clients predicted higher levels of anxiety than controls. Not surprisingly, depressed clients also predicted both higher levels of sadness and lower levels of interest than controls.

**Outcomes.** As with predictions, depressed clients’ outcomes tended to be more negative than those of control participants (see Table 3). On the LE-PAQ, depressed clients’ outcomes were less positive than those of controls. Depressed clients experienced significantly fewer desirable events than control participants, and there was a non-significant trend for depressed clients to experience more undesirable events than controls. On the RPC task, depressed clients were rated less positively by their significant others than were control participants. As would be expected due to how groups were defined, depressed clients reported being more anxious, sadder, and less interested on the ES-MPT than controls.

**Bias.** Descriptive statistics and differences in bias scores between depressed participants and control participants are shown in Table 4. There was no difference in bias on the LE-PAQ between depressed clients and controls. This lack of difference was consistent when separately considering desirable and undesirable life events. When considering RPC bias, we failed to find a difference between the depressed sample and controls. There was also no difference in bias on the ES-MPT regarding anxiety when comparing depressed clients and controls. After accounting for multiple comparisons,
depressed clients and non-depressed controls did not significantly differ in bias on sadness or interest on the ES-MPT, though there were moderate effect sizes for these comparisons, with depressed clients more pessimistically biased regarding sadness and less optimistically biased regarding interest than controls.

**Change from Intake to Post**

**Predictions.** Descriptive statistics for predictions at intake and post-treatment on each measure, as well as the results of tests comparing means at intake and post, are listed in Table 5. Predictions of life events became more positive from intake to post-treatment, which appeared to be attributable to desirable life events, as predictions of desirable life events increased from intake to post-treatment whereas predictions of undesirable life events did not change. On the RPC task, predictions from intake to post-treatment did not change. Evaluating changes from intake to post-treatment on the ES-MPT, depressed clients predicted less anxiety at post than at intake and also predicted lower levels of sadness at post than at intake. Depressed clients’ predictions of interest increased from intake to post-treatment.

**Outcomes.** Descriptive statistics for outcome scores on each task at intake and post-treatment are listed in Table 6. Outcomes for life events, as measured on the LE-PAQ, became more positive from intake to post-treatment. When examining desirable life events specifically, these events increased from intake to post, but there was no change in the experience of undesirable life events from intake to post. Change in the RPC task outcomes could not be measured from intake to post, as significant others’ ratings were all collected at intake. As reported elsewhere (Adler, 2012), there was a
reduction in depressive symptom severity from intake to post on both the BDI ($d = 2.11$) and HRSD ($d = 2.27$). In line with depressed clients’ predictions on the ES-MPT (and thus consistent with the therapeutic gains clients achieved), clients reported lower levels of anxiety and sadness at post compared to intake. They also reported higher levels of interest at post-treatment compared to intake.

**Bias.** Table 7 illustrates means and standard deviations for bias scores on all tasks at intake and post-treatment. There was no change in bias on the LE-PAQ from intake to post-treatment. When analyzing desirable and undesirable life events separately, there was no change in bias on life events for either desirable or undesirable events. Bias did not change from intake to post on the RPC task. There was no change in bias regarding anxiety, interest, or sadness from intake to post on the ES-MPT.

**Are Bias Variables Associated with Depressive Symptom Severity?**

Correlations between LE-PAQ variables and depressive symptom severity are provided in Table 8. At intake, predictions of life events were negatively related to depressive symptoms as measured by the BDI-II and HRSD, such that higher depressive symptom severity was associated with more negative predictions. LE-PAQ outcomes were not related to depressive symptoms as measured by the BDI-II, though there was a trend-level relationship between outcomes and HRSD scores. Bias was not related to depressive symptoms as measured by either the BDI-II or HRSD. At post-treatment, predictions of life events were related to depressive symptoms as measured on the BDI-II and the HRSD. There was a relationship between life event outcomes and depressive
symptoms as measured by the BDI-II, but not as measured by the HRSD. Bias on the LE-PAQ was not related to depressive symptoms on the BDI-II or HRSD.

Correlations between RPC variables and depressive symptom severity are shown in Table 9. At intake, more negative predictions on the RPC task were related to higher depressive symptoms as measured by both the BDI-II and HRSD. There was a trend-level negative relationship between bias on the RPC and BDI-II scores but not HRSD scores. At post, there was no relationship between predictions or bias on the RPC and depressive symptoms.

Correlations between ES-MPT variables and depressive symptom severity are shown in Table 10. On the ES-MPT at intake, predictions of sadness were related to BDI-II scores, but not to HRSD scores. There was no relationship between predictions of anxiety or interest and depressive symptom severity. As might be expected, outcome on the ES-MPT was generally related to depressive symptoms. Anxiety was related to BDI-II scores at a trend level and was significantly related to HRSD scores. Sadness was significantly related to BD-II and HRSD scores. Interest was associated with BDI-II but not HRSD scores. Bias scores were related to depressive symptoms in an unexpected way at intake: though bias about anxiety and sadness were not related to BDI-II scores, there were trend-level positive relationships with HRSD scores, meaning that optimism in predictions of anxiety and sadness was related to higher depressive symptom severity on that measure. There was no relationship between bias about interest and depressive symptoms. At post, predictions seemed to be more strongly related to depressive symptoms than at intake. Higher predictions of anxiety were associated with higher BDI-
II and HRSD scores. Higher predictions of sadness were associated with the BDI-II but only at a trend level with the HRSD. Lower predictions of interest were associated with higher scores on both the BDI-II and HRSD. In terms of outcomes, experiences of anxiety on the ES-MPT were not related to BDI-II or HRSD scores. Experiences of sadness were associated with BDI-II but not HRSD scores. Lower experiences of interest were associated with higher scores on the BDI-II and HRSD. There was no relationship between bias about anxiety and BDI-II scores though there was a negative relationship between anxiety bias and HRSD scores. There was a negative relationship between bias about sadness and BDI-II scores but not HRSD scores. Finally, there was no relationship between bias about interest and depressive symptom severity.
Discussion

This study evaluated the presence of pessimistic bias and change in bias-related variables among treatment-seeking adults with MDD. Bias was calculated by comparing predictions to outcomes on three tasks that were intended to be emotionally engaging and of consequence to participants. The primary aims of this study were to determine if depressed clients were negatively biased prior to treatment with CT, compare bias-related variables in the depressed sample with a demographically matched control sample, and establish whether bias-related variables changed from pre-treatment to post-treatment after a 16-week course of CT for depression.

Presence of Depressive Bias

There were mixed results regarding the presence of bias in depressed clients’ judgments. Clients were optimistically biased (i.e., their predictions were more positive than their reported outcomes) regarding desirable events on the LE-PAQ. Clients were pessimistically biased on the sadness question on the ES-MPT. Clients did not appear to be consistently biased in either direction on the RPC task, and after correcting for multiple comparisons, there appeared to be a lack of consistent bias regarding the LE-PAQ overall and interest and anxiety questions on the ES-MPT.

There is a large body of research showing that people with depression tend to think negatively compared to people without depression. However, the current study’s
results do not support the contention that clients with depression are consistently pessimistically biased. This study’s results do not particularly support the depressive realism hypothesis either; there was no consistent finding regarding bias across all the tasks. It may be possible that in some domains and some tasks, depressed clients are usually overly negative and some in which they are typically not biased or even optimistically biased, and rather than consistent negative bias, it may be relative negativity on predictions or outcomes compared with controls that is driving their depressed state. Or, perhaps, negativity in certain domains may vary on at a personal level, with each person having a specific negative schema in their individual case. However, these current study’s results do not replicate very similar tasks from other studies in which people with high depressive symptom severity were negatively biased. On the LE-PAQ, Strunk, Lopez, and DeRubeis (2006) and Strunk and Adler (2009) observed pessimistic bias in participants with high symptom severity, and on the RPC, Strunk and Adler observed pessimistic bias in participants with high symptom severity. It may be that the present sample differs from previous samples in some way that influences a lack of bias. The present sample may have had less sophisticated understanding of probability, which could have influenced their consideration of probability in the LE-PAQ.

**Depressed Clients Compared With Healthy Controls**

To gain a greater understanding of which aspects of bias may be driving the presence or absence of bias, – for example, consistently negative predictions relative to controls vs. consistently negative outcomes relative to controls -- analyses of bias were
complemented with analyses investigating predictions and outcomes separately. Predictions, outcomes, and bias were compared between depressed clients as well as matched healthy controls. As expected, depressed clients were more negative in their predictions than healthy controls on all measures. In terms of outcomes, depressed clients also reported experiencing greater negativity in life events than controls, were rated more negatively than controls on the RPC task, and reported experiencing more sadness, anxiety, and less interest than controls on the ES-MPT. There were no significant differences in bias between depressed clients and healthy controls on the LE-PAQ, RPC and ES-MPT. However, there were moderate effect sizes suggesting that depressed clients were more negatively biased than controls on the sadness and interest questions on the ES-MPT, which might be especially relevant because these questions ask participants to directly assess the likelihood of experiencing the most central symptoms of depression: low mood and anhedonia. Their overly negative expectations about feeling depressed might be maintaining the disorder, though this can not be regarded as conclusive due to the lack of statistical significance after correcting for multiple comparisons.

One possible explanation for the lack of consistent differences in bias between the depressed and control groups is that while depressed clients may be more negative than controls in their predictions, they generally concurrently experience more negative outcomes than controls. Thus, both groups may be equally optimistic, pessimistic, or accurate in assessing the negativity of life events they are experiencing, even though these life events are overall more negative among depressed clients. However, again,
these findings do not replicate the findings of Strunk, Lopez, and DeRubeis (2006) and Strunk and Adler (2009). It may be possible that bias among treatment-seekers is different from bias among a research volunteer sample. Perhaps people volunteering for research studies have a higher need for cognition or differ in some other important cognitive way. Another possibility is that our healthy controls were abnormally healthy and some of Strunk et al.’s prior participants with current low depressive symptom severity may have previously been depressed or had an anxiety disorder.

**Change in Bias from Intake to Post-Treatment**

This is the first study in the research literature equipped to assess change in bias-related variables before and after the treatment of depression with CT. In general, predictions became more positive from intake to post-treatment, with changes evident on the LE-PAQ and sadness, anxiety, and interest questions on the ES-MPT. Predictions on the RPC did not statistically significantly differ from intake to post-treatment, however. Perhaps expecting change on life events and mood as opposed to interpersonal changes are more realistic given the brief timeframe of treatment.

Outcomes became more positive from intake to post-treatment, with clients reporting experiencing greater positivity of outcomes on the LE-PAQ at post-treatment, less anxiety and sadness at post on the ES-MPT, and greater interest in activities at post on the ES-MPT. Outcomes on the RPC could not be assessed separately at intake and post, as significant others’ ratings were obtained only at intake. This is problematic in that clients’ social interactions and mood may have changed over the course of treatment, which could have potentially altered significant others’ ratings of the client’s personality.
characteristics. Though outcomes were obtained in this way out of concern to clients’
convenience, future research should make reasonable efforts to obtain data at the most
relevant time points.

Perhaps most surprisingly, there was no change in bias from intake to post-
treatment on any of the tasks. Again, this may be because clients are aware of the
improvement in their outcomes, particularly regarding life events and mood. In CT for
depression, clients are frequently prompted to make more accurate assessments of the
consequences of events in their lives. They are also prompted to pay a great deal of
attention to their mood. For example, at the start of CT, clients are often asked to record
their activities and mood ratings on an hourly basis. They may also participate in
behavioral experiments, in which they predict what their mood may be during an activity
and then record what it actually is while participating in the activity. Further, clients may
complete a measure of their depressive symptoms, such as the BDI-II at every session,
which may result in them being more attentive to their depressive symptoms as treatment
progresses. As such, it may be expected that they might not be particularly biased,
especially at the end of treatment. Moreover, the lack of pessimistic biases at pre-
treatment might have made it difficult to show changes in line with expectations.

Valence of Life Events

At intake, depressed clients were optimistically biased regarding desirable life
events but pessimistically biased regarding undesirable life events, which may indicate
that depressed clients thought they were more likely to experience events in general.
Nonetheless, though they were optimistically biased regarding desirable events, they still
made significantly lower predictions of desirable life events than controls. Depressed clients’ predictions of undesirable life events did not differ from controls, however. Additionally, depressed clients experienced fewer desirable life events than controls, though there was only a trend for depressed clients to experience a greater amount of undesirable life events than controls. There was no difference in bias when considering desirable and undesirable events separately.

Depressed clients’ predictions of desirable events increased from intake to post-treatment. However, there was no change in their prediction of undesirable life events from intake to post-treatment. In line with predictions, clients experienced a greater number of desirable life events at post-treatment compared to intake, though there was no change in the number of experienced undesirable life events from intake to post-treatment. There was no change in bias from intake to post-treatment when considering desirable and undesirable life events separately. Overall, it seems that views of desirable life events were more differentiating and more subject to change than views of undesirable events among people with depression. It may be that people with depression have a specific deficit in assessing the probability of negative life events, or negativity in this domain may be difficult to change. However, given that depressed clients’ predictions of undesirable events did not differ from the predictions of non-depressed controls, it may be that evaluation of desirable events represents the stronger deficit in people with depression. In terms of outcomes, it is possible that desirable events are more controllable and that people with depression may more readily adjust to creating
more desirable events in their lives but require more time to make changes that could lead to a decrease in negative life events.

Limitations

There are several limitations of this study. Though the LE-PAQ and RPC have been used in previous studies, there were some adaptations made for the current study that may have contributed to the inconsistent results. The one-week prediction period on the LE-PAQ is much shorter than the time periods used in prior research. This time period was most practical for the purposes of this study; asking clients to predict outcomes over the next month would have been confounded with potential change initiated by treatment (i.e., a focus at the start of CT is encouraging increased activation in tasks deemed to be pleasurable and providing a sense of mastery), and, given ethical considerations, we would be reluctant to withhold treatment for a month to prevent this confound. It also may be possible that this time period was relatively inconsequential due to its briefness, or perhaps depressed clients’ attitudes may be more negative regarding long-term versus short-term outcomes. Alternatively, participants may have had difficulty adjusting their predictions to accommodate a specific time period. In addition, the longer month time period used in prior research provided a broader opportunity to experience the life events. Furthermore, it is possible that the desirability of the events on the LE-PAQ may have differed in our community sample of clients with MDD compared to college students in prior studies. Though the LE-PAQ items were originally evaluated for applicability to general community members, this evaluation was conducted by undergraduate and graduate students, rather than community members.
themselves. There is a possibility for a systematic reporting bias on the LE-PAQ, but such biased reporting would likely impede the finding of pessimistic bias if anything, as discussed earlier. The RPC task posed several challenges in this study, as well. Several participants reported difficulty identifying and recruiting a significant other to ask for ratings. Additionally, clients were asked to recruit two significant others at intake, rather than one at intake and one at post. This was done to ease the participation demands of the client, but this prevented us from evaluating change in significant others’ ratings from intake to post, and it reduces confidence in evaluations of bias at post-treatment, as it may have been possible that significant others would have rated clients differently after treatment with CT. Further, there were technical difficulties that resulted in unusable data for a few participants on the ES-MPT, and some clients did not answer enough surveys to merit inclusion or answered surveys at unexpected times, in which case data were censored. Because of the reduced amount of data available for the RPC and ES-MPT, it is possible that analyses of potential moderators, such as gender, were especially underpowered.

Another limitation relates to the ES-MPT specifically: it is important to note that there may be some confound in that the outcomes on the ES-MPT were mood variables themselves. Thus, examining relationships between outcomes or bias and depressive symptom severity on these levels may be influenced by unavoidable covariance. However, using mood as an outcome variable is an interesting concept that we believe merits inclusion, as expectations for one’s mood might be a substantial contributor to one’s future mood.
Finally, it is difficult to know what skills therapists actually worked with clients to develop in their 16 weeks of CT. Though a theoretical goal of CT is to help clients evaluate the accuracy of their thoughts, it is possible therapists may have collaborated with clients to think optimistically or employed more behavioral tactics, such as promoting engagement in more activities. Perhaps clients were encouraged to engage in more desirable activities to increase the odds of positive reinforcement, which could be reflected in the changes observed in the variables involving desirable but not undesirable events on the LE-PAQ. Also, some courses of therapy may have emphasized evaluation of how one is viewed by others, or the positivity of one’s future, whereas other courses may have paid little, if any, attention to these issues. Nonetheless, this study was not designed to assess whether change in bias was the mechanism through which CT for depression works; the study was designed to assess the presence of bias at the start of treatment and evaluate any change that may have occurred following treatment. Causality could not be assessed with the current design. It could be that increasing the positivity of predictions drove symptom improvement, but we can not evaluate this in this study. Further research may examine the emphases of clients’ specific courses of therapy, individualized therapy goals, and within session strategies employed to better assess mechanisms most important to symptom change.

Conclusions

The results of this study are mixed and do not strongly support either the depressive realism or depressive bias hypotheses. Before CT, depressed clients were pessimistically biased regarding undesirable life events and expected daily levels of
sadness, but they were optimistically biased regarding desirable life events and not systematically biased on the RPC task or daily expectations of anxiety or interest. Depressed clients’ predictions of future life events, significant others’ ratings of their personalities, and experiences of mood were more negative than those of healthy matched controls. Outcomes on these measures were also more negative among depressed clients than healthy controls. However, depressed clients were not consistently more negatively biased than controls. With the exception of the RPC task, depressed clients’ predictions became more positive from intake to post-treatment, and their outcomes became more positive, though bias did not generally change. It appears that an increase in the prediction and experience of desirable life events drove the change in LE-PAQ predictions and outcomes, as predictions and experiences of undesirable events did not change. To maximize generalizability, future studies should continue to use measures that are consequential and emotionally engaging and have measurable outcomes that map onto predictions as well as recruit participants who resemble the clients who present for treatment. It may be useful for future studies to investigate additional domains of bias, such as long-term event expectations, academic or work achievement, or social skills. Further, it may be necessary to match specific bias tasks to schemas that are particularly relevant to each individual client; for some clients, self-appraisals as being unlovable may be central, whereas for others, perceptions of the self as unintelligent may be more relevant and related to depression. It is also suggested that future investigators consider revising the current study’s measures; for example, adding an additional variable to the LE-PAQ that records participants’ individualized ratings of desirability via differential
weighting may be indicated and make predictions more personally meaningful. In addition, future research should consider the tactics that cognitive behavioral therapists use when asking clients to reappraise their thoughts and predictions. Gaining a better understanding of how CT achieves its affects should promote a better understanding of the role of bias, if any, in depression.
References


Adler, A. D. (2012). *Change in Automatic and Strategic Cognition: An Examination of Cognitive Therapy for Depression* (Unpublished doctoral dissertation). The Ohio State University, Columbus, OH.


Wood, J., Moffoot, A. P. R., & O’Carroll, R. E. (1998). “Depressive realism” revisited: Depressed patients are realistic when they are wrong but are unrealistic when they are right. *Cognitive Neuropsychiatry, 3*, 119-126.
Appendix A: Gender Analyses

Women and men have demonstrated differences in coping and symptom profiles (Nolen-Hoeksema, 1987), and Strunk, Lopez, and DeRubeis (2006) and Strunk and Adler (2009) found an interaction between bias and gender such that the correlation between bias and depressive symptom severity was stronger for women than men on the life event prediction task. Accordingly, assessing for differences between women and men may be valuable in better understanding the relationship between bias and depression, and thus analyses were conducted separately among men and women. The following analyses are presented for descriptive purposes only and are not meant to be confirmatory. Due to lack of statistical power and the exploratory nature of these analyses, effect sizes will be highlighted where possible.

On the LE-PAQ, among men, there was evidence for an optimistic bias overall \((t(26) = 2.92, p = .01)\). Men were optimistic about desirable events \((t(26) = 4.48, p < .001)\) but pessimistically biased about undesirable events \((t(26) = -3.30, p = .003)\). Among women, bias at intake did not differ significantly from zero, reflecting no evidence of systematic optimistic or pessimistic bias \((t(34) = .45, p = .66)\). When analyzing desirable and undesirable events separately, women were optimistically biased about desirable events \((t(34) = 3.75, p < .001)\) and pessimistically biased about undesirable events \((t(34) = -4.74, p < .001)\). On the RPC task, men did not demonstrate bias \((t(13) = .07, p = .95)\),
but women were pessimistically biased \( t(20) = -2.50, p = .02 \). On the anxiety portion of the ES-MPT, there was a trend for women to be pessimistically biased \( t(33) = -1.97, p = .06 \), whereas men did not display bias \( t(24) = -.56, p = .58 \). Regarding sadness on the ES-MPT, both men and women were pessimistically biased (men: \( t(24) = -2.22, p = .04 \); women: \( t(33) = -6.15 p < .001 \)). Men were not biased regarding interest on the ES-MPT \( t(24) = .47, p = .64 \), but women were optimistically biased \( t(33)= 2.60, p = .01 \).

Descriptive analyses by gender were then conducted to assess change in prediction, outcome, and bias following treatment with CT. Results suggested that effects were largely similar across men and women: on the LE-PAQ, predictions of life events became more positive from intake to post-treatment for both men \( t(47) = -2.26, p = .03, d = -.53 \) and women, \( t(62) = -2.29, p = .03, d = -.57 \). Analyzing only desirable events, there was a small effect for men’s predictions to become more positive \( t(47) = -1.38, p = .18, d = -.41 \) but a moderate effect for women’s predictions to become more positive \( t(62) = -2.15, p = .04, d = -.54 \). Regarding undesirable events, neither men’s \( t(47) = .66, p = .51, d = .26 \) nor women’s \( t(39.13) = -.03, p = .98, d = 0 \) predictions changed.

On the RPC, men’s predictions did not change, \( t(41) = -.19, p = .85, d = -.06 \). For women, predictions on the RPC appeared to become more positive from intake to post-treatment, \( t(60) = -1.87, p = .07, d = -.48 \). On the ES-MPT, among men, depressed clients predicted less anxiety at post than intake, \( t(37) = 2.43, p = .02, d = .77 \). Their predictions of interest did not change \( t(17.38) = -1.18, p = .25 d = -.42 \), but they predicted less sadness at post than intake \( t(37) = 3.52, p = .001, d = 1.14 \). Among women, predictions of anxiety became less negative from intake to post, \( t(51) = 2.46, p = .02, d = .70 \). Predictions of
interest increased ($t(51) = -4.74, p < .001 \ d = -1.33$), and predictions of sadness decreased ($t(51) = 5.35, p < .001, d = 1.48$). On the whole, both men and women appeared to make more positive predictions at post-treatment compared with intake, with this effect slightly more consistent among women than men.

For descriptive purposes, change on outcomes was analyzed separately for women and men. On the LE-PAQ, outcomes became more positive for both men ($t(43) = -2.63, p = .02, d = -.74$) and women ($t(60) = -2.95, p = .005, d = -.71$). There was a strong effect for an increase in desirable outcomes among men ($t(43) = -2.56, \ p = .01, d = -.76$) and a moderate effect for an increase in desirable outcomes among women ($t(41.98) = -2.12, \ p = .05, d = -.53$). Regarding undesirable events, there was no substantial change in outcomes among men ($t(60) = .50, p = .62, d = .16$) or women ($t(60) = 1.34, p = .19, d = .35$), indicating that the overall positive shift in event outcomes was driven by desirable events for both genders. On the ES-MPT, men reported lower levels of anxiety at post compared to intake, $t(36)= 1.78, p = .08, d = .65$. There was no change in interest among men, $t(36) = -1.14, \ p = .26, d = -.37$. However, men reported significantly less sadness at post than intake, $t(36) = 3.48, \ p = .001, d = 1.22$. Among women, clients reported lower levels of anxiety at post, $t(50.72) = 3.69, p < .001, d = .98$. Interest increased ($t(51) = -3.04, p = .004, d = -.85$) and sadness decreased ($t(51) = 4.02, p < .001, d = 1.15$) at post among women. Overall, both women and men appeared to experience more positivity of outcomes at post-treatment compared to intake, with most changes similar between women and men.
Change in bias was also evaluated separately for men and women. The only strong effect was for a reduction in pessimistic bias among women on the sadness portion of the ES-MPT. On the LE-PAQ, there was no change in bias from intake to post-treatment for men ($t(43) = .65, p = .52, d = .15$) or women ($t(59) = .24, p = .81, d = .13$). There was no change from intake to post-treatment among men when considering desirable ($t(43) = .45, p = .66, d = .11$) and undesirable ($t(43) = .07, p = .95, d = .09$) events separately. There was also no change from intake to post-treatment among women when considering desirable ($t(59) = -.25, p = .80, d = -.06$) and undesirable ($t(59) = .58, p = .56, d = .15$) events separately. On the RPC, there was no change in bias when analyzing men ($t(25) = -.56, p = .58, d = -.25$) and women ($t(35) = -1.38, p = .18, d = -.47$) separately. On the ES-MPT, there was no change in bias regarding anxiety among men ($t(36) = -.81, p = .42, d = -.28$) or women ($t(51) = .53, p = .60, d = .16$). There was also no change in bias regarding interest among men ($t(36) = -.25, p = .80, d = -.09$) or women ($t(51) = -1.37, p = .18, d = -.39$). There was no change in bias regarding sadness among men ($t(36) = .26, p = .80, d = .09$), but, again, women became less pessimistically biased about sadness from intake to post-treatment ($t(51) = -2.04, p = .046, d = -.60$).

There appeared to be some differences by gender in assessing the relationship between the life event variables and depressive symptoms at intake. Descriptive statistics are shown in Table 11. There was no relationship between life event predictions and depressive symptoms on either the BDI-II or HRSD among men, but there was a negative relationship between life event predictions and depressive symptoms for women as measured by the BDI-II and a trend as measured by the HRSD. Among men, there was a
negative relationship between life event outcomes and depressive symptoms as measured on the HRSD though not on the BDI-II. Among women, there was a trend-level negative relationship between life event outcomes, though no relationship with the HRSD. When analyzing men and women separately, there was no relationship between bias and depressive symptoms on either measure of depressive symptoms. At post-treatment, there appeared to be a consistent negative relationship between life event predictions and depressive symptoms on both the BDI-II and HRSD for men and women. Among men, there was no relationship between life event outcomes and depressive symptoms on both measures. Among women, there was a negative trend-level relationship between life event outcomes and BDI-II scores but no relationship with HRSD scores. There was no relationship between bias and depressive symptoms on either measure when genders were analyzed separately. Overall, the relationship between predictions of life events and depressive symptoms seemed to be more consistent than relationships between outcomes and depressive symptoms or bias and depressive symptoms, though at intake, this relationship was only present among women.

A regression including bias, gender, and event type on the LE-PAQ (i.e., desirable or undesirable) as predictors of depressive symptoms was conducted using scores at intake. Depressive symptom level was defined as the average of standardized BDI-II and HRSD scores. At intake, there was a main effect of sex on depressive symptom score, \( F(1, 60) = 6.38, p = .01 \). The interaction between bias, gender, and event was also significant, \( F(1, 56) = 6.07, p = .01 \). Correlations were conducted to further understand this interaction. Under predicting desirable events was associated with high depressive
symptom severity among women, $r = -.37, p = .03$. There was no association between bias on desirable life events and depressive symptom severity among men, $r = .19, p = .34$. Further, there was no relationship between bias on undesirable life events and depressive symptoms severity among men ($r = -.18, p = .38$) or women ($r = .22, p = .21$).

Correlations between RPC variables and depressive symptoms are shown separately by gender in Table 12. For men, predictions were negatively related to BDI-II and HRSD scores. For women, predictions were negatively related to BDI-II scores, and there was a trend-level negative relationship between predictions and HRSD scores. Among men or women, there was no relationship between RPC bias and BDI-II or HRSD scores. At post, predictions and bias on the RPC task were not related to depressive symptoms for men or women.

Correlations between ES-MPT variables and depressive symptoms by gender are shown in Table 13. There appeared to be no consistent pattern of differences between men and women when evaluating the relationship between ES-MPT variables and depressive symptoms.

In summary, when considering bias, women generally tended to be more negative relative to men. Whereas men’s bias scores at intake did not significantly differ from zero on the RPC or on the anxiety and interest ES-MPT questions, women were negatively biased on all of those tasks. Further, men were optimistically biased on the LE-PAQ, whereas women’s bias scores did not differ from zero. Both men and women were pessimistically biased on the sadness question on the ES-MPT. There were no especially notable differences between men and women when examining change in
predictions or outcomes from intake to post. However, interestingly, on the ES-MPT, women became less negatively biased in their judgments about feeling sad from intake to post. There was an association between prediction of life events and depression only among women at intake, though this associated was present for both women and men at post. On the ES-MPT, there was a relatively strong relationship between predictions and depression among women. Moreover, at intake, women who underpredicted positive life events had higher symptom severity. One possible explanation for these findings is that negative cognition could be a strong etiological or maintaining factor in depression in women, whereas depression in men could be driven by other sources, such as lack of behavioral activation. Nolen-Hoeksema (1987) summarized a wide body of literature assessing gender differences in coping with depression, noting that men tend to participate in distracting activities to distance themselves from low mood, whereas women tend to withdraw and ruminate about contributing factors and consequences of their depression, which are cognitively-focused activities. Nolen-Hoeksema further argued that rumination maintains and perhaps even worsens depressive symptoms in that it prevents people with depression from carrying out important behaviors, may enhance availability of recall of past negative events, and might prime people to consider negative explanations for current experiences. Accordingly, the presence of negative bias may be especially important in women due to their tendency to cope via rumination. Further research into these gender differences may be warranted.
Appendix B: Tables and Figures
Table 1

*Bias (absolute difference from zero) among clients with MDD*

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>LE-PAQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>62</td>
<td>0.02</td>
<td>0.07</td>
<td>2.04*</td>
</tr>
<tr>
<td>Desirable</td>
<td>62</td>
<td>0.12</td>
<td>0.16</td>
<td>5.76***</td>
</tr>
<tr>
<td>Undesirable</td>
<td>62</td>
<td>-0.08</td>
<td>0.11</td>
<td>-5.76***</td>
</tr>
<tr>
<td>RPC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>35</td>
<td>-0.06</td>
<td>0.20</td>
<td>0.46</td>
</tr>
<tr>
<td>ES-MPT</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>59</td>
<td>-0.22</td>
<td>0.84</td>
<td>-1.97†</td>
</tr>
<tr>
<td>Sadness</td>
<td>59</td>
<td>-0.49</td>
<td>0.64</td>
<td>-5.86***</td>
</tr>
<tr>
<td>Interest</td>
<td>59</td>
<td>0.19</td>
<td>0.65</td>
<td>2.25*</td>
</tr>
</tbody>
</table>

*Note. Bias scores range from -1 to 1 on all measures. t-values in bold indicate statistical significance after implementing the Holm-Bonferroni procedure for multiple comparisons. †p < .10, *p < .05, **p < .01, ***p < .001.*
Table 2
Comparisons of predictions between depressed clients at intake and healthy controls

<table>
<thead>
<tr>
<th>Variable</th>
<th>Depressed</th>
<th>Control</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n  M  SD</td>
<td>n  M  SD</td>
<td>t   d</td>
</tr>
<tr>
<td>LE-PAQ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>66 0.07 0.07</td>
<td>45 0.16 0.06</td>
<td><strong>-6.77</strong>* -1.38</td>
</tr>
<tr>
<td>Desirable</td>
<td>66 0.32 0.17</td>
<td>45 0.47 0.17</td>
<td><strong>-4.47</strong>* -0.88</td>
</tr>
<tr>
<td>Undesirable</td>
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<td>45 0.15 0.12</td>
<td>1.61 0.33</td>
</tr>
<tr>
<td>RPC</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>61 62.50 14.26</td>
<td>43 75.24 10.58</td>
<td><strong>-5.24</strong>* -1.01</td>
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<tr>
<td>ES-MPT</td>
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<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>59 2.75 0.80</td>
<td>38 1.60 0.63</td>
<td><strong>-7.49</strong>* 1.60</td>
</tr>
<tr>
<td>Sadness</td>
<td>59 2.75 0.63</td>
<td>38 1.31 0.48</td>
<td><strong>-12.08</strong>* 2.57</td>
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<tr>
<td>Interest</td>
<td>59 2.62 0.62</td>
<td>38 3.85 0.82</td>
<td><strong>8.37</strong>* -1.69</td>
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</tbody>
</table>

*Note.* Prediction scores range from -1 to 1 on the Overall LE-PAQ and 0 to 1 on the Desirable and Undesirable subsets of the LE-PAQ. Prediction scores range from 0-100 on the RPC. Prediction scores range from 1-7 on the ES-MPT. *t*-values in bold indicate statistical significance after implementing the Holm-Bonferroni procedure for multiple comparisons.

†*p < .10, *p < .05, **p < .01, ***p < .001.
Table 3

Comparisons of outcomes between depressed clients at intake and healthy controls

<table>
<thead>
<tr>
<th>Variable</th>
<th>Depressed</th>
<th>Control</th>
<th>Comparison</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M</td>
<td>SD</td>
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<tr>
<td>LE-PAQ</td>
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<tr>
<td>Overall</td>
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<td>0.07</td>
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<tr>
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<td>63</td>
<td>3.84</td>
<td>2.56</td>
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<tr>
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<td>ESM</td>
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<tr>
<td>Anxiety</td>
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<tr>
<td>Sadness</td>
<td>59</td>
<td>2.28</td>
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</tr>
<tr>
<td>Interest</td>
<td>59</td>
<td>2.42</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Note. Outcome scores range from -1 to 1 on the Overall LE-PAQ. Outcome scores range from 0-20 on the Desirable and Undesirable subsets of the LE-PAQ and represent the average number of events that occurred within the Desirable and Undesirable subsets. Outcome scores on the RPC range from 0-100. Outcome scores range from 1-7 on the ES-MPT. t-values in bold indicate statistical significance after implementing the Holm-Bonferroni procedure for multiple comparisons. †p < .10, *p < .05, **p < .01, ***p < .001.
Table 4

Comparisons of bias between depressed clients at intake and healthy controls

<table>
<thead>
<tr>
<th>Variable</th>
<th>Depressed</th>
<th>Control</th>
<th>Comparison</th>
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<tbody>
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<td>LE-PAQ</td>
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<td>-0.08</td>
<td>0.11</td>
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<tr>
<td>Overall</td>
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<tr>
<td>Interest</td>
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<td>0.65</td>
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</table>

Note. Bias scores range from -1 to 1 on all measures. t-values in bold indicate statistical significance after implementing the Holm-Bonferroni procedure for multiple comparisons.

†p < .10, *p < .05, **p < .01, ***p < .001.
### Table 5

Change in predictions from intake to post-treatment among depressed clients

<table>
<thead>
<tr>
<th>Variable</th>
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<th>Post</th>
<th>Comparison</th>
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<td>M</td>
<td>SD</td>
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<td>LE-PAQ</td>
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<tr>
<td>Overall</td>
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<td>0.07</td>
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<td>Desirable</td>
<td>66</td>
<td>0.32</td>
<td>0.17</td>
</tr>
<tr>
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<td>0.19</td>
<td>0.12</td>
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<tr>
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<tr>
<td>Overall</td>
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<td>Interest</td>
<td>59</td>
<td>2.62</td>
<td>0.62</td>
</tr>
</tbody>
</table>

*Note.* Prediction scores range from -1 to 1 on the Overall LE-PAQ and 0 to 1 on the Desirable and Undesirable subsets of the LE-PAQ. Prediction scores range from 0-100 on the RPC. Prediction scores range from 1-7 on the ES-MPT. *t*-values in bold indicate statistical significance after implementing the Holm-Bonferroni procedure for multiple comparisons.

†*p* < .10, *p* < .05, ***p* < .01, ****p* < .001.
Table 6

Change in outcomes from intake to post-treatment among depressed clients

<table>
<thead>
<tr>
<th>Variable</th>
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<th></th>
<th>Post</th>
<th></th>
<th>Comparison</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
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<td>SD</td>
<td>n</td>
<td>M</td>
<td>SD</td>
<td>t</td>
</tr>
<tr>
<td>LE-PAQ</td>
<td></td>
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</tr>
<tr>
<td>Overall</td>
<td>63</td>
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<td>0.07</td>
<td>44</td>
<td>0.10</td>
<td>0.08</td>
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</tr>
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<td>2.56</td>
<td>44</td>
<td>5.73</td>
<td>3.43</td>
<td>-3.10**</td>
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<td>63</td>
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<td>1.74</td>
<td>44</td>
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<td>1.23</td>
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<tr>
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<td>0.64</td>
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<td>0.61</td>
<td>5.27***</td>
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<tr>
<td>Interest</td>
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<td>0.69</td>
<td>32</td>
<td>2.92</td>
<td>0.89</td>
<td>-3.01**</td>
</tr>
</tbody>
</table>

Note. Outcome scores range from -1 to 1 on the Overall LE-PAQ. Outcome scores range from 0-20 on the Desirable and Undesirable subsets of the LE-PAQ and represent the average number of events that occurred within the Desirable and Undesirable subsets. Outcome scores range from 1-7 on the ES-MPT. RPC outcome ratings were all collected at intake and are thus not included in this table. *-values in bold indicate statistical significance after implementing the Holm-Bonferroni procedure for multiple comparisons. †p < .10, *p < .05, **p < .01, ***p < .001.
Table 7

*Change in bias from intake to post-treatment among depressed clients*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intake</th>
<th></th>
<th></th>
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<tbody>
<tr>
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<td>M</td>
<td>SD</td>
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<td>M</td>
<td>SD</td>
<td>t</td>
<td>d</td>
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</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>62</td>
<td>0.02</td>
<td>0.07</td>
<td>44</td>
<td>0.01</td>
<td>0.07</td>
<td>0.62</td>
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<td>62</td>
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<td>44</td>
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<td>0.17</td>
<td>0.11</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Undesirable</td>
<td>62</td>
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<td>0.11</td>
<td>44</td>
<td>-0.09</td>
<td>0.14</td>
<td>0.55</td>
<td>0.08</td>
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<td></td>
<td></td>
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<td>Anxiety</td>
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<td>0.84</td>
<td>32</td>
<td>-0.22</td>
<td>0.72</td>
<td>0.02</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Sadness</td>
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<td>0.64</td>
<td>32</td>
<td>-0.33</td>
<td>0.46</td>
<td>-1.42</td>
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<tr>
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<td>0.65</td>
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<td>0.71</td>
<td>-1.24</td>
<td>-0.26</td>
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</tr>
</tbody>
</table>

*Note.* Bias scores range from -1 to 1 on all measures. *t*-values in bold indicate statistical significance after implementing the Holm-Bonferroni procedure for multiple comparisons. †*p* < .10, *p* < .05, **p** < .01, ***p** < .001.
### Table 8

Correlations between LE-PAQ variables and depressive symptoms among depressed clients

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intake</th>
<th></th>
<th></th>
<th>Post</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>BDI</td>
<td>HAMD</td>
<td>BDI</td>
<td>HAMD</td>
<td>BDI</td>
<td>HAMD</td>
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<td></td>
<td>n</td>
<td>r</td>
<td>n</td>
<td>r</td>
<td>n</td>
<td>r</td>
</tr>
<tr>
<td>Predictions</td>
<td>66</td>
<td>-.31*</td>
<td>66</td>
<td>-.30*</td>
<td>45</td>
<td>-.50***</td>
</tr>
<tr>
<td>Outcomes</td>
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<td>-.18</td>
<td>63</td>
<td>-.22†</td>
<td>42</td>
<td>-.40**</td>
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<td>62</td>
<td>-.12</td>
<td>62</td>
<td>-.11</td>
<td>42</td>
<td>-.04</td>
</tr>
</tbody>
</table>

*Note. †p < .10, *p < .05, **p < .01, ***p < .001.*
Table 9

Correlations between RPC variables and depressive symptoms among depressed clients

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intake BDI</th>
<th>Intake HAMD</th>
<th>Post BDI</th>
<th>Post HAMD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predictions</td>
<td>61 -.63***</td>
<td>61 -.37**</td>
<td>44 -.15</td>
<td>44 -.01</td>
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<td>21 -.40†</td>
<td>21 -.21</td>
<td>21 -.24</td>
<td>21 -.18</td>
</tr>
</tbody>
</table>

Note. †p < .10, *p < .05, **p < .01, ***p < .001.
Table 10

Correlations between ES-MPT variables and depressive symptoms among depressed clients

<table>
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<tr>
<th>Variable</th>
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<th>HRSD</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intake</td>
<td>Post</td>
<td>Intake</td>
<td>Post</td>
</tr>
<tr>
<td>Predictions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>.12</td>
<td>.43*</td>
<td>.11</td>
<td>.50**</td>
</tr>
<tr>
<td>Sadness</td>
<td>.28*</td>
<td>.57***</td>
<td>.14</td>
<td>.30†</td>
</tr>
<tr>
<td>Interest</td>
<td>-.15</td>
<td>-.56***</td>
<td>-.05</td>
<td>-.53**</td>
</tr>
<tr>
<td>Outcomes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>.25†</td>
<td>.25</td>
<td>.32*</td>
<td>.25</td>
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<td>.36**</td>
<td>.38*</td>
<td>.34**</td>
<td>.23</td>
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<td>Interest</td>
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<td>-.47**</td>
<td>-.18</td>
<td>-.47**</td>
</tr>
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<td>Bias</td>
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<td></td>
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<td>Anxiety</td>
<td>.16</td>
<td>-.27</td>
<td>.24†</td>
<td>-.40*</td>
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<td>Sadness</td>
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<td>-.40*</td>
<td>.24†</td>
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<td>Interest</td>
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<td>-.17</td>
<td>.09</td>
<td>-.11</td>
</tr>
</tbody>
</table>

Note: n for all cells at intake is 59. n for predictions at post is 33. n for outcomes and bias at post is 32.
†p < .10, *p < .05, **p < .01, ***p < .001.
Table 11

Correlations between LE-PAQ variables and depressive symptoms among depressed clients, by gender

Panel A - Men

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intake</th>
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<th>Post</th>
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</tr>
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<td>HAMD</td>
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<td>n</td>
<td>r</td>
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<td>29</td>
<td>-.27*</td>
</tr>
<tr>
<td>Outcomes</td>
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<td>-.12</td>
<td>27</td>
<td>-.39*</td>
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<tr>
<td>Bias</td>
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<td>.09</td>
<td>27</td>
<td>.08</td>
</tr>
</tbody>
</table>

Panel B - Women

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intake</th>
<th></th>
<th>Post</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BDI</td>
<td>HAMD</td>
<td>BDI</td>
<td>HAMD</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>r</td>
<td>n</td>
<td>r</td>
</tr>
<tr>
<td>Predictions</td>
<td>37</td>
<td>-.47**</td>
<td>37</td>
<td>-.32†</td>
</tr>
<tr>
<td>Outcomes</td>
<td>35</td>
<td>-.30†</td>
<td>36</td>
<td>-.13</td>
</tr>
<tr>
<td>Bias</td>
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<td>-.21</td>
<td>35</td>
<td>-.21</td>
</tr>
</tbody>
</table>

Note. †p < .10, *p < .05, **p < .01, ***p < .001.
Table 12

Correlations between RPC variables and depressive symptoms among depressed clients, by gender

Panel A - Men

<table>
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<tr>
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<th>Post</th>
<th>Intake</th>
<th>Post</th>
</tr>
</thead>
<tbody>
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<td>HAMD</td>
<td>BDI</td>
<td>HAMD</td>
</tr>
<tr>
<td>Predictions</td>
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<tr>
<td>Bias</td>
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<td>18</td>
<td>-.35</td>
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</table>

Panel B - Women

<table>
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<tr>
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<th>Intake</th>
<th>Post</th>
<th>Intake</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
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<td>HAMD</td>
<td>BDI</td>
<td>HAMD</td>
</tr>
<tr>
<td>Predictions</td>
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<td>-.69***</td>
<td>36</td>
<td>-.32†</td>
</tr>
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<td>Bias</td>
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<td>12</td>
<td>-.04</td>
</tr>
</tbody>
</table>

Note. †p < .10, *p < .05, **p < .01, ***p < .001.
Table 13

Correlations between ES-MPT variables and depressive symptoms among depressed clients, by gender.

Panel A - Men

<table>
<thead>
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<th>Intake</th>
<th>Post</th>
<th>Intake</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predictions</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
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<td>.22</td>
<td>-.04</td>
<td>.48†</td>
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<td>.29</td>
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<td>-.02</td>
<td>-.60*</td>
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<tr>
<td>Outcomes</td>
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</tr>
<tr>
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<td>.09</td>
<td>.32</td>
<td>.28</td>
</tr>
<tr>
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<td>-.01</td>
<td>.47*</td>
<td>.04</td>
</tr>
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<td>-.63*</td>
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Panel B - Women

<table>
<thead>
<tr>
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<th>Post</th>
<th>Intake</th>
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</tr>
</thead>
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<td>-.26</td>
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</tbody>
</table>

Note: In Panel A, n for all cells at intake is 25. n for all cells at post is 13. In Panel B, n for all cells at intake is 34. n for all cells at post is 19.

†p < .10, *p < .05, **p < .01, ***p < .001.
Figure 1. Illustration of depressive realism and depressive bias hypotheses (Strunk, Lopez, & DeRubeis (2006).