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The current study examines the interrelationships of personality, cognitive biases, and stressful life events in the prediction of depression. Previous research has indicated that personality factors of Gray's Reinforcement Sensitivity Theory (Gray & McNaughton, 2000), the Behavioral Inhibition System and the Behavioral Approach System, predict concurrent and future depression symptoms. Other lines of research indicate that cognitive biases including negative cognitive content such as dysfunctional thoughts and negative cognitive processes such as attention and memory biases predict depression symptoms when measured after a negative mood prime or under cognitive load (Alloy & Abramson, 1999; Rude, Covich, Jarrold, Hedlund, & Zentner, 2001; Wenzlaff, Rude, Taylor, Stultz, & Sweatt, 2001). Finally, stressful life events predict the onset of depression symptoms (Miller & Rahe, 1997; Paykel, 2003; Tennant, 2002). However, little research examines the relationship among these factors, especially the relationship between personality and cognitive biases.

The current study found that high BIS, more stressful life events, and more negative and fewer positive automatic thoughts are associated with greater depression symptoms. BIS was related to automatic thoughts but had only very minimal associations with attention and memory biases.

REINFORCEMENT SENSITIVITY, COGNITIVE BIASES,  
STRESSFUL LIFE EVENTS, AND  
DEPRESSION SYMPTOMS

By

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## CHAPTER I

### INTRODUCTION

Extremes on Gray's Reinforcement Sensitivity (RST; Gray & McNaughton, 2000; Pickering & Gray, 1999) personality traits and cognitive biases such as negative automatic thoughts, attention bias and memory bias predict risk for depression. We know very little about how RST and cognitive biases are related, but three possibilities exist: 1) they represent separate factors that independently predict depression; 2) they represent the same factor; 3) personality causes cognitive biases which then cause depression. Knowing how these personality factors and cognitive biases are related would increase understanding of the nature of these risk factors and may help us design prevention and treatment interventions. The current study examined relationships of RST traits, stressful life events, negative automatic thoughts, and attention and memory biases in the prediction of depression symptoms. Although this cross-sectional study did not allow conclusions about which of the above possibilities is correct, it provided a preliminary examination of the association between these factors. It also examined the interaction of stressful life events with the supposed cognitive and personality diatheses. First, I describe each of these three components and then I will examine the interrelationships among these components.

#### *Reinforcement Sensitivity Theory*

Gray's Reinforcement Sensitivity Theory is a biologically-based personality model that

may provide a useful framework for understanding depressive symptoms. RST posits the existence of three major brain systems that underlie normal mood, orienting, and appetitive functioning. These brain systems are referred to as the Behavioral Approach System (BAS), the Behavioral Inhibition System (BIS), and the Fight-Flight-Freeze System (FFFS).

The BAS is sensitive to cues of reward and relief from punishment and activates reward-seeking behavior, feelings of elation, and desire for reward, despite risk or threat to the individual (Pickering & Gray, 1999). This system responds to unconditioned stimuli such as food, social contact, or sex, as well as to conditioned stimuli such as money. When activated by potential reward, the BAS activates the dopamine system in the ventral tegmental area (Depue & Collins, 1999), the basal ganglia, ventral striatum, and the dopaminergic fibers connecting the mesencephalon and mesolimbic system to the basal ganglia and thalamic nuclei (Harmon-Jones, Abramson, Sigelman, Bohlig, Hogan, & Harmon-Jones, 2002) and stimulates an emotion similar to hope (Reuter, Stark, Hennig, Walter, Kirsch, Schienle et al., 2004).

The BIS causes anxiety, inhibition, orienting, arousal, and passive avoidance when experiencing cues of punishment and novel stimuli. Brain structures involved include the septo-hippocampal system and its connections to the frontal cortex, the locus coeruleus, and the raphe nucleus (Gray & McNaughton, 2000), areas identified by neuropsychological research as important in anxiety. From an emotional perspective, the BIS produces anxiety and negative affect. Gray's concept of the BIS is similar to the temperamental concept of behavioral inhibition identified in children (Coplan, Wilson, Frohlick, & Zelenski, 2006; Hirshfeld-Becker, Biederman, & Rosenbaum, 2004).

Finally, the FFFS motivates avoidance and escape behaviors in response to both conditioned and unconditioned aversive stimuli and produces the emotion of fear. Corr (2004) has suggested that the BIS as previously studied actually reflects combined BIS/FFFS functioning.

Therefore, the current paper refers to BIS/FFFS functioning as BIS functioning.

Developed as a modification of Eysenck's personality theory of neuroticism and extraversion, Gray's model represents a 30° rotation such that high BAS is a combination of high extraversion and high neuroticism and high BIS is a combination of low extraversion and high neuroticism. Implicit in Gray's theory is the idea that an individual is predisposed to certain levels of BIS and BAS activation by genetic and biological factors and that environmental contingencies and learning modify these predispositions throughout development (Pickering & Gray, 1999). Both the BIS and BAS are relatively stable over time and over clinical state (Kasch, Rottenberg, Arnow, & Gotlib, 2002).

Extreme under- or over- sensitivity of these systems predicts psychopathology (Pickering & Gray, 1999). Low BAS predicts depression symptoms (Depue, Krauss, & Spoont, 1987; Kimbrel, Nelson-Gray, & Mitchell, 2007; Meyer, Johnson, & Carver, 1999) and is associated with persistence of those symptoms over an 8-month interval (Campbell-Sills, Liverant & Brown, 2004). The BIS appears to be an anxiety system (Gray & McNaughton, 2000) and predicts subclinical anxiety symptoms (Kimbrel et al., 2007) and anxiety disorder diagnoses (Johnson, Turner, & Iwata, 2003). However, it appears that BIS also predicts both classical depression (Campbell-Sills et al., 2004; Kasch et al., 2002; Meyer et al., 1999) and mixed-anxiety depression symptoms (Kimbrel et al., 2007; Hundt, Kimbrel, Mitchell, Nelson-Gray & Kwapil, 2007). High BIS sensitivity in adolescence predicts later diagnoses of depression (Johnson et al., 2003). In addition, BIS sensitivity predicts depression symptoms even when anxiety symptoms are partialled out (Hundt et al, 2007) and in individuals with no comorbid diagnosis of anxiety (Johnson et al., 2003). Thus, it appears that high BIS and low BAS both predict depression symptoms and diagnoses of depression.

### *Cognitive Biases*

Cognitive models of depression (Beck, 1967; 1987) suggest that maladaptive schemas lead to depression through a negative information-processing bias involving both negative cognitive content (dysfunctional attitudes and beliefs) and negative cognitive processes (attention and memory biases for negative information). Thus, Beck's model proposes that cognitive biases are antecedent to and increase risk for depression. Other possible hypotheses include that cognitive biases may simply be a concomitant of depression or may be a consequence of having a previous episode of depression (the "scar" hypothesis). Attention biases, memory biases and dysfunctional attitudes have been consistently demonstrated in currently depressed or dysphoric individuals (e.g., Colombel, Gilet, & Corson, 2004; Gotlib & McCann, 1984; Hammen, Miklowtz, & Dyck, 1986; Hertel, 2002; Matthews & Antes, 1992). These explicit biases, however, are not consistently found before the onset or after the remission of depression symptoms when measured by endorsement of negative thought patterns or measurement of attention and memory bias in euthymic participants (Barnett & Gotlib, 1988; Hollon, Kendall, and Lumry, 1986; for a review, see Coyne & Gotlib, 1983). This evidence suggests that negative cognitive biases and content are simply concomitants of a depressive episode.

Other research, however, has suggested a number of strategies for revealing cognitive biases that are latent or suppressed when the person is not currently in a depressive episode. People have a tendency to suppress negative cognitive processes and content in order to maintain positive mood (e.g., Matthews and Antes, 1992; Walker, Skowronski, & Thompson, 2003) which makes detection of these biases more difficult when a person is not depressed. There are three approaches that attempt to detect biases in order to predict the onset of future depression symptoms. In this line of research, remitted depressives are often participants of interest because

they have had at least one depressive episode and 50-60% of these individuals will go on to have another episode of depression (APA, 2000). Thus, remitted depressives are prime candidates for holding latent depressogenic cognitions. In addition, this line of research also often focuses on longitudinal studies of never-depressed individuals who during the course of the study become depressed or develop subclinical depression symptoms. This paper reviews results for both of these types of subjects using three different approaches to reveal cognitive bias.

*First Approach: Negative Mood Induction*

The first approach to detecting suppressed cognitive bias involves inducing a negative mood in participants. This is consistent with Beck's (1967, 1987) cognitive theory of depression that suggests that schemas become activated when stressful events occur that resemble the type of events that originally led to the creation of the schema. This priming hypothesis suggests that under conditions similar to previous depressive episodes, such as sad mood, persons with remitted depression and persons at-risk for depression would show negative cognitive content and processes (Beck, Rush, Shaw, & Emery, 1979) whereas other individuals would not show cognitive biases despite negative mood.

Consistent with Beck's theory, studies that use a negative mood induction with cognitive bias questionnaires generally find that increased cognitive bias does distinguish remitted depressives from controls and distinguishes those who later develop depression from controls. Scores on the Dysfunctional Attitudes Scale (DAS; Weissman, 1980) distinguish participants with remitted depression from those without a history of depression only after a negative mood induction (Miranda & Persons, 1988). Similarly, when tested after a negative mood prime, automatic negative thoughts and dysfunctional attitudes were higher in participants with a previous history of depression than in participants without this history

(Roberts & Kassel, 1996). This effect appeared only when participants felt increased negative affect, not decreased positive affect. Finally, there is some evidence that this pattern is apparent in never-depressed individuals who later become depressed. After a negative mood prime, increased negative cognitive bias as measured by the Dysfunctional Attitudes Scale and the Cognitive Style Questionnaire (CSQ; Alloy, Abramson, Hogan, Whitehouse, Rose, Robinson, Kim, & Lapkin, 2000) predicted both the first onset of depression (Alloy & Abramson, 1999) and recurrence of depression over a 2.5 year period (Alloy et al., 2000). Overall, there is some evidence that cognitive content biases are stable, trait-like features detectable before a depressive episode and that these biases predict the onset of depression symptoms.

Just as a negative mood induction reveals suppressed cognitive biases on questionnaires, it also reveals attention and memory biases on cognitive tasks that predict depression. Teasdale and Dent (1987) demonstrated that when in a negative mood, previously depressed women had better recall for self-referent negative words than did never depressed women. Following a negative mood induction, biased recall was found among formerly dysphoric participants (Gilboa & Gotlib, 1997). Previously-depressed adults showed greater attentional bias for negative information on a dichotic listening task after a negative mood induction whereas their performance was no different from controls in the neutral mood condition (Ingram & Ritter, 2000). Following a negative mood induction, girls at risk for depression as defined by having a mother diagnosed with depression attended more to negative faces than did low-risk girls (Joorman, Talbot, & Gotlib, 2007). Few prospective studies have examined whether these cognitive biases predict the onset of depression but the results appear to be generally consistent with the mood induction hypothesis. For example, after a negative mood induction attentional biases assessed with a dot-probe task predicted increases in dysphoria longitudinally (Beevers & Carver, 2003).

### *Second Approach: Adding Cognitive Load*

A second approach to revealing cognitive biases involves measuring biased attention and memory during cognitive load; that is, while the participant is doing some other task that takes up cognitive processing ability, such as remembering a 6-digit number. Wenzlaff et al. (2001) suggest that cognitive biases are often hard to detect because those at risk for depression actively try to suppress negative information and negative thoughts. This suppression is achieved by two mechanisms: an operating process that promotes and turns attention to desired thoughts and a monitoring process that continually scans for negative thoughts and alerts the operating process to their presence. As the operating process requires mental effort, its efficiency can be reduced by a cognitive load. The more automatic monitor process, however, continues detecting negative thoughts. Thus, under cognitive load, the monitor will increasingly highlight negative information and bring failures to suppress negative thoughts to the attention of the individual, increasing negative mood (Wenzlaff & Wegner, 2000). As predicted by this theory, previously-depressed participants score higher on a thought-suppression inventory (Rude & McCarthy, 2003), suggesting that these individuals may be attempting to suppress negative depression-related thoughts.

Similar ideas come from other areas of research. Beevers (2005) posits a dual process model of depression in which associative or implicit cognitive processes underlie risk for depression whereas reflective or explicit cognitive processes can challenge the implicit negative thoughts if sufficient cognitive resources are available. Posner and Rothbart (2000) suggest that effortful attentional control mechanisms that allow shifting attention towards positive information and away from negative information are related to better regulation of distress. Matthews and Antes (1992) theorize that the tendency for individuals to fixate on positive parts

of images more frequently than negative parts reflects a type of “perceptual defense” mechanism that attempts to maintain the attention away from depressogenic stimuli.

Overall, this literature suggests that people have cognitive processes that reduce the perceived frequency and importance of negative events (Walker et al., 2003), a process that is disrupted in individuals with depression symptoms. Wenzlaff and Wegner’s (2000) model of cognitive suppression of negativity and Beevers’ (2005) dual process model provide interesting hypotheses about how this self-protecting bias might be disrupted in those at risk for depression symptoms.

As predicted by these theories, the addition of a cognitive load to an attention task allowed detection of negative cognitive biases in never depressed participants (Rude, Wenzlaff, Gibbs, Vane, & Whitney, 2002) who 6 weeks later developed depressive symptoms. In another sample, cognitive load allowed detection of attention biases that predict depression symptoms four months later (Rude et al., 2001). Similarly, cognitive load during an attention task allowed detection of attentional biases in remitted depressives who showed no negative bias without load (Wenzlaff et al., 2001).

### *Third Approach: Measuring Implicit and Incidental Memory*

Finally, various types of memory have been studied for their possible effect upon depression. One approach to detecting latent cognitive biases is to measure memory bias in such a way that participants are not aware that they are being tested for memory. Consistent with research previously discussed indicating that non-depressed individuals at risk for depression try to suppress their negative cognitive style and therefore try to forget explicit memories of negativity, negative implicit memory bias should be associated with the risk for depression symptoms, although this effect has not been shown to be robust (Barry, Naus, &

Rehm, 2004; Watkins, Grimm, Whitney, & Brown, 2005). In addition, the studies that have shown significant implicit memory bias require that tests of memory be conceptual (i.e. regard word meaning) rather than perceptual (i.e., filling in a word stem).

Incidental memory bias has also been studied as a candidate. Incidental memory requires that the participant is not aware that they are encoding information for which they will later be tested. Prior research indicates that incidental memory is negatively biased in depressed participants and participants who experience a negative mood induction (e.g., Bradley, Mogg, & Williams, 1995; Drenfield and Roberts, 2006; Watkins, Martin & Stern, 2000).

#### *Differentiating Positive and Negative Bias*

The previously discussed studies of cognitive bias generally do not differentiate bias for negative information with lack of bias for positive information, yet there is some evidence that increased attention and memory for negative information is not synonymous with decreased attention and memory for positive information (Noguchi, Gohm, & Dalsky, 2006; Watkins et al., 2005). Studies that measure memory and attention for negative, positive, and neutral information occasionally find enhanced bias for both positive and negative information simultaneously, relative to neutral information (e.g., Ingram & Ritter, 2000). Therefore, it appears that bias for negative and positive information can be measured independently.

In fact, different personality traits predict negative bias and positive bias. Memory for positive information is related to BAS whereas bias for negative information is related to BIS (Gomez & Gomez, 2002; Gomez, Cooper, McOrmond, & Tatlow, 2003). BIS predicts expectancies of negative outcomes whereas BAS predicts expectancies of positive outcomes (Beavers & Meyer, 2000; Corr, Pickering, & Gray, 1995; Smith, Williams, Cyders, & Kelley, 2006; Zinbarg & Mohlman, 1998); BIS predicts negative judgments of the self and situations

whereas BAS predicts positive judgments (Gomez et al., 2003; Heimpel, Elliot, & Wood, 2006; Jackson, 2001; Noguchi et al., 2006).

Previous studies have tended to focus on negatively biased attention and memory or to simply compare the ratio of memory for negative events to memory for positive events. However, a recent review (Watkins et al., 2005) suggests that some studies of currently depressed or at risk participants find a lack of the positive bias as well as an increased negative bias relative to neutral stimuli. For example, Fogarty and Hemsley (1983) found that currently depressed participants had poorer memory for positive information and better memory for negative information compared to remitted depressives. Teasdale and Dent (1987) found that after a negative mood induction, remitted depressives had poorer memory for positive words as well as better memory for neutral words. These studies suggest that depression involves both poor attention and memory for positive information and increased attention and memory for negative information. Thus, the current study investigated both negative bias and positive bias.

### *Stressful Life Events*

Both personality and cognitive theories of depression suggest that stressful life events may be important in triggering the underlying vulnerabilities to psychopathology. Stressful life events predict depression symptoms in both correlational and longitudinal studies (Miller & Rahe, 1997; Paykel, 2003; Tennant, 2002; Williamson, Birmaher, Dahl, & Ryan, 2005), although few have examined the interaction of personality, cognitive biases, and life stress in predicting internalizing symptoms. Of these few studies, stressful life events have been shown to interact with RST personality dimensions in the prediction of depressive symptoms (Hundt et al., 2007), and have been shown to interact with attentional biases to predict increases in dysphoria seven weeks later (Beavers & Carver, 2003). Overall, there is some evidence to

suggest that stressful life events interact with both personality and cognitive biases to predict concurrent depression symptoms.

### *Depression as a Continuum*

As Ingram, Miranda, and Segal (1998) point out in their comprehensive review of risk for depressive disorders, a great deal of evidence suggests that depression represents a continuum containing major depression, dysthymia, depressive personality disorder, and subclinical depression. Diagnosable major depression falls at the extreme end of the continuum and minor or subclinical depression represents a qualitatively similar but less extreme variant of this phenomenon. Subclinical depression and major depression have similar risk factors, similar prevalence across genders and age of onset, and respond to similar interventions (American Psychiatric Association, 2000). The genes that place one at risk for depression symptoms are identical to those for major depressive disorder, and there is some evidence that periods of depression symptoms often precede a diagnosis of major depression in any individual (Ingram et al., 1998). Thus, studying depression symptoms may inform our knowledge of the diagnosis of major depression.

### *Statement of Purpose*

The previously reviewed research indicates that both personality and cognitive biases are stable risk factors for the development of dysphoria and depression. Currently, research on Gray's personality theory and cognitive biases tends to treat these as entirely separate risk factors. Research programs focus either on RST or on cognitive biases, yet it is very likely that these two factors are related. First, theories of personality tend to assume that personality influences cognition or that cognitive styles are a part of personality. Gray hypothesizes that the BIS, as part of its punishment-detection function, searches for, orients toward, and increases

attention towards threatening stimuli (Gray & McNaughton, 2000) which could lead to attention biases for negative information in individuals who are temperamentally high on BIS sensitivity. Memory biases may also result from increased attention to negative or threatening stimuli, as greater attention paid to a stimulus generally produces greater memory for that stimulus. Second, cognitive theories of depression state that cognitive biases result from life experiences that become incorporated into cognitive schemas (Beck, 1967; 1987). Some personality theories also postulate that these same life experiences also shape personality (e.g., Cloninger, 1993; Gray & McNaughton, 2000). Thus, it is unlikely that cognitive biases and personality styles are completely independent constructs, and research must focus on examining them together. According to the literature reviewed, the most likely possibilities are that both cognitive biases and personality are in essence the same risk factor examined on a different level of analysis.

The current study examined the relationship of RST and cognitive biases to current symptoms of dysphoria. To maximize the ability to detect cognitive biases, the current study measured cognitive biases in the four ways outlined above, namely, using a negative mood induction, adding a cognitive load, and measuring implicit and incidental memory. The first approach, using a negative mood induction, has been applied to both questionnaire assessments of negative cognitive content and to cognitive tasks that assess attention. To simplify and shorten the current study, however, this study only examined a negative mood induction added to questionnaire assessments of cognitive style. To summarize, there were four assessments of cognitive bias: 1) a questionnaire measure of biased cognitive content, the ATQ-Positive and ATQ-Negative, administered after a negative mood induction, 2) a cognitive task measuring biased attention, the Imbedded Word Task, administered under cognitive load, 3) an implicit memory task, and 4) an incidental memory task.

Finally, the diathesis-stress model of depression implies that both a stable diathesis such as genetics, personality, or cognitive bias and a stressor like a recent loss or change are associated with depression symptoms. In both cognitive theories and personality theories of depression, stressful life events are assumed to activate these diatheses. Thus, an integration of multiple predictors of depression should also include stressful life events. It was expected that stressful life events would interact with cognitive biases and personality to predict concurrent depression symptoms.

### *Hypotheses*

In summary, specific hypotheses are as follows:

1. BIS will positively predict concurrent depression symptoms; BAS will negatively predict concurrent depression symptoms.
2. Stressful life events will predict concurrent depressive symptoms.
3. Stressful life events will interact with BIS, BAS, and biased cognitive content and processes to predict concurrent depression symptoms.
4. ATQ-Negative, negatively biased attention and implicit and incidental memory will load onto the same factor as BIS and this factor will predict depression symptoms; ATQ-Positive, positively biased attention and implicit and incidental memory will load onto the same factor as BAS and will negatively predict concurrent depression symptoms.

## CHAPTER II

### METHODS

#### *Participants*

Two hundred and ninety nine college students participated in this study. A college student population was used because cognitive biases and maladaptive personality styles are apparent in some individuals in this population, and college students typically experience relatively large numbers of stressful life events. Within this population, no specific selection criteria were enforced. Participants signed up for experiment appointments on the [www.experimentrix.com](http://www.experimentrix.com) website and received course credit for participation.

Participants' mean age was 19.6 (SD = 3.2) and 70.6% were female, 58.2% were Caucasian, and 28.4% were African American. Mean GPA was 2.9 (SD = .65). Family income varied widely (23.1% reported family income below \$40,000, 23.8% reported income above \$80,000). According to scores on the Inventory to Diagnose Depression, Lifetime Version, 17.8% of participants had a prior history of depression, but only 13.4% of participants self-reported a prior diagnosis of depression. Ten percent reported some lifetime use of antidepressants and 5% reported current use of antidepressants.

## *Materials*

### *Questionnaire Measures*

#### *Beck Depression Inventory-II*

The Beck Depression Inventory (BDI-II) Beck, Steer, & Brown, 1996) is a 21-item inventory assessing depression symptoms that requires participants to select one of four statements that best describes their mood and state over the last two weeks. These statements inquire about sad mood, feelings of guilt, suicidality, and other depressive symptoms. The BDI has good internal consistency ( $\alpha = .89$  to  $.93$ ) and is widely used in research and clinical settings (Dozois, Dobson, & Ahnberg, 1998; Whisman, Perez, & Ramel, 2000).

#### *Center for Epidemiologic Studies Depression Scale*

The CES-D (Radloff, 1977) is a self-report measure of 20 depressive symptoms designed specifically for use in community samples. Examples of items from this measure include: “I felt that everything I did was an effort” and “I felt that I could not shake off the blues even with help from my family or friends.” Participants rate the extent of their agreement with these items over the past week. The CES-D correlates substantially with other measures of depression such as the BDI (Radloff, 1977), although some research has suggested that the CES-D focuses more on the affective component of depression whereas the BDI focuses on the cognitive component (Skorikov & Vandervoort, 2003). Thus, both measures of depression were included to tap the entire construct of depression. The CES-D and has good internal consistency reliability ( $\alpha = .90$ ; Skorikov & Vandervoort, 2003) and moderate test-retest reliability.

### *Beck Anxiety Inventory*

The BAI (Beck & Steer, 1993) is a 21-item self-report measure of anxiety included as a contrasting measure of psychopathology. Participants read each symptom of anxiety, such as sweating, hands trembling, and fear of the worst happening, and rate how much they were bothered by that symptom in the past month on a scale of 0 (Not at all) to 3 (Severely, I could barely stand it). The highest possible score is 63, with scores of 26 and above signifying severe anxiety. The BAI has excellent internal consistence ( $\alpha = .92$ ) and acceptable test-retest reliability and convergent and discriminant validity (Beck, Epstein, Brown, & Steer, 1988).

### *Behavioral Inhibition System/Behavioral Activation System Scales*

The BIS/BAS Scales (Carver & White, 1994) is one of two personality measure used in this study to assess Reinforcement Sensitivity. It includes 20 items that measure a person's emotional responding in situations that may evoke anxiety or impulsivity. Although there is a single BIS scale, there are three related BAS scales: Drive, Reward Responsiveness, and Fun Seeking. Examples of items on these scales include: "When I want something, I usually go all-out to get it" (BAS Drive scale) "When I get something I want, I feel excited and energized" (BAS Reward Responsiveness) "I crave excitement and new sensation" (BAS Fun Seeking) and "Criticism or scolding hurts me quite a bit" (BIS scale). Confirmatory factor analyses indicate that the BAS scales load on a general BAS factor although the Reward Responsiveness scale also correlates positively with BIS ( $r = 0.2$  to  $r = 0.3$ , Campbell-Sills et al., 2004; Leone, Perugini, Bagozzi, Pierro, & Mannetti, 2001). The BIS/BAS Scales have moderate internal consistency with  $\alpha$  ranging from .66 to .76 (Carver & White, 1994) and good convergent and discriminant validity (Campbell-Sills et al., 2004; Carver & White, 1994).

### *Sensitivity to Punishment/Sensitivity to Reinforcement Questionnaire*

The SPSRQ (Torrubia, Avila, & Molto, 2001) contains two 24-item scales to measure Sensitivity to Reinforcement (SR) and Sensitivity to Punishment (SP), or BAS and BIS, respectively. Examples of items include: “Comparing yourself to people you know, are you afraid of many things?” (SP scale) and “Do you like to compete and do everything you can to win?” (SR scale). The scales showed acceptable to good internal consistency with  $\alpha$  in the range of .76 to .84 (O’Connor, Colder & Hawk, 2004). The SPSRQ has good factor structure (O’Connor et al., 2004) and convergent and discriminant validity (Torrubia et al., 2001).

### *Recent Life Change Questionnaire*

The RLCQ (Miller & Rahe, 1997) is a 74-item self-report inventory that assesses recent stressful life events and changes in five domains: work, health, home/family, financial, and personal/social. This questionnaire is based upon Miller and Rahe’s (1997) assertion that both positive and negative events can be stressful. Examples of events included in this questionnaire are financial difficulties, ending a romantic relationship, birth of a child, and starting a new school or job. Respondents indicate if the event occurred in the past two years and if so, when. Events are weighted by severity based upon the 1995 rescaling in which participants were asked to estimate the severity of each event compared to marriage, which was assigned an arbitrary rating of 50 on a scale from 0 to 100. The RLCQ has good test-retest reliability ( $r = .83$  over one month) and predicts depression, anxiety, medical illnesses, and psychological symptoms in general, although the relationship is generally small ( $r = .2$  to  $.3$ , Miller & Rahe, 1997).

### *Automatic Thoughts Questionnaire – Negative*

The ATQ-N is a 30-item questionnaire measuring negative self-statements and automatic thoughts that are believed to play a role in depression. Participants rate on a 5-point Likert scale how often certain automatic negative thoughts came to them over the past week. Scores range from 30 to 150 with higher scores indicating more negative automatic thoughts. It has excellent internal consistency (.96; Dobson & Breiter, 1983; Hollon & Kendall, 1980). Scores on the measure correlate very highly with current depression symptoms (Hollon & Kendall, 1980) and predict future depression symptoms and suicidal ideation (Chioqueta & Stiles, 2007). Convergent and discriminant validity is good and the mean score in non-clinical populations is 38.35 (Harrell and Ryon, 1983).

### *Automatic Thoughts Questionnaire – Positive*

The ATQ-P (Ingram & Wisnicki, 1988) is a 30 item measure designed as a counterpart to the ATQ-N. Like the ATQ-N, scores range from 30-150 and participants rate on a 5-point Likert scale how often certain automatic positive thoughts came to them over the past week. The ATQ-P has good internal consistency reliability and convergent and discriminant validity (Ingram, Kendall, Siegle, Guarino, & McLaughlin, 1995). ATQ-P scores are lower during episodes of depression and, for non-depressed persons, are higher after a positive mood induction. The mean ATQ-P score in non-clinical participants is 101.53 (Ingram et al., 1995). Previous studies report correlations of .29 to -.46 with the ATQ-N (Ingram et al., 1995).

### *Cognitive Tasks*

The following tasks measure negative cognitive processes—attention and memory.

### *Imbedded Word Task*

The Imbedded Word Task (IWT; Wenzlaff et al., 2001) is designed to detect attentional bias. Wenzlaff et al. (2001) suggested that this task is less transparent to participants and less vulnerable to self-presentational concerns than other attentional tasks. As in a word-search, participants searched for and circled words imbedded in a grid of random letters. Words were forwards, backwards and diagonally placed. The grid of letters was randomly generated by a computer program provided by SuperKids Educational Software Review. Ten negative, 10 positive, and 10 neutral stimulus words were included, and each word was between 3 and 7 letters in length and was equated on frequency of use according to Francis and Kucera's (1982) norms. This set of stimuli was previously piloted by Wenzlaff et al. (2001) who determined that the words were rated by participants as appropriately positive, negative, and neutral. Two sets of words were used, with ten different versions of the letter grid per word set to negate any idiosyncratic effects of word arrangements. Each participant completed only one Imbedded Word Task and had three minutes to identify and write down as many words as possible from the letter grid. Proportion of negative words to neutral words identified indicates degree of negative attentional bias; proportion of positive words to neutral words identified indicates degree of positive attentional bias. Participants completed this task under a cognitive load, remembering a novel six-digit number. As a manipulation check, participants were asked to report that number after the task and to rate how much they tried to remember it.

### *Implicit Memory Task*

This task investigates implicit memory bias. Similar to tasks used by Watkins et al. (2000) in studies of depression, this task requires participants to view a list of 15 negative depression-relevant words, 15 neutral words and 15 positive words and rate how recently they

experienced something related to each word. These words were equated for frequency and length based upon Francis and Kucera's (1982) norms and were piloted by Watkins et al. (2000) to ensure that they have the appropriate valence. To minimize recency effects and help conceal the nature of the memory task, participants completed mathematics problems as a distractor task. Next, participants were given a task in which they generated a word that fits a definition. Answering with a word from the previous rating task was evidence of implicit memory for that concept. Distractor items—that is, items whose definition does not fit a word from the word rating task—were included to help prevent participants from realizing the nature of the task. Negative implicit memory bias was operationalized as ratio of negative to neutral items recalled from the first rating task. Positive implicit memory bias was operationalized as the ratio of positive to neutral items recalled. As a manipulation check, at the end of this task participants were asked if they were aware of any relationship between these two parts of the task.

#### *Incidental Memory Task*

This task was designed to measure incidental memory bias for positive or negative information. In this free recall task, participants were asked to list any words that they remembered from the previous implicit memory encoding task. This is a common method of testing depression-congruent memory bias (Barry et al., 2004). Proportion of negative words to neutral words recalled indicated degree of incidental memory bias for negative information whereas proportion of positive words to neutral words recalled indicated degree of incidental memory bias for positive words.

### *Procedure*

Participants completed the study in small groups. After signing a consent form and being allowed to ask questions about the study, participants participated in the Imbedded Word Task under cognitive load. Next they completed the tasks to assess memory bias, the Implicit Memory Task and Incidental Memory Task, and filled out the depression, personality and life event questionnaires in random order. Finally, as a negative mood induction, participants were given the following prompt: “Write about a time in the past few years when you have been very unhappy. Please include details such as when this happened, what happened to cause you to feel unhappy, who else was involved, what you were thinking and what you were feeling.” As a manipulation check, participants rated positive and negative affect before and after the mood induction with the following questions: “Right now, how positive is your mood?” and “Right now, how negative is your mood?” Response options ranged from “extremely” to “not at all” on a 7-point scale. After this, participants completed the Automatic Thoughts Questionnaires. To minimize post-study negative affect, participants were given a positive mood induction entailing writing about a happy time in their life. Afterwards, participants were debriefed and received course credit.

## CHAPTER III

### RESULTS

Means, standard deviations, skewness, ranges and Cronbach's alpha values are presented in Appendix A, Table 1. All scales had acceptable to excellent internal consistency. Variables were normally distributed with the exception of the BDI, CESD, BAI, BAS-Reward Responsiveness, ATQ-Negative, and negative and positive incidental memory. BDI, CESD, BAI, and ATQ-N were normalized using the log transformation. Neither BAS-RR nor either incidental memory score could be normalized with transformations. Correlations of all variables are presented in Table 2.

#### *Imbedded Word Task (IWT) Manipulation Check Results*

To ensure that participants actively attempted to remember the 6-digit number in the cognitive load procedure, they reported that number after completing the IWT. Participants were given one point for each correct digit reported, regardless of position in the 6 digit number, and another point for each digit reported in the correct order. A participant who correctly remembered all digits in order would receive a score of 12. Numbers were scored in this manner to give participants partial credit for transposed digits. Mean score for this manipulation check was 11.15 (standard deviation 1.69), suggesting that participants did remember the number. In fact, 74.9% of participants remembered all digits in the correct order. Fifty four participants received a score of less than 10 points out of 12. Analyses were run with and without these participants and the results were not substantially different. Therefore, all participants were included for final analyses.

Table 1

*Means, standard deviations, skewness, and range of all variables by type*

Variable	Alpha	Mean	SD	Skewness	SE Skewness	Minimum	Maximum
<b>Personality Variables</b>							
BIS	.77	20.31	3.98	-.47	.28	7	28
BAS Reward Responsiveness	.78	17.40	2.41	-1.53	.28	6	20
BAS Drive	.80	10.62	2.56	-.04	.28	4	16
BAS Fun Seeking	.75	12.28	2.42	-.39	.28	5	16
Sensitivity to Punishment	.84	11.77	5.29	.00	.28	1	24
Sensitivity to Reward	.77	11.79	4.25	.07	.28	2	23
<b>Symptom Variables</b>							
CESD	.89	15.20	9.51	.84	.28	0	41
BDI	.90	8.28	7.57	1.63	.28	0	44
BAI	.91	11.58	9.73	1.17	.28	0	47
<b>Environmental Variables</b>							
Recent Life Event Questionnaire	.83	12.45	6.73	.60	.28	0	32
<b>Bias Variables</b>							
Negative Automatic Thoughts Questionnaire	.96	55.46	22.60	1.34	.28	30	142
Positive Automatic Thoughts Questionnaire	.96	106.70	23.44	-.36	.28	45	150
Negative Attention Bias	--	1.36	.92	.45	.28	0	7
Positive Attention Bias	--	1.18	.75	.36	.28	0	4
Negative Implicit Memory	--	1.46	.82	.74	.40	0	4
Positive Implicit Memory	--	1.39	.89	1.28	.40	0	5
Negative Incidental Memory	--	.78	.98	1.38	.28	0	6
Positive Incidental Memory	--	.75	.99	1.33	.28	0	5

Table 2  
*Pearson correlations of all variables*

	1	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1. BDI	1	<b>.57**</b>	<b>.81**</b>	-.09	.06	-.07	-.04	.03	.12*	<b>-.50**</b>	<b>.74**</b>	<b>.40**</b>	<b>.41**</b>	.19**	<b>.35**</b>	.02	-.00	-.03
2. BAI		1	<b>.61**</b>	-.06	.11*	-.10	.08	.02	.04	<b>-.25**</b>	<b>.40**</b>	<b>.35**</b>	<b>.39**</b>	<b>.22**</b>	<b>.45**</b>	.09	.01	.00
3. CESD			1	-.08	.03	-.00	.04	.02	.13*	<b>-.50**</b>	<b>.76**</b>	<b>.38**</b>	<b>.42**</b>	.16*	<b>.40**</b>	-.02	.01	-.05
4. Positive Attention Bias				1	<b>.23**</b>	-.01	.07	-.05	.03	.08	-.03	.04	-.11*	.08	-.14*	-.10	.05	.05
5. Negative Attention Bias					1	.04	.09	.01	.13*	.01	-.12*	.09	-.03	-.09	-.01	-.05	-.05	-.05
6. Positive Implicit Memory						1	<b>.25**</b>	-.02	.17*	.04	-.04	.10	-.07	-.10	-.07	.02	-.12	-.17*
7. Negative Implicit Memory							1	-.08	-.05	.05	-.01	-.07	-.02	-.04	.08	-.03	-.08	-.02
8. Positive Incidental Memory								1	.11*	-.06	.02	.04	-.03	.02	-.06	-.01	-.07	-.03
9. Negative Incidental Memory									1	-.06	.13*	.11*	.17*	-.03	.17*	.06	-.06	-.03
10. ATQ Positive										1	<b>-.52</b>	-.06	<b>-.39**</b>	.11*	<b>-.29**</b>	<b>.21**</b>	<b>.34**</b>	<b>.26**</b>
11. ATQ Negative											1	<b>.27</b>	<b>.44**</b>	.15*	<b>.32**</b>	-.08	-.07	-.03
12. Stressful life events												1	<b>.13*</b>	.17*	.08	.14*	.08	<b>.14*</b>
13. Sensitivity to Punishment													1	.08	<b>.63**</b>	.07	-.15*	-.15*
14. Sensitivity to Reward														1	.06	<b>.24**</b>	<b>.39**</b>	<b>.39**</b>
15. BIS															1	<b>.22**</b>	-.07	-.08
16. BAS-Reward Responsiveness																1	<b>.40**</b>	<b>.45**</b>
17. BAS-Drive																	1	<b>.39**</b>
18. BAS-Fun Seeking																		1

Note: \* significant at  $p < .05$ ; \*\* significant at  $p < .01$ . Bolded items are medium effect sizes; bolded and italicized are large effect sizes.

Participants were also asked how hard they tried to remember the 6-digit number on a scale of 1 (did not try) to 7 (tried very hard). Mean score for this manipulation check was 5.02 (standard deviation 1.34), with only 1% reporting they did not try at all. Twenty seven participants gave a rating of less than 4 on the 1 to 7 scale of effort. Analyses were run with and without these participants and the results were not substantially different. Therefore, all participants were included for final analyses.

#### *Mood Induction Manipulation Check Results*

A further manipulation check concerned the mood induction procedure in which participants wrote a narrative detailing a recent negative event. A research assistant blind to the hypotheses coded the narratives for amount of detail provided and evidence of negative emotions in the narrative. The experimenter verified each rating. Eighty nine percent of participants provided a substantial amount of details as evidenced by including at least 5 detailed sentences. Sixty eight percent of participants described a very emotionally negative memory using emotionally-laden words. Common negative memories included deaths of family members, breakups of serious relationships, etc. Participants rated both positive and negative mood before and after the mood induction procedure using a 7-point scale. Forty-four percent of participants experienced at least a two-point change in mood. After the mood induction, 24.2% reported being in an overall moderately or very bad mood. Analyses were run with only these participants. ATQ-Negative and Positive became slightly better predictors of depression but overall results were similar. Therefore, all participants were included for final analyses.

#### *Implicit Memory Manipulation Check Results*

After completing the implicit memory task, participants were asked if they noticed a relationship between the words they were asked to rate and the free-association task. Thirty-

nine percent noticed a relationship and correctly identified what the relationship was. When analyses were run with only the participants who did not know the purpose of the task, results did not differ from results with the overall sample. Therefore, all participants were included in the final analyses.

### *Hypothesis Testing*

Hypotheses were tested with structural equation modeling using AMOS version 17. Competing models and fit statistics are presented below. In general, fit statistics indicate whether an overall model matches the data well. Although a model may have a poor overall fit, certain parts of the model may still be significant predictors and should be retained in future models. The specific fit statistics presented in this study are in Table 3. Presented are the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI), in which higher values represent better fit and values over .90 are considered good fit. For Root Mean Square Error of Approximation (RMSEA), lower values are better fitting and values less than .08 are considered good. Also presented are Akaike’s Information Criterion (AIC) and the Browne-

Table 3

#### *Fit statistics for SEM models*

Model	$\chi^2(df)$	CFI	TLI	RMSEA	RMSEA 90%	AIC	BCC
Model 1	20.5 (7)	.98	.92	.08	.04-.12	60.5	61.5
Model 2	51.1 (13)	.95	.88	.10	.07-.13	95.1	96.3
Model 3	26.8(11)	.98	.94	.07	.04-.10	74.8	76.1
Model 4	43.6 (17)	.97	.93	.07	.05-.10	97.6	99.3
Model 5	161.5(61)	.86	.91	.07	.05-.08	247.5	251.6
Model 6	161.8(62)	.86	.91	.07	.06-.09	245.8	249.9
Model 7	1763.9(133)	.47	.32	.20	.19-.21	1875.9	1883.4
Model 8	171.2(75)	.83	.88	.09	.04-.07	259.2	263.8

*Note.* CFI = comparative fit index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; AIC = Akaike’s Information Criterion; BCC = Browne-Cudeck Criterion.

Cudeck criterion (BCC) which allow comparisons between nested models such that lower values represent a better model, corrected for parsimony.

The first model tested the factor structure of BIS and BAS. The relevant scales from the BIS/BAS Scales and the SPSRQ loaded onto BIS and BAS latent factors. BAS Reward Responsiveness was allowed to load onto the BIS latent factor because previous studies have demonstrated a correlation around  $r = .3$  (Carver & White, 1994). Fit was good.

The second model tested Hypothesis 1, that BIS would positively predict depression symptoms whereas BAS would negatively predict depression symptoms. In Model 2, presented in Appendix B, Figure 2, BIS and BAS latent factors from Model 1 were allowed to load onto the latent depression symptom factor, composed of BDI and CESD scores. Fit was poor. The BIS factor significantly predicted depression as hypothesized but the BAS factor did not. The reduction in fit from Model 1 was likely due to allowing BAS to load onto depression when BAS was not a significant predictor.

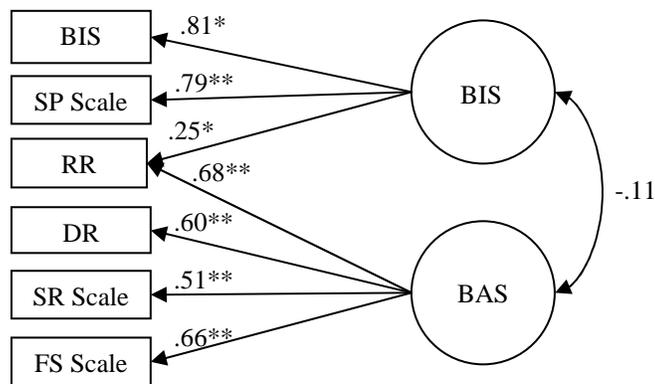


Figure 1. BIS and BAS CFA

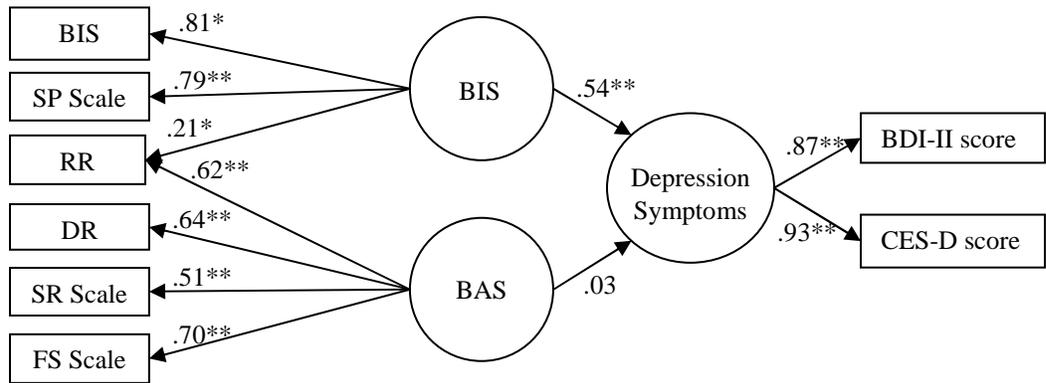


Figure 2. BIS and BAS predicting depression symptoms.

To test this idea, Model 3 was tested in which only the BIS latent factor loaded onto the depression latent factor. The fit was good and improved from Model 2.

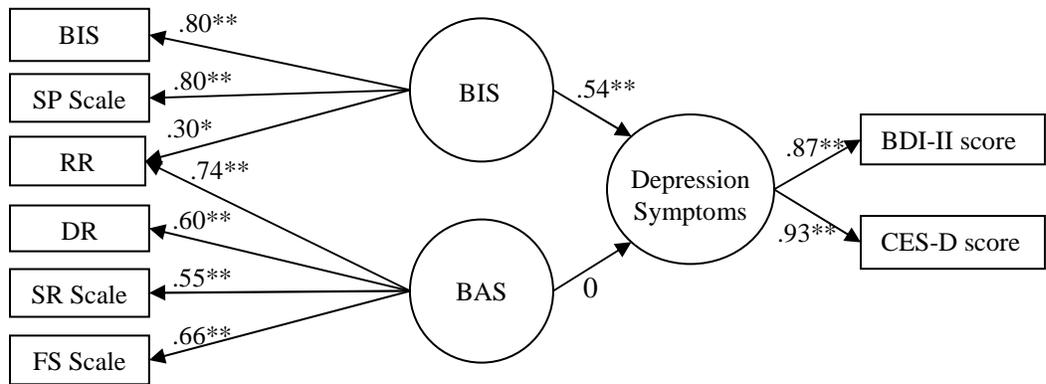


Figure 3. BIS and BAS predicting depression symptoms.

Hypothesis 2 predicted that stressful life events would predict depression symptoms. This was tested in Model 4 in which stressful life events and BIS predicted depression symptoms. Based upon previous models indicating that BAS did not predict depression, the loading of BAS upon depression was fixed at zero. Fit was again good. As predicted, stressful life events and BIS were associated with depression symptoms.

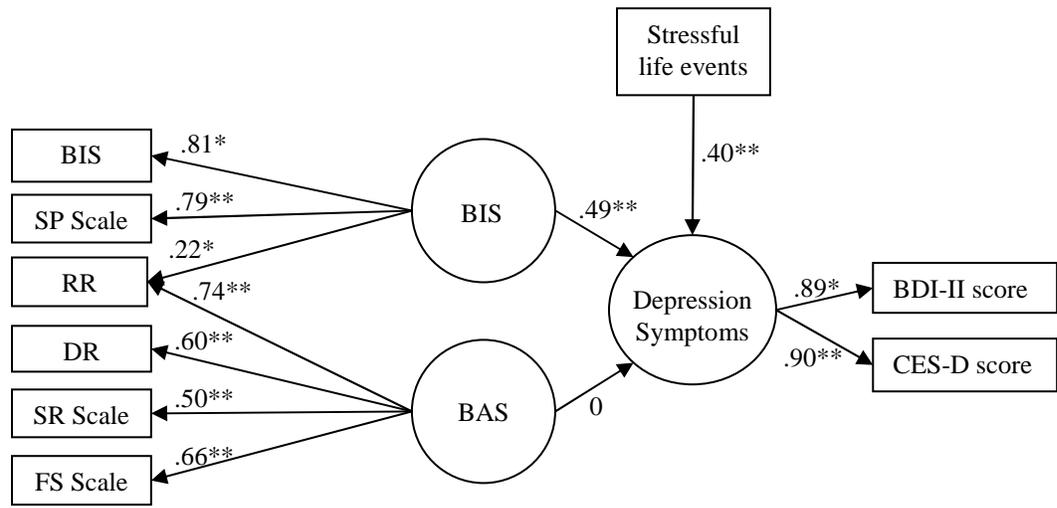


Figure 4. BIS, BAS, and stressful life events predicting depression symptoms.

Hypothesis 3 predicted that stressful life events would interact with personality and cognitive biases to predict depression symptoms. The interaction of BIS, BAS, and stressful life events was tested in Model 5. Interactions in SEM are tested by computing latent variables for each indicator of the independent variable multiplied by each indicator of the moderator, and then allowing all of those variables to load onto one interaction variable (Little, Bovaird, & Widaman, 2006). Only the latent interaction variables are presented in the model for clarity. This model had acceptable fit. The interaction of BIS and stressful life events was significant ( $p < .05$ ) but the effect was small in magnitude. Next, because the interaction of BAS and stressful life events was not significant and including it in the model may have lowered fit, the same model was computed with the BAS\*stressful life events interaction fixed at zero (Model 6). Fit improved only very slightly and the results were similar to the previous model. BIS, stressful life events, and their interaction were significant predictors of depression symptoms.

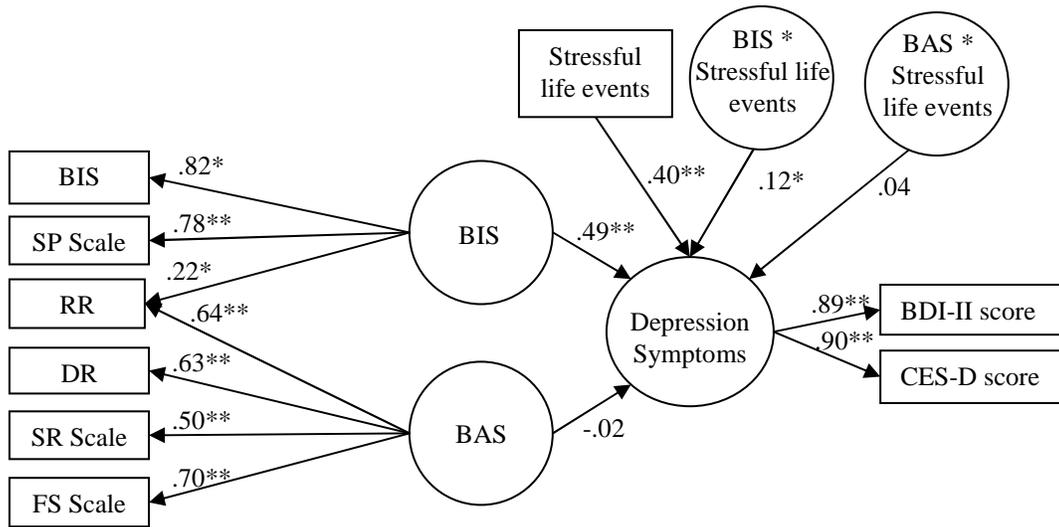


Figure 5. BIS, BAS, stressful life events, and their interaction predicting depression symptoms.

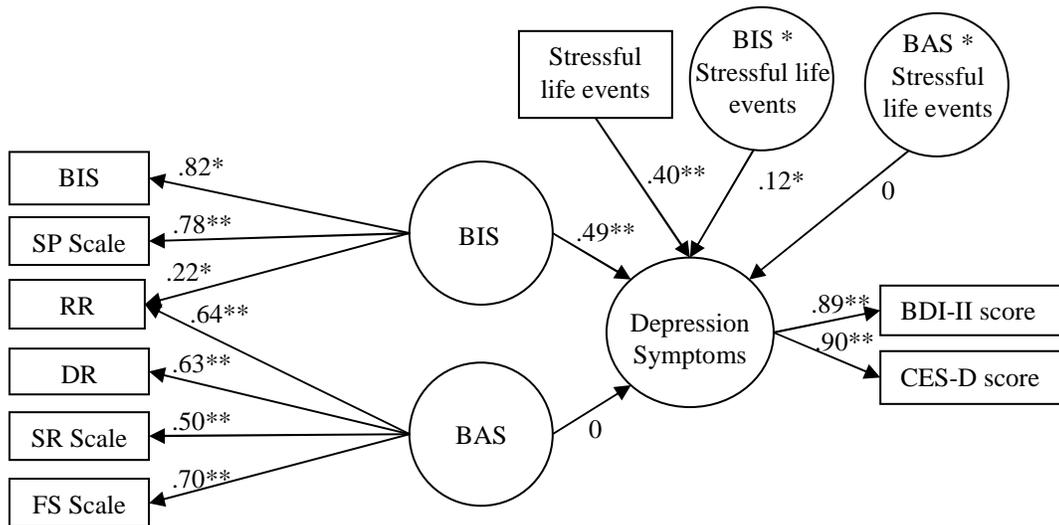


Figure 6. BIS, BAS, stressful life events, and their interaction predicting depression

Hypothesis 3 also predicted that stressful life events would interact with cognitive biases to predict depression symptoms. This was tested in Model 7, in which all cognitive biases were allowed to interact with life events. Fit was very poor and no interaction was

significant, suggesting that cognitive biases did not interact with life events in predicting depression symptoms.

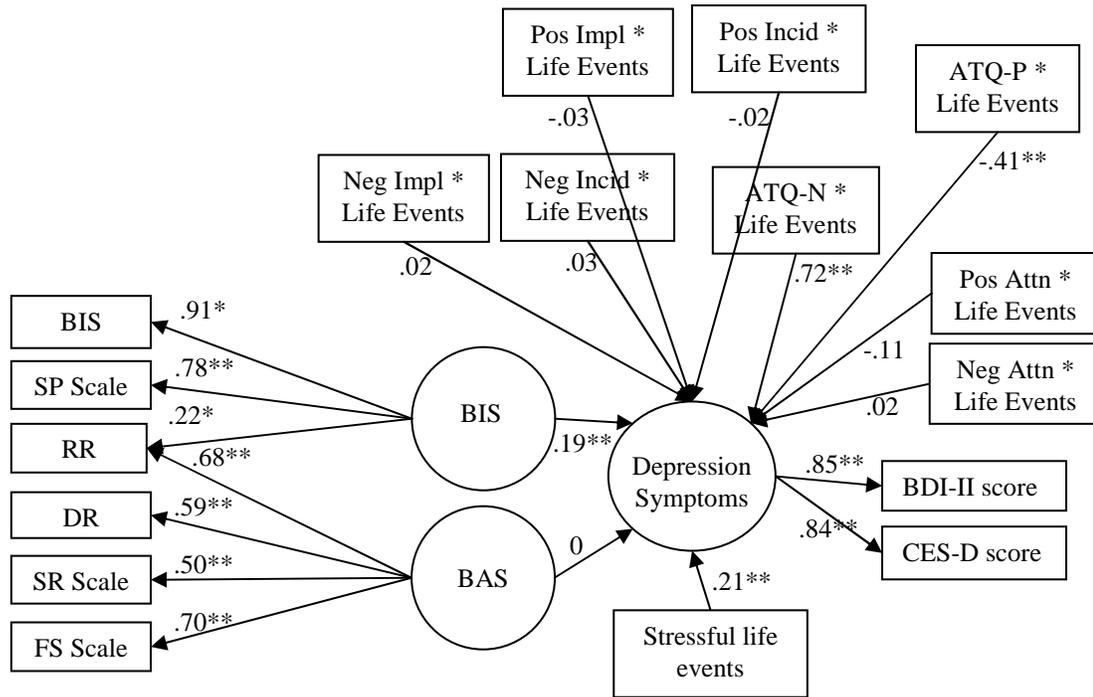


Figure 7. BIS, BAS, cognitive bias, and their interaction predicting depression symptoms.

Because the interaction of cognitive bias and stressful life events was not significant, the main effects of cognitive biases were examined in Model 8. In this model, BIS, stressful life events, and all cognitive biases were allowed to predict depression symptoms. Fit was poor. Of cognitive biases, only ATQ-P and ATQ-N were significant predictors of depression symptoms. However, these relationships were so high as to suggest that the ATQ may actually be measuring depression symptoms.

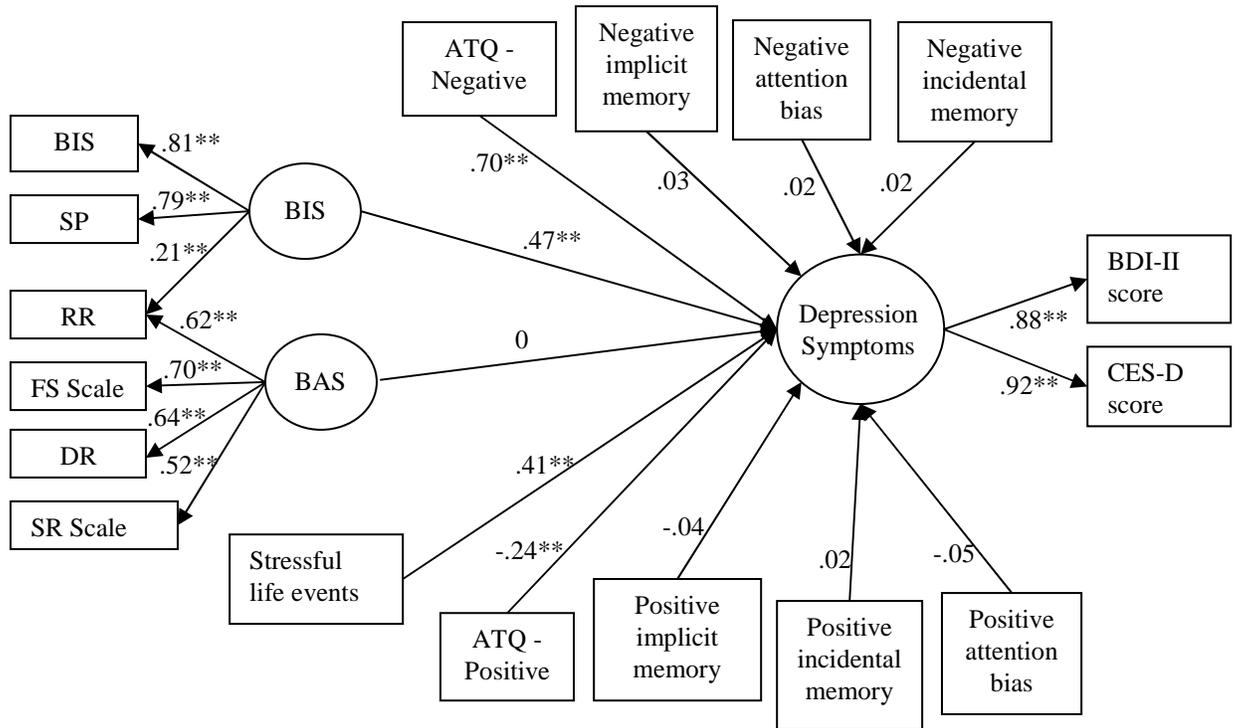


Figure 8. Separate factors model.

Hypothesis 4 predicted that ATQ-Negative, negatively biased attention and implicit and incidental memory will load onto the same factor as BIS and this factor will predict depression symptoms whereas ATQ-Positive, positively biased attention and implicit and incidental memory will load onto the same factor as BAS and will negatively predict concurrent depression symptoms. However, correlations suggested that there were only minimal or null relationships among positive and negative bias variables. A confirmatory factor analysis—not presented here—verified this.

In deciding which model to accept, the Chi-square difference test cannot be used because the models are not nested. Instead, a comparison of the fit indices suggests that models 1, 3, and 4 have similarly good fit, with models 5 and 6 having only slightly lower fit.

However, since model 6 represents a more complex model that still maintains good fit, this model was accepted as the final model. This model indicates that BIS and stressful life events both separately predict depression symptoms and interact to produce depression symptoms.

Because previous research has often found that memory and attention bias, under certain conditions, are significant predictors of depression symptoms, a few alternate analyses were run. Wenzlaff et al. (2001) found that Imbedded Word Task scores were higher in a dysphoric group than a non-dysphoric group using a cutoff of 8 on the Beck Depression Inventory. Using the same cutoff, several ANOVAs were run to determine whether the dysphoric group had a significantly higher level of negative bias or lower level of positive bias. ATQ-Positive and ATQ-Negative differed between these groups, but no other bias variable did. Next, because some previous studies have found that people with a prior history of depression differed on cognitive biases from those without histories of depression, ANOVAs were run to determine if this was the case in the current sample. Prior history of depression on the Inventory to Diagnose Depression – Lifetime Version (17.8% of participants) was used as the independent variable, and again, ATQ-Positive and Negative differed, but no other cognitive bias variables did.

## CHAPTER IV

### DISCUSSION

Most studies of the correlates of depression symptoms examine either personality or cognitive biases and perhaps their interaction with stressful life events. This study examined the relationships among RST personality traits, positive and negative cognitive content and processes, and stressful life events in predicting concurrent depression symptoms.

#### *Predicting Depression*

Consistent with previous literature and with this study's hypotheses, depression symptoms were associated with higher BIS (Campbell-Sills et al., 2004, Meyer et al., 1999), more stressful life events (Miller & Rahe, 1997; Paykel, 2003; Tennant, 2002), higher ATQ-Negative scores and lower ATQ-Positive scores (Hollon & Kendall, 1980; Ingram et al., 1995). These results suggest that depression symptoms are associated with a personality style of being sensitive to threats and punishments, experiencing greater than average life stress, and having many negative and few positive automatic cognitions. In addition, this study replicates previous work (e.g., Hundt et al., 2007) demonstrating an interaction of BIS and stressful life events in predicting depression symptoms.

Although these results do not allow conclusions about the etiology of depression, they are consistent with a diathesis-stress model in which personality and cognitions may be a

diathesis triggered by life stress. A person with high BIS sensitivity may experience depression symptoms because BIS is associated with avoidance, negative affect, and greater negative response to stress. Avoidance can be especially problematic because it might lead the person to avoid things that would help relieve their negative affect such as social situations or going to work. Another type of avoidance, experiential avoidance, can prolong negative affect and lead to feelings of failure because of the futility of trying to avoid negative affect (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). The interaction of BIS and stressful life events suggests that a person with high BIS will have a more difficult time coping with stressful life events and will experience more depression symptoms. Cognitions may play a role in depression because as Beck (1987) suggests, negative thoughts about oneself, the environment, and the future lead to negative affect and hopelessness. Experiencing stressful life events such as beginning college, the breakup of a romantic relationship, or the death of a family member increases negative affect and expends coping resources. A person with all three of these factors—high BIS, more stressful life events, and more negative than positive cognitive content—would have a particularly hard time resisting depression symptoms because high BIS leads her to be more sensitive to those stressors and negative thoughts are likely to be more believable and more difficult to rationalize away in the presence of actual evidence of failure or loss.

Contrary to hypotheses, depression symptoms were not associated with BAS. In fact, the SR scale but not the three BAS scales had a small but significant positive correlation with depression symptoms. Although low BAS is typically associated with depression (Depue et al., 1987; Meyer et al., 1999), some studies have found that low BAS does not predict depression symptoms (Hundt, Shah, & Nelson-Gray, in preparation; Johnson et al., 2003; Meyer & Hofmann, 2005) or only predicts anhedonic depression symptoms rather than anxious or ruminative depression (Hundt et al., 2007). In addition, low BAS is more likely to predict

depression in studies that use a clinical sample (Campbell-Sills et al., 2004; Depue et al., 1987) than in studies that use a continuous sample (Hundt et al., in preparation; Johnson et al., 2003; Meyer & Hofmann, 2005) such as the current study's sample, suggesting that low BAS may be present only in the most severe anhedonic depression. Thus, this study's results are in line with some previous findings.

Contrary to hypotheses, depression symptoms were not associated with either positive or negative attention bias, unlike in some previous studies (Rude et al., 2002; Wenzlaff et al., 2001). One possible reason for this failure may be that the cognitive load, remembering a 6-digit number, was not a strong enough manipulation. A few other previous studies have used 8-digit numbers instead (e.g., Rude et al., 2002). In addition, the attention bias task used in this study was selected for ease of administration in group settings and is less well established than other measures of attention bias such as the dot-probe and the emotional Stroop. Finally, null results with this task may reflect the fact that previous research indicates that attention bias is more consistently and strongly linked to anxiety than depression (Mogg & Bradley, 2005; Williams, Watts, MacLeod, & Mathews, 1997). Consistent with this, in the current study there was a small correlation of attention bias with BAI scores. These null results, in addition to other null findings in the literature cited previously, suggest that the association between attention bias and depression is not robust.

In contrast to the literature on negative attention biases in depression symptoms, the literature on negative incidental memory bias more consistently shows an association with depression symptoms. Contrary to hypotheses, however, neither negative nor positive incidental memory was strongly associated with depression symptoms in any SEM model. Pearson correlations indicated only a very small but significant relationship between depression symptoms and negative incidental memory. These results lend only minimal support to the idea that

incidental memory biases are associated with depression, which is puzzling in light of previous findings. However, one explanation may be the restricted range of incidental memory in the current study. Many participants (27%) reported not being able to remember any words from the list at all. Some participants may have had trouble remembering the list of words because of several filler tasks intervening and some participants reported remembering words from the filler tasks or the attention task, suggesting that proactive interference of memory may have played a role. Another methodological problem is that participants completed packets at their own pace in large groups and could have read the instructions and simply skipped that page in order to finish more quickly and leave the experiment. This suggests that the current incidental memory task should be modified, including tighter experimental control, for future studies. Overall, however, this study's findings also suggest that incidental memory for negative words is not strongly linked to depression symptoms.

This study also predicted that depression symptoms would be associated with increased implicit memory for negative information and decreased implicit memory for positive information. Contrary to this hypothesis, there was no association of either type of implicit memory with depression symptoms. One possible reason for this is methodological: the manipulation check revealed that many participants were aware that implicit memory was being tested. This awareness may have allowed participants with depression symptoms to actively attempt to suppress negative information. However, the implicit memory effect in depression is not robust (reviewed in Watkins, 2002), and is typically found on only certain types of conceptual, rather than perceptual, implicit memory tasks. For example, although Watkins, Vache, Verney, Muller, and Mathews (1996) did find evidence that negative implicit memory predicted depression symptoms, Watkins (2000) did not. In a review of the literature, Watkins (2002) suggests that in order to successfully tap implicit memory, the encoding must involve a

great deal of conceptual elaboration and the test must also involve conceptual processing. Although in the current study both the encoding and test involve conceptual processing, the encoding instructions (“Think about and rate how recently you experienced something related to this word”) may not have encouraged participants to elaborate enough about the concept, similar to what Watson (2002) believes caused the null results in the Watson et al. (1996) study. Overall, it appears that based upon previous research and the current study’s results, implicit memory bias in depression is more difficult to find and less well-established than incidental memory bias. Therefore, the current study’s findings do not stand in contrast to much of the literature on this effect.

Although cognitive processes were only minimally associated with depression symptoms, cognitive content was strongly and significantly associated with depression. People experiencing depression symptoms had more negative automatic thoughts and fewer positive automatic thoughts. This is consistent with cognitive theories of depression (e.g., Beck, 1987) which emphasize the causal role of maladaptive thoughts. However, the results also suggested that negative automatic thoughts are so strongly associated with depression ( $r = .74$ ) as to be virtually the same variable as depression. Positive automatic thoughts were also highly related to depression symptoms ( $r = -.50$ ).

#### *Associations Among Cognitive Biases*

This study hypothesized an association among negative cognitive biases and among positive cognitive biases. Contrary to hypotheses, there were only small or null relationships. Most previous studies of cognitive biases only examined either attention or memory or cognitive content. Recently, because of some equivocal findings about the relationships between biased attention, memory, cognitive content and depression, several researchers have

called for the inclusion of a variety of attention and memory tasks in single studies (Koster, De Raedt, Leyman, De Lissnyder, 2010). Some of these studies have found that performance on various cognitive bias tasks are correlated (Koster et al., 2010; Reid, Salmon, & Lovibond, 2006; Rude, Durham-Fowler, Baum, Rooney, Maestas, 2010) but others have not (Dagleish, Taghavi, Neshat-Doost, Moradi, Canterbury, Yule, 2003; Firk & Marcus, 2009; Gotlib, Kasch, Traill, Joormann, Arnow, & Johnson, 2004). For example, performance on two tasks thought to tap attention bias, the dot-probe and the emotional Stroop task, have sometimes been found to be uncorrelated (Mogg, Millar, Bradley, 2000), and in one study that found a correlation between memory and attention biases, those memory biases did not predict dysphoria (Koster, De Raedt, Leyman, De Lissnyder, 2010).

Thus, although there are many studies that do find that different types of biased cognitive processes are related to each other and to dysphoria, there are also many that do not, suggesting that these effects can be difficult to find and may only appear under certain circumstances. One possible problem with this literature is that there are a wide variety of cognitive tasks used that can tap a wide variety of underlying processes (e.g., in attention: orienting, selective attention, disengaging attention, attention for visual vs. verbal stimuli). Relationships among these cognitive tasks are not well-established and finding significant effects appears to be dependent upon running those tasks in very specific ways. For example, in Posner's spatial cueing task, significant attention biases are more likely to be found when stimuli are presented for 500ms or above than when they are presented for 250ms (Koster et al., 2005). Future research should determine which specific attention and memory tasks are most reliably associated with depression symptoms and under what conditions individuals with depression symptoms or at risk for depression exhibit biases.

This study's results suggest that cognitive content and processes are largely unrelated. This may be because cognitive content and processes rely upon very different brain mechanisms. Cognitive processes like orienting are typically not under voluntary control whereas cognitive content is, such that cognitive therapy focuses on modifying it. A person may not be aware that they are exhibiting biased attention and memory but likely is aware or can easily become aware that they are thinking negative thoughts. Based upon the current study's results, cognitive content has a much closer relationship to depression than cognitive processes. This is consistent with Beck's (1987) cognitive theory of depression which targets negative cognitive content such as maladaptive thoughts rather than basic processes such as attention. Although Beck's theory includes biases like filtering—that is, paying more attention to negative information than positive—he assumes that the filtering is a conscious, voluntary action more similar to cognitive content in this study than basic attention processes like orienting.

#### *Associations Between Personality and Cognitive Bias*

I predicted that BIS would be associated with negatively biased cognitive content and processes and BAS would be associated with positively biased cognitive content and processes. As expected, BIS was associated with negative cognitive content and BAS was associated with positive cognitive content. BIS was also negatively associated with positive cognitive content, consistent with the idea that high BIS can suppress the functioning of the BAS and suppress positive emotions (Corr, 2001; Gable, Reis, & Elliot, 2000). This suggests that people high in BIS have both more negative thoughts and fewer positive thoughts. Contrary to hypotheses, BIS and BAS did not predict attention biases and had only minimal relationships with incidental memory biases. A few previous studies have found that BAS is associated with

positive memory and attention biases and positive cognitive content whereas BIS is associated with negative memory and attention biases and negative cognitive content (e.g., Corr et al., 1995; Gomez & Gomez, 2002; Heimpel et al., 2006; Jackson, 2001). However, there are only a few such studies and they use attention and memory tasks that differ from the ones used in research on depression-relevant attention and memory. In addition, the previous studies examining BIS/BAS and bias typically measure attention and memory for punishing or threatening stimuli rather than the depression-relevant stimuli used in the current study. This suggests that BIS may be responsible for attention to threatening stimuli rather than depression-relevant stimuli. Rather than exerting its effects on depression via attention for depression-relevant stimuli, BIS may predict depression due to avoidance behaviors, sensitivity to stress, or other mechanisms.

In addition, method variance may have decreased ability to detect relationships between BIS, BAS, and bias. BIS and BAS were measured with questionnaires whereas biased attention and memory were measured with cognitive tasks. Relatedly, BIS and BAS questionnaire measures sometimes do not correlate very highly with BIS and BAS laboratory tasks. For example, Mitchell (2007) found that the CARROT, a measure of responsiveness to reward, was not correlated with BAS. Many studies have found non-significant or negative correlations between questionnaires and behavioral tasks that theoretically tap BIS and BAS (e.g., Hayden, Bodkins, Brenner, Shekhar, Nurnberger, O'Donnell, & Hetrick, 2008; Kane, Loxton, Staiger, & Dawe, 2004). If tasks that are purported to measure BIS and BAS often do not correlate with questionnaire measures of BIS and BAS, it is no surprise that attention and memory bias tasks which theoretically may tap only a single dimension of RST would have lower correlations with RST questionnaires.

Another possible reason is related to the measurement of BIS and BAS through questionnaires. Although there is evidence that the BIS/BAS Scales and SPSRQ predict avoidant and reward-seeking behavior (e.g., Carver & White, 1994; Torrubia et al., 2001) it is very difficult to prove that they are measuring brain activity in the regions Gray pinpointed as involved in BIS and BAS. Even if this were the case, the questionnaires only ask about certain pieces of BIS and BAS functioning. For example, the BIS scale includes questions like “If I think something unpleasant is going to happen I usually get pretty “worked up” and “I worry about making mistakes.” However, Gray’s concept of BIS includes orienting towards threatening stimuli and the BIS scale does not include any questions that specifically ask about attention or orienting. This might explain why the BIS factor in this study had no relationship to attention for negative information despite theory predicting that it would.

In summary, this study suggests that biased attention and memory as operationalized in this study are not robustly associated with depression. Previous literature in this area finds inconsistent results, perhaps partially due to the wide variety of ways to measure cognitive biases. Overall, this study indicates that personality, stressful life events, and their interaction are associated with depression symptoms and are much more strongly associated with depression than biased cognitive processes are. In addition, biased cognitive content appears to be part and parcel of depression.

### *Clinical Implications*

The finding that BIS, automatic negative and positive thoughts, and stressful life events are associated with depression suggests that therapy should target these correlates of depression as a way of alleviating distress. Several therapeutic interventions might reduce the effects of stressful life events: case management and coping skills such as exercise, relaxation, and using

social support. First, case management might help the person discover resources that would help remove the stress entirely. For example, if stress results from the loss of a job, case management might focus on helping the person apply for food stamps and job training programs. Next, coping and relaxation skills would help the person cope with stress that cannot be changed. Therapeutic interventions designed to ameliorate the effects of a personality style high in BIS would address avoidance both of negative situations through exposure therapy and avoidance of negative emotions through acceptance techniques. Therapeutic interventions designed to change negative automatic thoughts include cognitive techniques such as those involved in Beck's (1987) cognitive therapy for depression. The treatments that this study implies would be important are the same treatments that research indicates are effective.

In addition, these results may help therapists identify people currently experiencing depression symptoms or people who may go on to develop depression. For example, a person presenting with a great deal of life stress should be thoroughly screened for depression symptoms at their first appointment. Although this study does not allow conclusions about risk for future depression, whether high BIS "causes" depression may be irrelevant in a clinical context. For example, it may not matter if high BIS and depression symptoms are associated because of a third factor or because depression symptoms cause high BIS, in that BIS is still a marker of depression symptoms. This suggests that a provider should screen carefully for concurrent depression symptoms and also for depression symptoms in the future.

### *Limitations*

This study examined depression symptoms rather than major depression per se. However, it is likely that depression symptoms represent a true continuum with major depression as the most severe end of that continuum. Persons (1988) suggests that cognitive

biases be studied in subclinical depression participants to avoid the confound of memory and attention deficits that typically co-occur with severe depression. Other limitations include the failure of the measure of implicit memory to function as expected in nearly half of the participants. Finally, this study did not allow clarification of whether cognitive biases result from personality features or vice versa, but as it is not possible to experimentally manipulate personality features the current study represented a first step in identifying how distal risk factors like personality, cognitive bias, and stressful life events are related.

### *Strengths*

Although this study does have several limitations, strengths of this study include comprehensive examination of various types of cognitive biases, both content and process, and inclusion of personality and stressful life events. No previous study has examined depression, cognitive biases, RST, and stressful life events in tandem. In addition, this study examined positive and negative biases separately. Another strength is the use of structural equation modeling and latent variables for both depression and personality. Finally, this study included a variety of manipulation checks to determine whether the cognitive bias measures functioned as expected.

### *Future Directions*

This study found that RST, cognitive biases, and depression symptoms did not correlate as expected. However, there are a variety of ways to measure cognitive biases and future research should examine relationships between RST, depression, and other measures of cognitive bias. Because of the findings regarding the lack of relationships among various types of cognitive bias, future research should examine the coherence of and relationships between various attention bias and memory bias tasks and cognitive content questionnaires. Specifically, research should clarify

the nature of the attention and memory tasks and differentiate between various types of attention (e.g., early attention vs. late attention, sustained attention, orienting, difficulty disengaging attention from negative stimuli, etc.) in order to determine whether there are any types of biased cognitive content that are more strongly associated with depression.

### *Conclusion*

In summary, these results suggest that depression is associated with stressful life events, high BIS, their interaction, and with more negative and fewer positive thoughts. Cognitive process biases played only a very small role in depression symptoms in the current study, suggesting cognitive processes are not strongly associated with depression. This study replicated important findings with respect to personality, stress, and their interaction in depression.

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## APPENDIX A: MATERIALS

### *Imbedded Word Task Words*

#### Word List 1

##### Neutral

Café  
Store  
Green  
Zero  
Lawn  
Ship  
Lock  
Vote  
Coat  
Gift

##### Positive

Calm  
Peace  
Smile  
Friend  
Joy  
Happy  
Glad  
Pride  
Relief  
Eager

##### Negative

Fail  
Gloom  
Grief  
Hurt  
Sad  
Stress  
Suffer  
Tragic  
Ugly  
Worry

#### Word List 2

##### Neutral

Bath  
Bowl  
Iron  
Mars  
Neck  
Pen  
Rice  
Stick  
Track  
Uncle

##### Positive

Humor  
Excited  
Glory  
Hope  
Kind  
Laugh  
Love  
Luck  
Pleased  
Proud

##### Negative

Awful  
Bad  
Blame  
Cry  
Fear  
Guilt  
Misery  
Pain  
Shame  
Worse

*Memory Task Word Lists:*

Neutral

Sweater  
Flannel  
Bowling  
Peaches  
Turtles  
Dresser  
Spatula  
Willows  
Giraffe  
Propane  
Muffler  
Piccolo  
Magenta  
Geology  
Hearing  
Cabbage

Negative

Detested  
Accused  
Neglected  
Gloomy  
Unworthy  
Lonely  
Punished  
Useless  
Abandoned  
Unwanted  
Supported  
Failure  
Judged  
Rejected  
Unsatisfied  
Hopeless

Positive

Accepted  
Optimistic  
Appreciated  
Liked  
Admired  
Talented  
Needed  
Praised  
Competent  
Gratified  
Superior  
Witty  
Accomplished  
Overcame  
Desirable

## BIS/BAS Scales

Read each statement and rate your agreement with it on a scale of 0-3.

1. If I think something unpleasant is going to happen I usually get pretty "worked up."
2. When I get something I want, I feel excited and energized.
3. I will often do things for no other reason than that they might be fun.
4. When I want something, I usually go all-out to get it.
5. I worry about making mistakes.
6. When I'm doing well at something, I love to keep at it.
7. I go out of my way to get things I want.
8. I crave excitement and new sensation.
9. Criticism or scolding hurts me quite a bit.
10. When good things happen to me, it affects me strongly.
11. If I see a chance to get something I want, I move on it right away.
12. I'm always willing to try something new if I think it will be fun.
13. I feel pretty worried or upset when I think or know somebody is angry at me.
14. It would excite me to win a contest.
15. When I go after something I use a "no holds barred" approach.
16. I often act on the spur of the moment.
17. Even if something bad is about to happen to me, I rarely experience fear or nervousness.
18. When I see an opportunity for something I like, I get excited right away.
19. I feel worried when I think I have done poorly at something.
20. I have very few fears compared to my friends.

### Sensitivity to Punishment Sensitivity to Reward Questionnaire (SPSRQ)

1. Do you often refrain from doing something because you are afraid of it being illegal?
2. Does the good prospect of obtaining money motivated you strongly to do some things?
3. Do you prefer not to ask for something when you are not sure you will obtain it?
4. Are you frequently encouraged to act by the possibility of being valued in your work, in your studies, with your friends or with your family?
5. Are you often afraid of new or unexpected situations?
6. Do you often meet people that you find physically attractive?
7. Is it difficult for you to telephone someone you do not know?
8. Do you like to take some drugs because of the pleasure you get from them?
9. Do you often renounce (give up) your rights when you know you can avoid a quarrel with a person or an organization?
10. Do you often do things to be praised?
11. As a child, were you troubled by punishment at home or in school?
12. Do you like being the center of attention at a party or a social meeting?
13. In tasks that you are not prepared for, do you attach great importance to the possibility of failure?
14. Do you spend a lot of your time on obtaining a good image?
15. Are you easily discouraged in difficult situations?
16. Do you need people to show their affection for you all the time?
17. Are you a shy person?
18. When you are in a group, do you try to make your opinions the most intelligent or the funniest?
19. Whenever possible, do you avoid demonstrating your skills for fear of being embarrassed?
20. Do you often take the opportunity to pick up people you find attractive?
21. When you are with a group, do you find you have difficulties selecting a good topic to talk about?
22. As a child, did you do a lot of things to get people's approval?
23. Is it often difficult for you to fall asleep when you think about things you have done or must do?
24. Does the possibility of social advancement move you to action, even if this involves not playing fair?
25. Do you think a lot before complaining in a restaurant if your meal is not well prepared?
26. Do you generally give preference to those activities that imply an immediate gain?
27. Would you be bothered if you had to return to a store when you noticed you were given the wrong change?
28. Do you often have trouble resisting the temptation of doing forbidden things?
29. Whenever you can, do you avoid going to unknown places?
30. Do you like to compete and do everything you can to win?
31. Are you often worried by things that you said or did?
32. Is it easy for you to associate tastes and smells to very pleasant events?
33. Would it be difficult for you to ask your boss for a raise (salary increase)?
34. Are there a large number of objects or sensations that remind you of pleasant events?

35. Do you generally try to avoid speaking in public?
36. When you start to play with a slot machine, is it often difficult for you to stop?
37. Do you, on a regular basis, think that you could do more things if it was not for your insecurity or fear?
38. Do you sometimes do things for quick gains?
39. Comparing yourself to people you know, are you afraid of many things?
40. Does your attention easily stray from your work in the presence of an attractive stranger?
41. Do you often find yourself worrying about things to the extent that performance in intellectual abilities is impaired?
42. Are you interested in money to the point of being able to do risky jobs?
43. Do you often refrain from doing something you like in order not to be rejected or disapproved of by others?
44. Do you like to put competitive ingredients in all of your activities?
45. Generally, do you pay more attention to threats than pleasant events?
46. Would you like to be a socially powerful position?
47. Do you often refrain from doing something because of your fear of being embarrassed?
48. Do you like displaying your physical abilities even though this many involve danger?

## Recent Life Change Questionnaire (RLCQ)

### Health

In the past 6 months, have you experienced an illness or injury which:

1. Kept you in bed a week or more or sent you to the hospital?
2. Was less serious than above?
3. Major dental work?
4. A major change in eating habits?
5. A major change in sleeping habits?
6. A major change in your usual type and/or amount of recreation?

### Work

7. A change to a new type of work?
8. A change in your work hours or conditions?  
A change in your responsibilities at work:
9. More responsibilities?
10. Less responsibilities?
11. Promotion?
12. Demotion?
13. Transfer?  
Troubles at work:
14. With your boss?
15. With co-workers?
16. With persons under your supervision?
17. Other work troubles?
18. A major business readjustment?
19. A retirement
20. Laid off from work?
21. Fired from work?
22. A correspondence course to help you in your work?

### Home and Family

23. A major change in your living conditions (home improvements or a decline in your home or neighborhood)?  
A change in residence:
24. Move within the same town or city?
25. Move to a different town, city, or state?
26. A change in family "get togethers"?
27. A major change in the health or behavior of a family member (illness, accidents, drug or disciplinary problems, etc.?)
28. Marriage?
29. A pregnancy?
30. A miscarriage or an abortion?  
A gain of a new family member:
31. Birth of a child?
32. Adoption of a child?
33. A relative moving in with you?

34. A spouse beginning or ending work outside the home?  
A child leaving home:
35. To attend college?
36. Due to marriage?
37. For other reasons?
38. A change in arguments with your spouse?
39. In-law problems?  
A change in the marital status of your parents:
40. Divorce?
41. Remarriage?  
A separation from your spouse:
42. Due to work?
43. Marital problems?
44. A divorce?
45. The birth of a grandchild?
46. The death of a spouse?  
The death of another family member:
47. Child?
48. Brother or sister?
49. Parent?

#### Personal and Social

50. A change in personal habits (your dress, friends, life-style, etc.)?
51. Beginning or ending school or college?
52. A change of school or college?
53. A change in political beliefs?
54. A change in religious beliefs?
55. A change in social activities (clubs, movies, visiting, etc.)?
56. A vacation?
57. A new, close personal relationship?
58. An engagement to marry?
59. Girlfriend or boyfriend problems?
60. Sexual difficulties?
61. A "falling out" of a close personal relationship?
62. An accident?
63. A minor violation of the law (traffic ticket, etc.)?
64. Being held in jail (DUI, felony, etc.)?
65. The death of a close friend?
66. A major decision regarding your immediate future?
67. A major personal achievement?

#### Financial

- A major change in finances:
68. Increased income?
  69. Decreased income?
  70. Investment and/or credit difficulties?
  71. A loss or damage of personal property?
  72. A moderate purchase (such as an automobile)?

73. A major purchase (such as a home?)
74. A foreclosure of a mortgage or loan?

### Automatic Thoughts Questionnaire (ATQ-N)

1. I feel like I'm up against the world.
2. I'm no good.
3. Why can't I ever succeed?
4. No one understands me.
5. I've let people down.
6. I don't think I can go on.
7. I wish I were a better person.
8. I'm so weak.
9. My life's not going the way I want it to.
10. I'm so disappointed in myself.
11. Nothing feels good anymore.
12. I can't stand this anymore.
13. I can't get started.
14. What's wrong with me?
15. I wish I were somewhere else.
16. I can't get things together.
17. I hate myself.
18. I'm worthless.
19. Wish I could just disappear.
20. What's the matter with me?
21. I'm a loser.
22. My life is a mess.
23. I'm a failure.
24. I'll never make it.
25. I feel so hopeless.
26. Something has to change.
27. There must be something wrong with me.
28. My future is bleak.
29. It's just not worth it.
30. I can't finish anything.

### Automatic Thoughts Questionnaire – Positive (ATQ-P)

Listed below are a variety of thoughts that pop into people's heads. Please read each thought and indicate how frequently, if at all, the thought occurred to you over the last week. Please read each item carefully and fill in the blank with the appropriate number, using the following scale.

1 = Not at all    2 = Sometimes    3 = Moderately often    4 = Often    5 = All the time

1. I am respected by my peers.
2. I have a good sense of humor.
3. My future looks bright.
4. I will be successful.
5. I'm fun to be with.
6. I am in a great mood.
7. There are many people who care about me.
8. I'm proud of my accomplishments.
9. I will finish what I start.
10. I have many good qualities.
11. I am comfortable with life.
12. I have a good way with others.
13. I am a lucky person.
14. I have friends who support me.
15. Life is exciting.
16. I enjoy a challenge.
17. My social life is terrific.
18. There's nothing to worry about.
19. I'm so relaxed.
20. My life is running smoothly.
21. I'm happy with the way I look.
22. I take good care of myself.
23. I deserve the best in life.
24. Bad days are rare.
25. I have many useful qualities.
26. There is no problem that is hopeless.
27. I won't give up.
28. I state my opinions with confidence.
29. My life keeps getting better and better.
30. Today I've accomplished a lot.

## Beck Depression Inventory

Please read each group of statements carefully and choose the one statement in each group which best describes the way you have been feeling for the past two weeks, including today. If several statements in a group seem to apply equally well, fill in the circle for each one.

1. I do not feel sad.  
I feel sad.  
I am sad all the time and I can't snap out of it.  
I am so sad or unhappy that I can't stand it.
2. I am not particularly discouraged about the future.  
I feel discouraged about the future.  
I feel I have nothing to look forward to.  
I feel that the future is hopeless and that things cannot improve.
3. I do not feel like a failure.  
I feel I have failed more than the average person.  
As I look back on my life, all I can see is a lot of failures.  
I feel I am a complete failure as a person.
4. I get as much satisfaction out of things as I used to.  
I don't enjoy things the way I used to.  
I don't get real satisfaction out of anything anymore.  
I am dissatisfied or bored with everyone.
5. I don't feel particularly guilty.  
I feel guilty a good part of the time.  
I feel quite guilty most of the time.  
I feel guilty all of the time.
6. I don't feel I am being punished.  
I feel I may be punished.  
I expect to be punished.  
I feel I am being punished.
7. I don't feel disappointed in myself.  
I am disappointed in myself.  
I am disgusted with myself.  
I hate myself.
8. I don't feel I am any worse than anybody else.  
I am critical of myself for my weaknesses or mistakes.  
I blame myself all the time for my faults.  
I blame myself for everything bad that happens.
9. I don't have any thoughts of killing myself.  
I have thoughts of killing myself, but I would not carry them out.  
I would like to kill myself.  
I would kill myself if I had the chance.
10. I don't cry any more than usual.  
I cry more now than I used to.  
I cry all the time now.  
I used to be able to cry, but now I can't cry even though I want to.
11. I am no more irritated now than I ever am.  
I get annoyed or irritated more easily than I used to.

- I feel irritated all the time now.  
I don't get irritated at all by the things that used to irritate me.
12. I have not lost interest in other people.  
I am less interested in other people than I used to be.  
I have lost most of my interest in other people.  
I have lost all of my interest in other people.
13. I make decisions about as well as I ever did.  
I put off making decisions more than I used to.  
I have greater difficulty in making decisions than before.  
I can't make decisions at all anymore.
14. I don't feel I look any worse than I used to.  
I am worried that I am looking old or unattractive.  
I feel that there are permanent changes in my appearance that make me unattractive.  
I believe that I look ugly.
15. I can work about as well as before.  
It takes an extra effort to get started at doing anything.  
I have to push myself very hard to do anything.  
I can't do any work at all.
16. I can sleep as well as usual.  
I don't sleep as well as I used to.  
I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.  
I wake up several hours earlier than I used to and cannot get back to sleep.
17. I don't get more tired than usual.  
I get tired more easily than usual.  
I get tired from doing almost anything.  
I am too tired to do anything.
18. My appetite is not worse than usual.  
My appetite is not as good as it used to be.  
My appetite is much worse now.  
I have no appetite at all anymore.
19. I haven't lost much weight, if any.  
I have lost more than 5 pounds.  
I have lost more than 10 pounds.  
I have lost more than 15 pounds.
20. I am no more worried about my health than usual.  
I am worried about physical problems such as aches and pains; or upset stomach; or constipation.  
I am very worried about physical problems and it's hard to think of much else.  
I am so worried about my physical problems that I can't think about anything else.
21. I have not noticed any recent change in my interest in sex.  
I am less interested in sex than I used to be.  
I am much less interested in sex now.  
I have lost interest in sex completely.

## Beck Anxiety Inventory

Below is a list of common symptoms of anxiety. Please carefully read each item in the list. Indicate how much you have been bothered by that symptom during the past month, including today, by circling the number in the corresponding space in the column next to each symptom.

	Not At All	Mildly but it didn't bother me much.	Moderately - it wasn't pleasant at times	Severely – it bothered me a lot
Numbness or tingling	0	1	2	3
Feeling hot	0	1	2	3
Wobbliness in legs	0	1	2	3
Unable to relax	0	1	2	3
Fear of worst happening	0	1	2	3
Dizzy or lightheaded	0	1	2	3
Heart pounding/racing	0	1	2	3
Unsteady	0	1	2	3
Terrified or afraid	0	1	2	3
Nervous	0	1	2	3
Feeling of choking	0	1	2	3
Hands trembling	0	1	2	3
Shaky / unsteady	0	1	2	3
Fear of losing control	0	1	2	3
Difficulty in breathing	0	1	2	3
Fear of dying	0	1	2	3
Scared	0	1	2	3
Indigestion	0	1	2	3
Faint / lightheaded	0	1	2	3
Face flushed	0	1	2	3
Hot/cold sweats	0	1	2	3

Center for Epidemiologic Studies Depression Scale (CES-D)

The 20 items below refer to how you have felt and behaved during the last week. Choose the appropriate response.

1. I was bothered by things that don't usually bother me.
  - Rarely or none of the time (<1 day)
  - Some or a little of the time (1-2 days)
  - Occasionally or a moderate amount of the time (3-4 days)
  - Most or all of the time (5-7 days)
2. I did not feel like eating; my appetite was poor.
  - Rarely or none of the time (<1 day)
  - Some or a little of the time (1-2 days)
  - Occasionally or a moderate amount of the time (3-4 days)
  - Most or all of the time (5-7 days)
3. I felt that I could not shake off the blues even with the help of my family or friends.
  - Rarely or none of the time (<1 day)
  - Some or a little of the time (1-2 days)
  - Occasionally or a moderate amount of the time (3-4 days)
  - Most or all of the time (5-7 days)
4. I felt that I was just as good as other people.
  - Rarely or none of the time (<1 day)
  - Some or a little of the time (1-2 days)
  - Occasionally or a moderate amount of the time (3-4 days)
  - Most or all of the time (5-7 days)
5. I had trouble keeping my mind on what I was doing.
  - Rarely or none of the time (<1 day)
  - Some or a little of the time (1-2 days)
  - Occasionally or a moderate amount of the time (3-4 days)
  - Most or all of the time (5-7 days)
6. I felt depressed.
  - Rarely or none of the time (<1 day)
  - Some or a little of the time (1-2 days)
  - Occasionally or a moderate amount of the time (3-4 days)
  - Most or all of the time (5-7 days)
7. I felt everything I did was an effort.
  - Rarely or none of the time (<1 day)
  - Some or a little of the time (1-2 days)
  - Occasionally or a moderate amount of the time (3-4 days)
  - Most or all of the time (5-7 days)
8. I felt hopeful about the future.
  - Rarely or none of the time (<1 day)
  - Some or a little of the time (1-2 days)
  - Occasionally or a moderate amount of the time (3-4 days)
  - Most or all of the time (5-7 days)
9. I thought my life had been a failure.
  - Rarely or none of the time (<1 day)
  - Some or a little of the time (1-2 days)

- Occasionally or a moderate amount of the time (3-4 days)  
Most or all of the time (5-7 days)
10. I felt fearful.  
Rarely or none of the time (<1 day)  
Some or a little of the time (1-2 days)  
Occasionally or a moderate amount of the time (3-4 days)  
Most or all of the time (5-7 days)
11. My sleep was restless.  
Rarely or none of the time (<1 day)  
Some or a little of the time (1-2 days)  
Occasionally or a moderate amount of the time (3-4 days)  
Most or all of the time (5-7 days)
12. I was happy.  
Rarely or none of the time (<1 day)  
Some or a little of the time (1-2 days)  
Occasionally or a moderate amount of the time (3-4 days)  
Most or all of the time (5-7 days)
13. I talked less than usual.  
Rarely or none of the time (<1 day)  
Some or a little of the time (1-2 days)  
Occasionally or a moderate amount of the time (3-4 days)  
Most or all of the time (5-7 days)
14. I felt lonely.  
Rarely or none of the time (<1 day)  
Some or a little of the time (1-2 days)  
Occasionally or a moderate amount of the time (3-4 days)  
Most or all of the time (5-7 days)
15. People were unfriendly.  
Rarely or none of the time (<1 day)  
Some or a little of the time (1-2 days)  
Occasionally or a moderate amount of the time (3-4 days)  
Most or all of the time (5-7 days)
16. I enjoyed life.  
Rarely or none of the time (<1 day)  
Some or a little of the time (1-2 days)  
Occasionally or a moderate amount of the time (3-4 days)  
Most or all of the time (5-7 days)
17. I had crying spells.  
Rarely or none of the time (<1 day)  
Some or a little of the time (1-2 days)  
Occasionally or a moderate amount of the time (3-4 days)  
Most or all of the time (5-7 days)
18. I felt sad.  
Rarely or none of the time (<1 day)  
Some or a little of the time (1-2 days)  
Occasionally or a moderate amount of the time (3-4 days)  
Most or all of the time (5-7 days)
19. I felt that people disliked me.

Rarely or none of the time (<1 day)  
Some or a little of the time (1-2 days)  
Occasionally or a moderate amount of the time (3-4 days)  
Most or all of the time (5-7 days)

20. I could not get "going".

Rarely or none of the time (<1 day)  
Some or a little of the time (1-2 days)  
Occasionally or a moderate amount of the time (3-4 days)  
Most or all of the time (5-7 days)

## Inventory to Diagnose Depression, Lifetime Version

On this questionnaire are groups of 5 statements. Please read each group of statements carefully. Then pick out the one statement in each group which best describes the way you have felt DURING THE TIME IN YOUR LIFE when you felt the MOST depressed, down, or sad.

1. I did not feel sad or depressed.  
I occasionally felt sad or down.  
I felt sad most of the time, but I could snap out of it.  
I felt sad all of the time, and I couldn't snap out of it.  
I felt so sad or unhappy that I couldn't stand it.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

2. My energy level was normal.  
My energy level was occasionally a little lower than normal.  
I got tired more easily or had less energy than usual.  
I got tired from doing almost anything.  
I felt tired and exhausted almost all of the time.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

3. I had not been feeling more restless and fidgety than usual.  
I felt a little more restless or fidgety than usual.  
I had been very fidgety, and I had some difficulty sitting still in a chair.  
I had been extremely fidgety, and I had been pacing a little bit almost each day.  
I had been pacing more than an hour a day, and I couldn't sit still.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

4. I had not been talking or moving more slowly than usual.  
I talked a little slower than usual.  
I spoke slower than usual and it took me longer to respond to questions but I could still carry on a normal conversation.  
Normal conversations were difficult because it was hard to start talking.  
I felt extremely slowed down physically, like I was stuck in the mud.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

5. I had not lost interest in my usual activities.  
I was a little less interested in 1 or 2 of my usual activities.  
I was less interested in several of my usual activities.  
I had lost most of my interest in almost all of my usual activities.  
I had lost all interest in all of my usual activities.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

6. I got as much pleasure out of my usual activities as usual.  
I got a little less pleasure from 1 or 2 of my usual activities.  
I got less pleasure from several of my usual activities.  
I got almost no pleasure from most of the activities which I usually enjoy.  
I got no pleasure from any of the activities I usually enjoy.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

7. I had not noticed any change in my interest in sex.  
I was only slightly less interested in sex than usual.  
There was a noticeable decrease in my interest in sex.  
I was much less interested in sex.  
I had lost all interest in sex.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

8. I had not been feeling guilty.  
I occasionally felt a little guilty.  
I often felt guilty.  
I felt quite guilty most of the time.  
I felt extremely guilty most of the time.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

9. I did not feel like a failure.  
My opinion of myself was occasionally a little low.  
I felt I was inferior to most people.  
I felt like a failure.  
I felt I was a totally worthless person.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

10. I didn't have any thoughts of death or suicide.  
I occasionally thought life was not worth living.  
I frequently thought of dying in passive ways (such as going to sleep and not waking up) or that I'd be better off dead.  
I had frequent thoughts of killing myself but I did not carry them out.  
I would have killed myself if I had the chance.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

11. I could concentrate as well as usual.  
My ability to concentrate was slightly worse than usual.  
It was harder and took longer to make decisions, but I did make them.  
I was unable to make some decisions.  
I couldn't make any decisions at all.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

12. I made decisions as well as I usually do.  
Decision making was slightly more difficult than usual.  
It was harder and took longer to make decisions, but I did make them.  
I was unable to make some decisions.  
I couldn't make any decisions at all.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

13. My appetite was less than normal.  
My appetite was slightly worse than usual.  
My appetite was clearly not as good as usual, but I still ate.  
My appetite was much worse.  
I had no appetite at all, and I had to force myself to eat even a little.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

14. I hadn't lost any weight.  
I lost less than 5 pounds.  
I lost between 5 and 10 pounds.  
I lost between 11 and 25 pounds.  
I lost more than 25 pounds.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

Had you been dieting or deliberately trying to lose weight?

15. My appetite was not greater than normal.  
My appetite was slightly greater than usual.  
My appetite was clearly greater than usual.  
My appetite was much greater than usual.  
I felt hungry all the time.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

16. I hadn't gained any weight.  
I gained less than 5 pounds.  
I gained between 5 and 10 pounds.  
I gained between 10 and 25 pounds.  
I gained more than 25 pounds.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

17. I did not sleep less than normal.  
I occasionally had slight difficulty sleeping.  
I clearly didn't sleep as well as usual.  
I slept about half my normal amount of time.  
I slept less than 2 hours per night.

If you answered choice 2, 3, 4, or 5, which of these sleep problems had you experienced?

- I had difficulty falling asleep.  
My sleep was fitful and restless.  
I woke up earlier than usual and could not fall back asleep.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

18. I was not sleeping more than normal.  
I occasionally slept more than normal.  
I frequently slept at least 1 hour more than normal.  
I frequently slept at least 2 hours more than normal.  
I frequently slept at least 3 hours more than normal.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

19. I did not feel anxious, nervous, or tense.  
I occasionally felt a little anxious.  
I often felt anxious.  
I felt very anxious most of the time.  
I felt terrified and near panic.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

20. I did not feel discouraged about the future.  
I occasionally felt a little discouraged about the future.

I often felt discouraged about the future.  
I felt very discouraged about the future most of the time.  
I felt that the future was hopeless and that things would never improve.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

21. I did not feel irritated or annoyed.  
I occasionally got a little more irritated than normal.  
I got irritated or annoyed by things that didn't usually bother me.  
I felt irritated or annoyed almost all of the time.  
I felt so depressed that I didn't get irritated at all by things that used to bother me.  
If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

22. I was not worried about my physical health.  
I was occasionally concerned about bodily aches and pains.  
I was worried about my physical health.  
I was very worried about my physical health.  
I was so worried about my physical health that I could not think about anything else.

If you answered choice 2, 3, 4, or 5, did you feel this way for more or less than two weeks?

23. When you were having these problems the most, was it after the death of a friend or relative?

24. When you were having these problems the most, did you seek treatment or professional help?