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Defective Cognitive Inhibition in Depression

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Abstract

This study examined attentional inhibition in depressed and nondepressed individuals using a computerized negative priming task. Previous research has suggested that defective inhibition may explain the selective attention deficits associated with depression (Lemelin et al., 1996; Linville, 1994; MacQueen, Tipper, Young, Joffe, & Levitt, 2000). This hypothesis was tested; in addition to testing the extent to which defective inhibition is associated with the ruminative response styles shown to exist in depressed individuals (Nolen-Hoeksema, 1987; 1991). Two samples of participants (N = 46, N = 29) completed the negative priming task, the Beck Depression Inventory (BDI-II; Beck, Steer & Brown, 1996), a diagnostic interview (Structured Clinical Interview for the DSM-IV Axis I Disorders; First, Spitzer, Gibbon, & Williams, 1996), the vocabulary section of the Shipley Institute of Living Scale (Zachary, 1986), and the Response Style Questionnaire (RSQ; Nolen-Hoeksema, 1987; 1991). These samples were analysed separately, compared for differences on the dependant variables, and then pooled as one sample. The resultant sample had 44 participants in the nondepressed group and 31 participants in the depressed group. The results failed to identify any differences between the depressed and nondepressed group on distractor inhibition for depression-related stimuli. Additionally, there were no negative priming effects in the overall sample. Supplementary analyses revealed that differences existed between the depressed and nondepressed group on the distractor portion of the negative priming task, indicating possible interference effects. Furthermore, a self-report measure of rumination was found to be positively correlated with cognitive interference, while a self-report measure of distraction was negatively correlated with cognitive interference.

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Defective Cognitive Inhibition in Depression

Depression is a long-lasting and pervasive disturbance in mood. Many individuals experience short-term disturbances in mood and feel mildly to moderately depressed at least occasionally. However, for the majority of individuals the symptoms of depression do not persist or cause significant dysfunction. An essential component of whether or not someone may experience an episode of depression may be those factors that cause the depressive affect to persist, rather than those factors that initiate it. Several factors have been identified in the reinforcement and maintenance of depression, such as biochemical factors (e.g., levels of serotonin, norepinephrine, and dopamine; Blier & Bergeron, 1997; Mann & Kapur, 1995), psychosocial factors (e.g., interpersonal deficits; Gotlib & Hammen, 1992), stressful situations (Brown & Harris, 1978), cognitive factors (e.g., attributional styles and negative biases; Abramson, Metalsky, & Alloy, 1989; Beck, 1976). While all these may play an important role in depression, cognitive factors are receiving much recent attention in explaining the maintenance and persistence of depression.

Research on the cognitive factors in depression has provided insight into the role and structure of depressive thinking styles. Indeed, there appears to be differences between the thinking styles of depressed and nondepressed individuals. Many theories of depression posit negative cognitive styles as the main etiological and symptomatic component. Such theories propose that depressed individuals pay more attention to depression-related (negative) information in the environment, evaluate information more negatively, are more preoccupied with negative thoughts, and remember more negative information than other individuals remember. Several cognitive processes have been examined for biases towards negative information. Such cognitive processes include: (a) attentional allocation, or how one notices

information, (b) attentional processing, or how one evaluates information, and (c) memory or recall of information. Such cognitive theories allow the examination of thinking styles in depressed individuals and have advanced the understanding of this disorder.

Cognitive Theory of Depression

Perhaps one of the most popular theories of depression is Beck's cognitive theory (1976), which characterizes depression as a set of negative cognitive patterns or cognitive distortions that maintain and reinforce depression. According to Beck, the causes of these cognitive patterns are negative cognitive schemata or mental representations that guide the processing of information and attention to stimuli. Within a diathesis-stress framework, depression occurs when these schemata are activated by stressful events. As a consequence of activated cognitive schemata, negative cognitive patterns occur with themes of the negative cognitive triad, or negative thoughts about one's self, world, and future. Beck's cognitive theory of depression has provided the basis of the majority of the research linking cognition and depression.

Many studies have examined Beck's cognitive theory of depression (Beck, Brown, Steer, Eidelson, & Riskind, 1987; Beck & Emery, 1985; Beck, Rush, Shaw, & Emery, 1979). Specifically, such researchers have focused on how the cognitions of depressed individuals differ from those of nondepressed individuals. In general, researchers hypothesize that depressed individuals' perceptions and recall of information will be negatively biased; that is, their perceptions and recall will contain more negative information than a nondepressed individual. The experimental paradigms that have been employed to evaluate such biases in depression include comparing the evaluation, perception, and recall of negative, neutral, and positive information by those who are depressed versus those who are not. Overall, the

presence of a negative bias in depressive thinking style has received mixed support (e.g., Craighead, Hickey, & DeMonbreun, 1979; Gotlib, 1981).

Potential reasons for the equivocal findings in these studies include a number of methodological flaws. One major problem is that most of these studies employ self-report measures to study cognitions and cognitive processes. Self-report measures have been criticized as being inaccurate measures of one's cognitive state, as one is often unaware of such implicit cognitive processes. Nisbett and Wilson (1977) argue that we often have little conscious access to our own thought processes. These authors have demonstrated that, while we may be sometimes aware of the thoughts themselves, we are often unaware of the processes that created those thoughts. Even when we do have access to these thoughts and thought processes, various factors can affect the accuracy of what we report. For example, memory biases can greatly alter the accuracy of what we self-report. Loftus and her colleagues (1978; 1989) have demonstrated that human memory can be grossly inaccurate. Repeatedly, her participants inaccurately recalled and identified features of a crime scene, regardless of how confident they were about their reports. A number of response biases can also alter the accuracy of self-report. The most prominent response biases include the motivation to present oneself in a socially desirable way, the tendency to be acquiescent, and the tendency to answer using extremes (McCrea & Costa, 1983; Paulhus, 1991).

On the positive side, recent research has indicated that cognitive processing paradigms can provide answers where the introspective measures used in self-report research fail (Ingram & Reed, 1986; McCabe & Gotlib, 1993). Specifically, non-explicit measurement, or measurement where an individual is not directly asked to provide descriptions of their cognitions, could more accurately tap into non-explicit processes. Such non-explicit

measurements are not affected by the memory and response biases associated with explicit reporting.

Indirect Measurement of Attentional Processes

In response to criticisms of the explicit measurement of cognitive processes in depression, recent research has used implicit measures of attentional biases. Before evaluating the experimental paradigms employed in this line of research, it is important to first review relevant theories of attentional processing. Conceptualisations of attention have emphasised that our mental resources have a limited capacity. When presented with multiple stimuli, our attentional mechanisms must select or inhibit relevant information. That is, we must allocate our attentional resources to information that facilitates goal attainment, and inhibit the processing of information deemed unimportant. Processes of selective attention are crucial in determining how information is attended to in one's environment. Historically, there has been debate over whether the selection of information to be attended to occurs "early" or "late" in information processing (Allport, 1989). Broadbent (1958) has argued that before information is attended to, little, if any semantic processing occurs. However, recent research has indicated that semantic processing is possible for both selected and ignored stimuli (e.g., Allport, Tipper, & Chimiel, 1985; Tipper, 1985). Thus, at even early levels of selective processing, biases may exist in the selection of semantic information. In relation to depression, such a model of selective attention has allowed investigation of attention biases for affective information, which would be purportedly semantically processed before inhibited or selected.

Selective attention has been examined in depression using two general strategies. These strategies involve demonstrating that competing stimuli either facilitate or disrupt

performance due to their salience (Williams, Watts, MacLeod, & Matthews, 1997). Affecting performance in either direction indicates that the stimulus is being selectively attended to. Examples of tasks demonstrating facilitated and distrupted performance include: those demonstrating lowered auditory thresholds, as in the dichotic listening task (Bargh, 1982; Foa & McNally, 1996; Gotlib & McCabe, 1992; Nielson & Saranson, 1981), those demonstrating lowered visual thresholds as in the dot-probe task (MacLeod, Matthews, & Tata, 1986), the deployment of attention task (DOAT; Gotlib, MacLachlan, & Katz, 1988; McCabe & Gotlib, 1995), and the Emotional Stroop Gotlib & Cane, 1987; Gotlib & McCann, 1984; Mathews & MacLeod, 1985)..

In the dichotic listening task, verbal stimuli are presented in both ears, one channel is shadowed (attended channel), and the other is to be ignored (the unattended channel). In this task, attention drawn away from the attended channel to the unattended channel may signify that stimuli in the unattended channel were more salient than stimuli in the attended channel. Facilitated performance is demonstrated if in the implicit recognition task the salient stimuli from the unattended channel are better recognized than the stimuli from the attended channel. Disrupted performance is demonstrated by shadowing errors and longer latencies to the probe, when salient stimuli are presented in the unattended channel. In the dot-probe task, two words are presented on a computer screen, one above and one below the other. A dot-probe replaces one of the words and the participant responds to the probe as quickly as possible by pressing a button on the keyboard. The participant in this case should respond to the probe more quickly if the probe replaces a more salient word, demonstrating facilitated performance. On the other hand, if the salient word is not followed by the dot-probe, then there would be disrupted response to the dot-probe. Similarly in the DOAT, two words are presented one above the

other on a computer screen, with each replaced by a coloured bar. The participant is asked to judge which colour bar appeared first when, in reality, both appeared at the same time. The idea is that the word most salient to the participants will draw their attention and cause the colour bar to appear first in their visual field. Facilitated performance would occur if salient stimuli caused the bar that replaced it to appear first more often than the bar than replaced the other stimuli.

These methodologies have obtained varied results for attentional biases in depression. Using the dichotic listening task, McCabe and Gotlib (1993) found that negative-content words in the unattended channel disrupted the attended channel performance of depressed participants and not nondepressed participants. Other researchers have obtained similar findings using the dichotic listening task with obsessive-compulsive patients (Foa & McNally, 1986), socially-anxious and agoraphobic patients (Burgess et al., 1981), and bulimic subjects (Schotte, McNally, & Turner, 1990). With the dot-probe task, MacLeod, Matthews, and Tata (1986) demonstrated that anxious participants had facilitated performance if the probe replaced threat words compared to neutral words and disrupted performance when the probe replaced neutral words compared to threat words. Also using the dot-probe task, Mogg, Bradley, Williams, and Matthews (1993) found that depressed participant's responses were facilitated when the probe replaced negative words that were presented for durations allowing conscious processing (supraliminal presentation), compared to controls. When the negative words were presented at preattentive levels, the attentional bias was observed in the anxious participants only. In contrast, studies with the DOAT, found attentional biases in nondepressed participants and not in depressed participants. For example, Gotlib, McLaughlan, and Katz (1988) found that nondepressed subjects demonstrated an attentional

bias away from negative stimuli and towards positive stimuli, whereas the depressed subjects were "even-handed" in their attention to all the stimuli. Furthermore, McCabe and Gotlib (1995) found that depressed individuals attended equally to positive-, neutral-, and negative-content words, while nondepressed individuals directed their attention towards positive stimuli, but not towards negative stimuli.

Thus, the three methodologies reviewed thus far have found different patterns of results with depressed participants. The dichotic listening task found a negative bias in the attention of depressed participants, the dot-probe task found an attentional bias in the depressed participants for conscious stimuli only, and the DOAT found no bias in the processing of negative information in depressed participants. The differences in the patterns of results for a negative bias in depression may be due to mechanism of attention that these tasks measure. The dot-probe and the DOAT examine which of two stimuli placed in the same visual field are attended to. Both of the stimuli are initially given equal priority for attentional processing. The dichotic listening task, on the other hand, places the individual's attention on the shadowing task and tests how well stimuli in the unattended ear draw attention from the shadowing of words. In this task, the to-be-attended stimuli are given attentional priority and the participant is directed to inhibit the stimuli in the unattended ear. Thus, the different tasks compare selective attention toward stimuli of competing affective valence or attentional allocation (dot-probe and DOAT), and inhibition or selection of stimuli of competing affective valence (dichotic listening task).

In selective attention tasks demonstrating debilitated performance, an alternative more salient stimulus interferes with one's attention to a task. Unlike attentional allocation, where the focus of one's attention to competing negative or positive information is compared,

interference addresses one's ability to inhibit irrelevant stimuli in the environment. An example of a task that examines attentional interference is the Emotional Stroop (Gotlib & Cane, 1987; Gotlib & McCann, 1984; Mathews & MacLeod, 1985). The Emotional Stroop is based on the original Stroop Test (1935), a task where one must name the ink colour of a word, while the meaning of the word represents a different colour or is a noncolour word. Subjects take longer to name the ink colour of words that have incongruent colour names than words with noncolour names. Thus, the Stroop task shows that the word is automatically read and that the meaning of the word competes for and interferes with the subject's abilities to name the colour of the ink of the word. The Emotional Stroop was modified to use the interference effects evidenced in the original Stroop, but with emotionally relevant words as distracters instead of colour words. Thus in the Emotional Stroop task, subjects are presented with emotionally relevant words of various colours and are required to report the colour of the word as quickly as possible. If more interference was caused by negative information than positive or neutral information, then the person presumably has increased access to negative schemata or preferential processing of negative information.

Gotlib and McCann (1984) used this paradigm to test the accessibility of stable depression-associated patterns of information. These researchers used the Emotional Stroop task, and required individuals to name the colour of depressed-, neutral-, or manic-content words. In this case, it was predicted that the mildly depressed individuals would demonstrate longer response latencies to the depressed-content words than the neutral or positive words, due to the interfering effects of the negative stimuli. Consistent with these predictions, it took longer for the depressed individuals to report the colour of the depressed-content words aloud than the neutral or manic-content words. The nondepressed group did not show different

response latencies across the three types of words. A similar study by Gotlib and Cane (1987), also using the Emotional Stroop, was conducted with clinically depressed individuals and nondepressed individuals. These researchers obtained a similar pattern of results to those of Gotlib and McCann (1984): the depressed patients took longer to name the depressed-content words than the nondepressed-content words. Mathews and MacLeod (1985) have also studied anxiety using the emotional Stroop task. Using individuals with generalised anxiety states, the researchers asked the subjects to name the colour of physical or social threat-content words or words unrelated to threat. With the threat relevant words, the anxious individuals were slower to name the word colour than the nonanxious individuals, however such differences were not obtained for neutral words. Additional studies using modified Stroop tasks have examined the "emotional salience words" (Watts et al., 1986), and "distraction by emotional stimuli" (Ray, 1979; Williams & Broadbent, 1986).

A criticism of the Emotional Stroop is that the resultant interference can be caused by more than one attentional mechanism (Gotlib & McCabe, 1992). For example, the cognitive process responsible for the response latency observed in the depressed group while reading the colour of the depression-relevant words is not clear. First, it may be that the depressed subjects are selectively attending to the negative words for a longer period of time than the nondepressed group. This latency would indicate that the depressed group is unable to inhibit the distracting negative information. Alternatively, it may be that the depressed group is taking longer to process the negative information and do not differ in their disengagement from the negative words compared to the nondepressed group. This latency would indicate difficulty processing negative information. Overall, using the Emotional Stroop it is unclear at

what level of attentional processing the interference occurs. The interference may occur either before or after attentional processing.

The emerging distinction in the selective attention research on depression is between facilitated attention to emotional stimuli (capture and attentional allocation; e.g., dichotic listening task, dot-probe task, DOAT) and disrupted attention caused by emotional stimuli (interference; e.g., Emotional Stroop). These two processes differ as the former involves selection of salient stimuli in the environment and the later entails the selective inhibition of certain stimuli.

Recently, Williams, Watts, MacLeod, and Matthews (1997) have supported the distinction between automatic and elaborated biases in attentional processes in depression. These authors believe that depression is an emotional response to loss, failure, or unattained goals. In accord, the conceptual processing of a depressed individual would be more related to internal representations of failure and loss, than an automatic perceptual vigilance. Thus, biased cognitive processing in depression would affect elaborated processes such as memory, and ruminations over unattained goals. However, anxiety is emotional response with the key purpose of facilitating the early detection of threat or danger. In relation of cognitive processes, anxious individuals would be expected to differ from nonanxious individuals in their pre-attentive functioning. This theory is useful in explaining some of the findings reviewed thus far, where no cognitive biases were observed for preattentive stimuli in the visual facilitated attention paradigms like the dot-probe task and the DOAT. The attentional biases were however observed in disrupted attention paradigms, which may indicate problems related to the cessation of processing negative stimuli. Recently the concept rumination has

been related to this inability to inhibit the processing of negative stimuli and will be discussed next.

Ruminative Coping

Where the above-mentioned research on depression has identified important aspects of depressive cognitive processing, other lines of research focus on the function of depressive thinking styles. The Response Styles Theory proposed by Nolen-Hoeksema (1991) has identified the role that persistent thoughts or ruminations can play in depression. Rumination is defined as thoughts and behaviours that focus one's attention on one's depressive symptoms and the meanings of these symptoms (Nolen-Hoeksema, 1991). According to this theory, individuals engage in ruminative thought as a coping strategy to increase their insight into their problems. However, such ruminative strategies were shown to be uncorrelated with structured problem-solving techniques in depressed individuals (Nolen-Hoeksema & Morrow, 1993). That is, rumination tends to entail a non-adaptive focus on problems.

Numerous laboratory studies have supported the Response Styles Theory of depression (Nolen-Hoeksema, 1987), where the induction of rumination reinforces negative affect in dysphoric individuals, with no change in affect in the nondysphoric individuals (Lyubomirsky & Nolen-Hoeksema, 1993; Morrow & Nolen-Hoeksema, 1990; Nolen-Hoeksema & Morrow, 1993). Furthermore, longitudinal studies of depressed individuals indicate that ruminative responses prolong periods of depressed mood, even after controlling for initial severity of mood (Nolen-Hoeksema & Morrow, 1991; Nolen-Hoeksema, Morrow, & Fredrickson, 1993; Wood, Salzberg, Neale, Stone, & Rachmiel, 1990). The converse process to rumination is distraction where one's attention is removed from his or her symptoms of depression and instead placed on pleasant or neutral activities. It has been shown

that depressed subjects assigned to a rumination condition had amplified and prolonged negative moods compared to depressed individuals assigned to a distraction condition (Lyubomirsky & Nolen-Hoeksema, 1993; Morrow & Nolen-Hoeksema, 1990; Nolen-Hoeksema & Morrow, 1993). Furthermore, Nolen-Hoeksema has shown that depressed individuals tend to use ruminative response styles, while nondepressed individuals tend to use distraction-related response styles. Taken together, these studies indicate that depression involves ruminative and not distractive response styles and that the distractive response styles are effective in reducing negative affect.

Nolen-Hoeksema (1987; 1991) has proposed two mechanisms to explain how rumination could prolong depression. First, ruminative thinking enhances the effect that depressed mood appears to have on biasing people's thinking. That is, depressed mood leads to the recall of negative memories and pessimistic inferences (Blaney, 1986; Bower, 1981; Teasdale, 1985), and ruminative thinking increases focus on such depressive symptoms. This reinforcement of negative affect is shown in studies that found that those who engage in ruminative responses have greater access to hopeless attitudes (Needles & Abramson, 1990) and are more likely to make depressing conclusions about events (Nolen-Hoeksema & Lyubomirsky, 1992). Second, rumination may conflict with attention, concentration, and the conduct of simple instrumental behaviours. Such a conflict purportedly reduces the attentional resources allocated to constructive thoughts and behaviours. In addition, ruminative responses may not only interfere with simple attentional resources, but also they may interfere with more complex problem solving. This hypothesis has been supported in laboratory studies showing that depressed people induced to engage in a ruminative task subsequently generated fewer solutions to specific problem paradigms (Morrow, 1990).

The above studies conducted by Nolen-Hoeksema and colleagues, while providing a critical foundation for the theory of depressive response styles, have used self-reports as a measure of rumination and distraction. For example, many of her studies have employed a Response Style Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991), a scale with 22 items describing responses to depressed mood that are self-focused. As mentioned, it is questionable whether or not self-reported measurement of internal processes can lead to an accurate assessment of the desired mechanisms. Again, indirect measures may be more useful means of tapping implicit processes.

Rumination, as a construct, appears to entail a combination of cognitive components. In order to obtain an implicit and precise measure of rumination, its component parts need to be identified. Nolen-Hoeksema describes rumination as any thought or behaviour that focuses an individual's attention on how they feel and the potential causes and consequences of these feelings (Nolen-Hoeksema, 1991). At one level, rumination seems to involve increased activation of negative affective mental representations or lowered inhibition of such representations.

Defective Inhibition

According to Linville (1996), those who engage in ruminative response styles do so unintentionally and automatically. Ruminations are nonadaptive and persistent thoughts that reduce problem-solving and lead to negative affect. Thus, ruminations often should be inhibited from conscious thought for adaptive processing. Contrarily, ruminations occupy the attention of depressed individuals and may lead to the concentration and attentional deficits observed in depression. Linville has proposed that the selective attention mechanism of inhibition underlies rumination. Inhibition is an automatic process that filters relevant material

in some instances and nonrelevant material in other instances from consciousness. Inhibition may act as an "automatic cognitive gatekeeper" and allow ruminative thoughts to occupy cognitive processing of depressed individuals. Thus, depressed mood interacts with one's level of control over these activation and inhibition processes.

Linville (1994) conducted a preliminary study examining the effects of depression on inhibition using a negative priming task. Like the Stroop Task (1935) mentioned previously, the negative priming task is a debilitated performance task measuring interference. In this negative priming paradigm, a red and green letter were superimposed and the participant had to read the red letters and ignore the green letters (or vice-versa). On the next trial, the distractor may become the target, providing a measure of negative priming. According to negative priming researchers, (Fox, 1994a, 1994b; Neill, 1989; Neumann & DeSchepper, 1992; Tipper, 1985; Tipper & Cranston, 1985; Yee, 1991) initially all stimuli in the visual field are identified, then the target stimuli are processed, while further processing of the distractors is inhibited. Thus, when the distractor stimulus becomes the target stimulus on the next trial, there should be a lowered ability to attend to that stimulus than when there is no relation between the distractor and target, provided that stimulus was successfully inhibited on the previous trial. The lowered ability to attend is observed as a slower response to the target stimulus, and is thought to reflect inhibition of distractor stimulus on trial N, which must be overcome to respond to the stimulus on trial N+1 (Tipper, 1985; Tipper & Cranston, 1985). Thus, negative priming occurs when there is a debilitation in attention to stimuli, due to inhibition of that stimulus on the previous trial. Linville demonstrated that when used with depressed subjects, there was a diminished inhibitory ability, while nondepressed subjects showed a strong inhibitory ability (i.e. less negative priming for depressed than nondepressed

subjects). The diminished inhibitory ability was observed as a faster response time to stimuli that was encountered as a distractor on a previous trial compared to response times when there was no relation between the distractor and the target. Similar findings have been shown with individuals experiencing stress (Linville, 1994).

The negative priming task appears to be a more decisive test of disrupted attention (or interference) than the Stroop (Treisman, 1969). As mentioned, the Stroop presents both the distractor and target stimuli in the same spatial location, and limits the attribution of interference to impaired distractor inhibition or reduced processing resources. Alternatively, the negative priming task presents the to-be-attended-to stimuli and the to-be-ignored stimuli in separate spatial locations, allowing a more direct examination of the stimuli causing interference. For example, the to-be-ignored stimuli or the distractor presented in one trial becomes the to-be-attended stimuli or the target on the next trial. By separating these stimuli, reduced processing would be observed as a disruption in performance for the same stimuli when presented as a distractor or a target. Contrarily, the reduction in negative priming associated with depression is observed as facilitated performance to target stimuli just presented as distractors. Thus, this facilitated performance to targets is seen as a failure to inhibit the distractors and not a reduction in processing to those stimuli.

To date there have been few examinations of negative priming in depressed populations. However, recent researchers have investigated impaired attentional processing in depressed populations tasks with desynchronized presentations of stimuli. Recently, Rokke, Arnell, Koch, and Andrews (2002) examined general reductions in attentional functioning in moderately to severely depressed participants using the attentional blink paradigm. The attentional blink paradigm entails the successive presentation of letters with participants

having to report either one or two targets from the stimulus stream. With the use of two targets (dual task condition), attentional processing that required conscious stimulus consolidation was impaired in moderately to severely depressed participants compared to mildly depressed and nondepressed participants. From this study, the exact nature of the attentional deficit was not clear. However, it was concluded that dysphoric participants may experience a general slowing of central processing or that their central processing may be occupied by extra-task processing such as rumination.

Recently, the Stroop paradigm has been modified to allow the comparison of competing accounts of attentional disturbance in depression with desynchronized stimuli; reduction in general processing resources and distractor inhibition. For example, Benoit et al. (1992) used a desynchronised Stroop task that varied the delay between the presentation of distractors and targets. Overall, these authors found that depressed participants displayed greater levels of interference than the control sample for non affective stimuli. This study supported the hypothesis that depressed participants had impaired cognitive inhibition to the distractor stimuli. Lemelin et al. (1996) also used a desynchronized Stroop task and a selective attention task with fewer cognitive demands than the Stroop task (Visuo-Spatial Interference Test; VSIT). This study was designed to examine whether interference on the Stroop or VSIT reflected distractor inhibition deficits or cognitive processing deficits. Distractor inhibition deficits were isolated from general response deficits, with the inclusion of a control conditions that included no interference stimuli. The Stroop paradigm used coloured words with incongruent or congruent colour names, and the VSIT involved identifying congruent or incongruent spatial colour targets. It was found that the depressed group had slower response times on Stroop test and the Visuo-Spatial Interference Test than

the control group, supporting a general resource deficit explanation of interference. However, they also found that in faster response-time depressed participants, a distractor inhibition deficit was present in the absence of a global response deficit, when compared to the slower control participants. These results suggest that a selective attention deficit can be observed in depressives who do not present a clear psychomotor retardation and therefore no clear sign of a processing resource deficit.

One recent study has examined selective processing deficits using the negative priming task. MacQueen, Tipper, Young, Joffee, and Levitt (2000) used a negative priming task to test impaired distractor inhibition, while controlling for a potentially confounding process called object review. Object review allows the perceptual linking of current and past information and would mimic negative priming effects by delaying the formation of a coherent mental picture. These authors were able to support a reduction in distractor inhibition not accounted for by impaired object review in depressed participants compared and not nondepressed participants.

The negative priming task has also been used with affective stimuli. Fox (1994a) studied the inhibition of threat-related and neutral words in high and low anxious subjects, as well as repressor subjects. Her study consisted of three experiments, each using a variant negative priming task. The first experiment had two tasks, the first was a traditional Stroop, and the second was a task using colour patches flanked by threat-content words and neutral words. The focus of the second task was to spatially separate the to-be-attended and to-be-ignored stimuli, for a clearer test of the source of the interference. The first experiment failed to replicate previous Stroop experiments that found different interference effects in different clinical groups. The second experiment was a visual search paradigm, where subjects were

required to respond to the locus of a target stimulus embedded in a matrix of three distractors. In contrast to the first experiment, the second experiment found evidence of interference in the high anxious group, and not the low anxious or repressor groups. The third experiment was conducted to test inhibitory differences in the elaborated cognitive processes of the anxious participants. The third experiment was a focused attention task, where the participant had to make lexical decisions about words that were either semantically and threat-related to words in the previous trial. Thus, in this experiment, rather than having to identify visual features, the participants needed to process the stimuli to decide if it was a word or not. To measure general negative priming, distractors and probes that were semantically related were compared to distractors and probes that were not semantically related. She hypothesized that the high anxious groups would show less general negative priming relative to a control group and a repressor group. Additionally Fox included measures of threat-related negative priming, to test if the high anxious group would demonstrate less threat-related negative priming than the other groups. Contrary to the predictions, there were no group differences in the amount of general negative priming for the three experimental groups in this task. In terms of threat-related negative priming, while not finding lower threat-related negative priming, the high anxious subjects demonstrated greater interference when distractor stimuli were threat-related. Thus, Fox was only able to demonstrate that high anxious individuals selectively attended to threat-related material with the attentional search task only. These findings are consistent with those found by MacLeod and Matthews (1988), where anxious individuals are more likely to demonstrate biases in visual facilitated attention tasks, than those examining disrupted attention (elaborated processing).

The Present Experiment

The current experiment used a negative priming task to explore whether participants exhibiting depression differed from nondepressed individuals in their ability to inhibit depression-related distractors. A negative priming task similar to the one used by Fox (1994a, Experiment 3) was employed in the current experiment. Using Fox's methodology allowed the examination of defective inhibition (as found by Lemelin et al., 1996; Linville, 1994; MacQueen et al., 2000) for depression-relevant stimuli. Participants were required to indicate if a target number was odd or even (number classification task) when the target number had a distractor (prime) word above or below it. A lexical decision task (LDT) was then presented, in which the participant indicated if letter string (probe) was a word or nonword.

The main conditions in the current task were: (1) neutral distractors in the prime display followed by a neutral word in the LDT (Neutral-Neutral; N-N); (2) depression-related distractors in the prime display followed by a neutral word in the LDT (Depressed-Neutral; D-N); (3) neutral distractors in the prime display followed by a depression-related word in the LDT (Neutral-Depressed; N-D); and (4) depression-related distractors in the prime display followed by a depression-related word in the LDT (Depressed-Depressed; D-D). Differences between response times on conditions 3 and 4 (N-D<D-D) are the index of depression-related negative priming. In other words, slower response times to depression-related stimuli when the distractors are depression-related would indicate that depression-related stimuli as a class are successfully inhibited. The other conditions were present as controls. For example, condition 2 was present to check if depression-related stimuli produce negative priming due to the capturing of attention by the distractor stimuli. Based on the findings of Lemelin et al. (1996), Linville (1994), and MacQueen et al. (2000), it was predicted that the depressed group will show defective inhibitory processes compared to the nondepressed group. Further

predictions are based on the previous studies of attentional biases to negative stimuli in depression. Most relevant are the Emotional Stroop studies that found greater interference for words that were congruent to their current emotional concerns (Gotlib & Cane, 1987; Gotlib & McCann, 1984). Thus, the present study predicts that there will be negative priming differences between the depressed and nondepressed group with depression-related stimuli. Specifically, it was predicted that the depressed group will have faster response times on the trials with depression-related stimuli than the other trials and that the nondepressed group will not show these differences.

In addition, the Response Style Questionnaire (RSQ) by Nolen-Hoeksema, Morrow, and Fredickson (1993) was included to measure the tendency for individuals to ruminate or distract themselves in response to a negative mood. This questionnaire is made of two subscales: the Ruminative Response Scale (RRS) the Distractive Response Scale (DRS). The responses on each of these subscales were correlated with the overall response times and the index depression-related negative priming. The current investigation did not attempt to determine the exact relationship between response styles and attentional processing. However, it was hypothesized that attentional processing and response styles are associated in depressed individuals. Specifically, it was predicted that lower levels of attentional inhibition to negative stimuli will be associated with higher levels of ruminative responses and lower levels of distractive responses. Such a finding would lead to an increased understanding of how depressive cognitive styles relate to rumination (Nolen-Hoeksema, 1987; 1991) and would support a relationship between the cognitive process attentional inhibition and a self-report measure of ruminative response styles.

Method

Study 1

Participants

Participants in the first study were recruited from first year psychology classes at Lakehead University and received a course bonus point and entry into a $100 draw for their participation in the study. Based on their responses to a screening questionnaire distributed after class, potential participants were invited to participate in the study. Two hundred and thirty-two potential participants filled out the screening questionnaire and were initially placed into one of two groups, a depressed group, or a nondepressed group, according to their responses to the screening questionnaire. The criteria for the depressed group were scores of 14 or over on the Beck Depression Inventory-Second Edition (BDI-II: Beck, Steer & Brown, 1996; see Appendix A) and scores of under 13 on the BDI-II for the nondepressed group. One-hundred and fifty-three participants met the screening criteria for the nondepressed group and 79 met the screening criteria for the depressed group. A total of 77 participants agreed to participate in the experimental session. During the experimental session, the BDI-II was re-administered along with a diagnostic interview. The criterion for the final depressed group was a score of 14 or greater on the BDI-II and a diagnosis of major or minor depression on the diagnostic interview. The criterion for the final nondepressed group was a score of 9 or under on the BDI-II and no current or past diagnoses of major or minor depression. Additionally, individuals were removed from the groups if they had essential symptoms for other psychological disorders according to the screening section of the diagnostic interview. Of the 77 participants who completed Study 1, two were removed due to their data not being recorded. Forty-six of these participants met criteria for the depressed or nondepressed group. The resultant sample contained 24 nondepressed individuals and 22 depressed individuals.

Measures

Beck Depression Inventory-Second Edition. The BDI-II is a 21-item self-report instrument that includes items descriptive of depressive symptomatology. Each item allows a response of 0-3, with three describing the most severe symptoms of depression and zero describing the least. The overall score on this measure ranges from 0-63, with a higher score indicating a greater level of depression. This measure has good reliability with an internal consistency of .93 (for college students) and a test-retest stability of .93 (Beck, Steer, & Brown, 1996). The validity of the BDI-II, as measured by its correlation with other measures of depression, ranges from poor to moderate, .37 to .71 (Beck et al., 1996).

Diagnostic Interview. The Structured Clinical Interview for the DSM-IV Axis I Disorders (*SCID*; First, Spitzer, Gibbon & Williams, 1996) was modified for diagnosing depression based on the Research Diagnostic Criteria. The interview is administered face-to-face and included a series of questions aimed at diagnosing major or minor depression in the present or past. In addition, the interview used here screens for various other disorders including mania, schizophrenia, panic disorder, and drug abuse using the essential symptom screening method suggested by Othmer and Othmer (1989).

Shipley Institute of Living Scale – Vocabulary Scale. The vocabulary section of the Shipley (Zachary, 1986; Appendix B) was administered to estimate verbal IQ. This test was included to ensure that any differences in response times between the groups to the verbal stimuli could be attributed to differences in levels of depression and not to differences in verbal abilities. This subscale contains 40 multiple-choice items, where each item requires the participant to match a target word to a semantically equivalent word among a word list. Wong

(1993) has shown that the Shipley vocabulary section has a strong positive correlation with the vocabulary subscale of the Wechsler Adult Intelligence Scale-Revised (Wechsler, 1981).

Response Style Questionnaire. The RSQ (Nolen-Hoeksema et al., 1993; Appendix C) is designed to measure trait-associated responses to negative affect. Participants respond on a 4-point Likert scale ranging from "never" to "always". The 41-item scale was grouped, a priori into the RRS, the DRS, the Problem-Solving scale, and the Dangerous Activities scale. For this experiment, only the responses on the RRS and the DRS were used. The RRS scale has 22 items assessing various responses to a negative mood such as focusing on the self, focusing on one's own symptoms, or focusing on the possible consequences and causes of one's own mood. This subscale has good internal consistency, $\alpha = .89$. The DRS has 13 items and assesses the tendency to engage in distracting, active responses to a negative mood. This subscale also has good internal consistency, $\alpha = .80$.

Stimulus Words

Depression-related and neutral words were used in the negative priming task. These words were obtained from a list of 400 depressed-content and neutral-content words normed by psychiatric professionals in a study by Myers (1990). A total of 80 depressed-content words and 100 neutral-content words from Myers' list were selected, matched by condition for word length, and frequency in the English language using norms by Thorndike and Lorge (1944). The stimulus words were paired as such: 20 neutral-prime target word-pairs were used in the first condition (N-N) of the negative priming task. Another 20 prime words matched on the dimensions of word length and word frequency, were paired with 20 nonword probes for the nonword conditions. For conditions 2, 3, and 4, another 60 prime-target word pairs were used: 20 pairs composed of 20 depression-related primes and 20 neutral probes for condition

2 (D-N); 20 pairs of 20 neutral primes and 20 depression-related probes for condition 3 (N-D); and 20 pairs of 20 depression-related probes and 20 depression-related primes for condition 4 (D-D). Another 60 prime words were selected to match the word length and word frequency of 60 nonword probes. The total 80 nonword probes were formed by changing the vowels in English words that matched the word probes in word length, syllables, and word frequency. All nonwords were pronounceable. To form the word pairs, first, the primes and probes in each condition were matched on word length and frequency, and then the matches were randomized with in a condition. See Appendix D for the stimulus word list.

Apparatus

Negative Priming Task. GWBasic programming software was used to present the negative priming task. The program was run on a Packard Bell Pentium I computer, with 166MHz and 32MB of RAM, and displayed by a 13-inch DataTrain DC529P colour monitor.

Experimental Room. Participants were seated individually in the same quiet room for each session. Participants were facing the wall at a computer desk, and the experimenter was present in a neighbouring room for the computer task and questionnaire portion of the experiment.

Procedure

Potential participants were administered the BDI-II in their psychology classes to screen for the absence or presence of depressive symptoms. They were asked to return these immediately, at the next class, or drop them off in a box. Based on their BDI-II scores (see above) they were invited to participate in the laboratory session.

During the laboratory session, participants were seated 45cm from the computer screen. At the start of the laboratory session, participants were introduced to the task and informed of

their rights to confidentiality and freedom to withdraw from the study at any time. They were then given the information/consent form to read and sign (see Appendix E). Next, they were instructed to complete the practice session of the computer task with the experimenter in the room. The practice session began with the following instructions presented on the computer screen:

> "In this task you will be shown a number presented in the centre of the screen. You are required to decide if it is an odd or even number. If it is odd, press the "red" key if it is even, press the " green" key. Next, a letter string will be presented in the centre of the screen that will be either a word or nonword. You will press the "red" key if it is a nonword and the "green" key if it is a word. It is best to keep your fingers on the "red" and "green" keys while completing the tasks. Also, please respond as quickly as you can without making too many errors. There will first be a practice session to begin."
>
> "Press the spacebar to continue"

The experimenter left the room for the experimental session. The participant was then required to "press the spacebar to continue". Each trial proceeded with the following sequence (see Figure 1 for a schematic representation of each trial). The fixation display was presented for 500 ms, with one fixation cross "+" in the centre and seven fixation crosses at a 2.4° visual angle above and below the centre "+". Next, a blank screen was shown for 100 ms. A number classification task (NCT) then followed, with a number replacing the centre cross and two same distractor words replacing the other sets of crosses for 150ms. The participants needed to decide if the number was odd or even and responded by pressing "v" for odd and "b" for even. The distractors were presented with a 2.4° visual angle center-to-center distance between them and the target. The target stimuli measured 0.5° of a vertical visual angle and 0.1° of horizontal visual angle. The distractors subtended a vertical visual angle of 0.8° and a horizontal visual angle of 0.8° to 2.5°, depending on word length. A fixation mask was presented for 100 ms, and then a blank screen was displayed until the response to the number

classification task was received. The lexical decision task (LDT) was presented next, in which the participant decided if the letter string presented in the centre of the screen was a word or nonword. The target word stimuli measured 0.5° of vertical visual angle and had a horizontal visual angle of 0.8° to 2.5°, depending on word length. The display remained on the screen until the participant responded. The two-key response to the lexical-decision was "b" for a word and "v" for a nonword. This display was presented in the centre of the screen until a response to the LDT was received. A new trial started after a 2000ms blank screen. After every 40 trials the participant was asked to "press the spacebar to continue". The program had 20 practice trials and 160 experimental trials.

Following completion of the computer task, the participants were asked to fill out the questionnaires, and complete the diagnostic interview. At the end of the experiment, they were asked if they detected or remembered any distractor words, received debriefing, and were asked if they had any further questions. Upon leaving, the participants were given a debriefing form with information about the study and information about how to contact the researchers (see Appendix F).

Design

The between-subjects factor was group (depressed, nondepressed). The within-subjects factors were: (1) number type in the number classification task (odd, even); (2) distractor type (neutral, depressed); (3) letter string type (word, nonword); and (4) relationship between the probe and prime words (condition type). The dependent variables were response time (in seconds) and accuracy. Half of the numbers in the classification task were odd and the other half were even. Half of the letter strings in the lexical decision task were words, and the other half was nonwords. The stimuli were displayed in a predetermined randomised

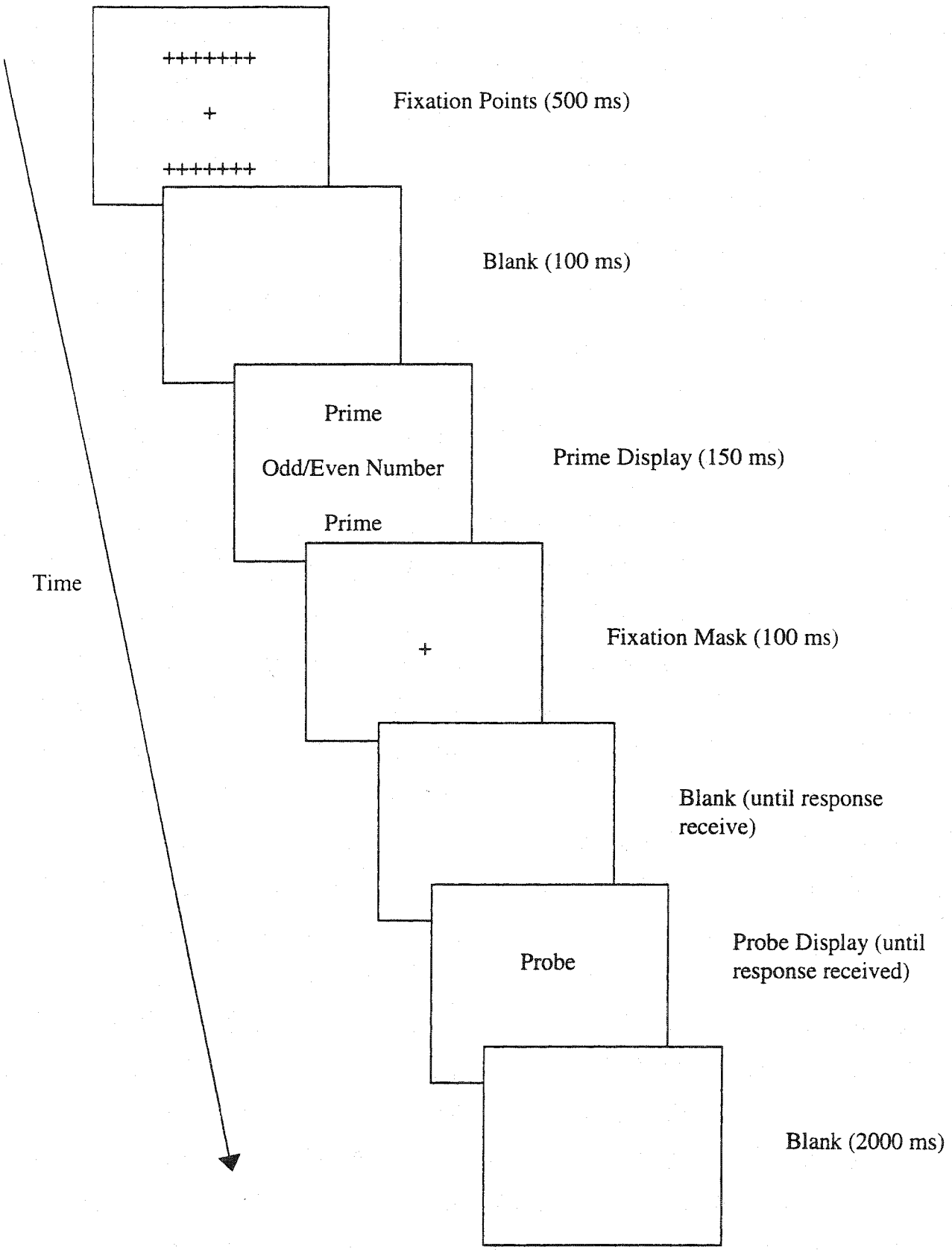

Figure 1. A schematic representation of each trial.

order, such that no two conditions were shown consecutively. In the practice trials, no depression-related words were presented and there were an equal number of odd and even letters, as well as an equal number of words and nonwords. No word was repeated as a probe or prime in the practice or experimental trials.

Data Reduction

Response times were first examined for outliers. To remove potentially invalid responses in the number classification trials, RTs greater than 4000 ms and less than 150 ms were eliminated. This accounted for 0.83% of the data. For the LDT trials, inaccurate RTs greater than 4000 ms and less than 200 ms were removed, which accounted for 1.43% of the data. One-hundred and fifty milliseconds was used as the lower bound for the number classification task because it was found that these responses tended to be faster than with LDT trials. These differential rates in responses between the two trial types follows the logic that it would take less time to respond to the number classification task where there was a single digit was presented, and longer with the LDT where there was a word of 3 to 12 letters to respond to. Although Fox (1994a) removed only the potentially invalid LDT RTs and not the potentially invalid number classification RTs, it was decided to remove both number classification and LDT potentially invalid response times in the present study, as these RTs were used in the analyses. Additionally for potentially invalid response time removal, Fox used the cutoff of RTs greater than 2000 ms. This value was determined to be too conservative with this data set, as too many data points fell outside this range, and instead 4000 ms was used.

Next, all number classification and LDT response times were standardized within individuals to remove idiosyncratic differences in the speed of responses. As suggested by Tabachnick and Fidell (1996), all standardized RTs less than –3.29 and greater than +3.29 were removed and replaced by these respective values. The corresponding outlier raw data in seconds was replaced by its raw score equivalent of -3.29 or +3.29, depending upon whether its respective z score was less than -3.29 or greater than +3.29. For the data analyses reported in the results, both the raw data in seconds and the z scores were used. There were no violations in homogeneity or sphericity on any of the variables, except on mixed Analysis of Variance comparisons of the groups for levels of depression-related negative priming trials. For these analyses, the degrees of freedom were adjusted using the Greenhouse-Geisser coefficient. When asked if they were aware of distractor stimuli above and below the numbers, the majority of the participants reported that they were aware of words above and below the number; however no participant could recall any of these words.

Study 2

Following the data collection for study 1, it was discovered that due to an error in the programming, the accuracy data for the lexical decision task was not stored. As a result, another data collection phase took place with the programming error corrected. There were no deviations from the above methodology with the exception of recruiting participants. The purpose of the second data collection phase was to test if a speed-accuracy trade-off existed for LDTs in the overall sample and between the depressed and nondepressed participants. As such, all analyses conducted on the reaction time data were also conducted on the accuracy data to test if the hypothesized differences in each analysis are accounted for by reaction time and/or accuracy differences. If the analyses for reaction times were significant and the

analyses for accuracy were not, it would be assumed that there were no speed-accuracy trade-offs on those variables. After testing for speed-accuracy trade-off with sample 2, the two samples were pooled for overall response time analyses.

Participants

Participants were recruited from various classes offered at Lakehead University or by responding to two types of posters and newspaper advertisements. One advertisement requested individuals interested in participating in a study on mood and attention. At a later date, another advertisement requested individuals who were specifically in sad, blue, or depressed moods. This second advertisement was placed because not enough depressed participants were obtained from the first advertisement. There was no screening session in Study 2. All participants were entered in a $100 or a $50 draw, depending on whether they responded to the first or second advertisement, respectively. Participants from a second year social psychology distance education course received two course bonus points for entering the study. A total of 45 participants who responded to the advertisements agreed to participate in the experimental session.

Of the 45 participants who completed Study 2, one was removed because the individual was not fluent in the English language and had difficulty completing the lexical decision task. Twenty-nine participants met criteria for the depressed and nondepressed groups. One age outlier was removed from the sample group with an age z score greater than +3.29. The resultant sample contained 20 nondepressed individuals and 9 depressed individuals.

Data Reduction

The response time outliers were removed following the same procedure as Study 1, with Study 1 and 2 as a combined sample.

Results

Study 1

Participant Characteristics

As mentioned, Sample 1 had a total of 46 participants, with 24 participants in the nondepressed group and 22 participants in the depressed group. Sample 1 contained 38 (82.6%) females and 8 (17.4%) males. The nondepressed group had 19 (79.2%) females and five (20.8%) males, and the depressed group had 19 (86.4%) females and three (13.6%) males. The ratio of females to males in each group did not differ significantly, $\chi^2(1) = .414$, n.s. The mean age of this sample was 23.61 ($SD = 7.47$), with the mean age of the nondepressed and depressed group equalling 24.50 ($SD = 8.92$) and 22.64 ($SD = 5.52$), respectively. The two groups did not differ significantly in age, $t(44) = .843$, n.s.

Self-Report Analyses

BDI-II. For Sample 1 the mean score on the BDI-II was 13.12 ($SD = 11.20$). The mean BDI-II score for the nondepressed and depressed group was 4.92 ($SD = 3.77$) and 22.05 ($SD = 9.16$), respectively. A *t*-test was conducted to compare these means for each group. As expected, there was a significant difference between the groups, with the depressed group scoring higher on the BDI-II than the nondepressed group, $t(25.59) = 8.70$, $p < .001$.

Shipley Institute of Living Scale – Vocabulary Scale. The overall mean on the Shipley-Vocabulary for Sample 1 was 32.59 ($SD = 2.47$). The nondepressed and depressed group had means of 32.83 ($SD = 2.33$) and 32.32 ($SD = 2.64$), respectively. The groups did not differ significantly on this measure, $t(44) = .702$, n.s . Thus, the depressed and nondepressed

samples did not differ significantly on estimated verbal IQ, and any differences in RTs between the groups to the verbal stimuli were not attributed to differences in levels of verbal abilities.

Response Style Questionnaire. On the RRS subscale of the RSQ, which measures ruminative responses styles to negative mood, Sample 1 participants obtained an overall mean score of 1.89 (*SD* =.44). As expected, the depressed group (*M* = 2.24, *SD* = .28) scored significantly higher on the RRS than the nondepressed group (*M* = 1.58, *SD* = .31), *t*(44) = -7.44, $p < .001$. On the DRS, a measure of distracting responses to negative mood, Sample 1 obtained a mean score of 2.30 (*SD* = .33). On the DRS there were no significant differences between the depressed group (*M* = 2.23, *SD* = .32) and the nondepressed group (*M* = 2.36, *SD* = .34), *t*(44) = 1.37, n.s.

Response Time Analyses

The mean response times for the number classification task and LDT were .526 (*SD* = .168) and 1.10 (*SD* = .299), respectively. A *t*-test revealed that the response times for these two tasks were significantly different, *t*(45) = 15.63, $p < .001$. Thus, it took significantly longer for the participants to respond to the lexical decision task than the number classification task.

Next, it was of interest to investigate the differences in response times between the depressed and nondepressed groups. A *t*-test was used to examine differences between groups for mean raw response times (i.e., mean of all 160 trials). As was expected, the mean number classification raw RTs for the depressed group (*M* = .594, *SD* = .178) was significantly slower than the nondepressed group (*M* = .464, *SD* = .1351, *t*(44) = -2.79, $p < .009$. However, for the

mean lexical decision task raw RTs, the depressed group (M = 1.133, SD = .279) did not differ significantly from the nondepressed group (M = 1.065, SD = .320), $t(44) = -2.79$, n.s.

Depression-related Negative Priming. Depression-related negative priming was examined by comparing the mean lexical decision RTs on the D-D trials to the mean lexical decision RTs on the control trials, N-D and D-N (see Table 1 for means and standard deviations). The N-D trials were used as a control for trials when probes were depression-related and to allow the comparison of trials with depression-related vs neutral distractors. According to the negative priming paradigm, if RTs to the depression-related probes (LDT) are slower in the D-D trials compared to N-D trials, then depression-related distractors were inhibited. The D-N trials were included as a control to ensure that any difference between the D-D and N-D trials were not due to attentional interference by the depressed distractor. To examine if these depression-related negative priming effects differed between the depressed and nondepressed groups, a mixed 2 (group; nondepressed vs. depressed) x 3 (condition; D-D, D-N, N-D) analysis of variance (ANOVA) was conducted on the both the raw RTs and z-scores. Contrary to hypotheses of a group differences for the depression-related negative priming effect, there were no significant differences between response times for conditions [raw; F (1.92, 84.49) = 2.67, ns, z-score; F (1.87, 82.21) = 1.97, n.s.] and there was no evidence of differences between response times for the depressed and nondepressed participants [raw; F (1, 44) = 1.70, ns, z-score; F (1, 44) = 2.53, n.s.]. Furthermore, the group by affective relation interaction was not significant [raw; F (1.92, 84.49) = .038, ns, z-score; F (1.87, 82.21) = .788, n.s.].

Accuracy Data

As mentioned, only data for the number classification task was obtained in this study. The overall proportion of accurate trials on the number classification trials for this sample was .98 (*SD* = .02). Additionally, no participant had lower than .91 of the total trials completed accurately. These data were analysed for differences between the depressed (*M* = .98, *SD* = .02) and nondepressed (*M* = .98, *SD* = .02) groups on overall proportion accurate, and no significant differences were found, $t(44) = -.178$, n.s.

Study 2

Participant Characteristics

As mentioned, Sample 2 included 29 participants, with 20 participants in the nondepressed and nine participants in the depressed group. In terms of sex, Sample 2 contained 21 (72.4%) females and 8 (27.6%) males. There were fourteen (70.0%) females and 6 (30.0%) males in the nondepressed group, and 7 (77.8%) females and 2 (22.2%) males and in the depressed group. The number of males and females in the depressed and nondepressed groups did not differ significantly, $\chi^2(1) = .18$, ns. The mean age of Sample 2 was 25.82 (*SD* = 5.12), with the mean age of the nondepressed and depressed group samples equalling 26.56 (*SD* = 5.46) and 25.11 (*SD* = 4.99), respectively. The two groups did not differ significantly in age $t(16) = .59$, n.s.

Self-Report Analyses

BDI-II. The overall Sample 2 mean score on the BDI-II was 9.57 (*SD* =10.01). The mean BDI-II scores for the nondepressed and depressed group were 3.60 (*SD* = 2.54) and 22.89 (*SD* = 6.86), respectively. A *t*-test was conducted to compare these means. As expected, there was a significant difference between the groups, with the depressed group scoring higher on the BDI-II, $t(9) = -8.18$, $p < .001$.

Table 1

Response Time Means and Standard Deviations in Seconds and Z-Scores for Sample 1 Depressed (n = 22) and Nondepressed (n = 24) Groups by Condition for the LDT

	Condition			
	D-D	N-D	D-N	N-N
Group	Mean (Standard Deviation)	Mean (Standard Deviation)	Mean (Standard Deviation)	Mean (Standard Deviation)
Depressed (Secs)	1.1391 (.3321)	1.096 (.2960)	1.1688 (.3408)	1.1287 (.3642)
Nondepressed (Secs)	1.026 (.3493)	1.0000 (.3072)	1.0178 (.3037)	1.0107 (.2914)
Depressed (Z Scores)	-.0129	-.0915	.0394	-.0474
Nondepressed (Z Scores)	-.1100	-.1200	-.0944	-.1163

Shipley Institute of Living Scale – Vocabulary Scale. The Sample 2 mean on the Shipley-Vocabulary Scale was 32.03 (*SD* = 2.26), with the nondepressed and depressed group Table 1 having means of 31.75 (*SD* = 2.55) and 32.67 (*SD* = 1.32), respectively. The groups did not differ significantly on this measure, $t(26.24) = -1.27$, ns . Thus, the Sample 2 depressed and nondepressed also did not differ significantly on estimated verbal IQ and any differences in response times between the groups to the verbal stimuli should not be attributed to differences in levels of verbal abilities.

Response Style Questionnaire. Sample 2 obtained a mean score of 1.92 (*SD* = .48) on the RRS and a mean score of 2.26 (*SD* = .47) on the DRS. The depressed group (*M* = 2.27, *SD* =.46) scored significantly higher on the RRS than the nondepressed group (*M* = 1.75, *SD* = .41), $t(27) = -3.02$, $p = .005$. There were no significant differences between the depressed group (*M* = 2.17, *SD* = .30) and the nondepressed group (*M* = 2.31, *SD* = .52), $t(27) = .75$, n.s on the DRS.

Response Time Analyses

The mean response times for the number classification task and LDT were .559 (*SD* = .236) and 1.1034 (*SD* = .333), respectively. A *t*-test revealed that the response times for these two tasks were significantly different, $t(28) = 15.44$, $p < .001$. Thus, as with Sample 1, it took significantly longer for the participants to respond to the lexical decision task than the number classification task.

A *t*-test was used to examine differences between groups for mean raw response times. Unlike Sample 1, the mean number classification raw RTs for the depressed (*M* = .594, *SD* = .178) and the nondepressed groups (*M* = .464, *SD* = .1350) did not differ significantly, $t(44) = -.547$, n.s. Like Sample 1, the mean lexical decision task raw RTs, for the depressed (*M* =

1.132, *SD* = .279) and the nondepressed groups (*M* = 1.064, *SD* = .320) were not significantly different, *t*(27) = -.513, n.s.

Depression-related Negative Priming. As with Sample 1, mixed 2 (group; nondepressed vs. depressed) x 3 (condition; D-D, D-N, N-D) ANOVA were conducted on the both the raw RTs and *z*-scores (see Table 2 for means and standard deviations). Consistent with the findings for Sample 1, there were no significant differences between response times for conditions [raw; *F* (1.82, 49.21) = .378, n.s., *z*-score; *F* (1.89, 50.82) = .326, n.s.]. Additionally, there was no evidence of differences between response times for the depressed and nondepressed participants [raw; *F* (1, 27) = .153, n.s., *z*-score; *F* (1, 27) = .284, n.s.]. Furthermore, the group by affective relation interaction was not significant [raw; *F* (1.82, 49.21) = 1.02, ns, *z*-score; *F* (1.88, 50.82) = 1.18, n.s.].

Accuracy Data

Sample 2 had an overall mean proportion accurate on the number classification trials of .97 (*SD* = .03) and all participants had at least.89 of the total trials correct. On the lexical decision trials, the overall mean proportion correct was .93 (*SD* = .05), with no participant getting less than .75 of the total trials correct. The proportion accurate on the number classification task and LDT differed significantly, *t*(28) = 5.51, *p* < .001. Thus, the proportion of correct trials was significantly greater in the number classification task than the LDT. A *t*-test was used to examine differences between the depressed (*M* = .96, *SD* = .02) and nondepressed (*M* = .98, *SD* = .04) groups for total proportion accurate on the number classification and LDT trials. There were no significant differences between groups for the mean number classification proportion accurate [*t*(27) = .294, n.s.]. There were no significant

Table 2

Response Time Means and Standard Deviations in Raw RTs and Z-Scores RTs for Sample 2 Depressed (n = 9) and Nondepressed (n = 20) Groups by Condition for the LDT

	Condition			
	D-D	N-D	D-N	N-N
Group	Mean (Standard Deviation)	Mean (Standard Deviation)	Mean (Standard Deviation)	Mean (Standard Deviation)
Depressed (Secs)	1.1433 (.4465)	1.1964 (.4843)	1.1175 (.4230)	1.1637 (.4463)
Nondepressed (Secs)	1.1026 (.3144)	1.0808 (.3544)	1.0988 (.3887)	1.0440 (.3121)
Depressed (Z Scores)	-.0827	.0264	-.1200	.0304
Nondepressed (Z Scores)	.0265	-.0482	-.0176	-.1049

differences between the depressed (M = .91, SD = .06) and nondepressed (M = .94, SD = .04) groups on mean lexical decision proportion accurate [$t(27) = 1.71$, n.s.].

Depression-related Negative Priming. A (group; nondepressed vs. depressed) x 3 (condition; D-D, D-N, N-D) analysis of variance (ANOVA) revealed no significant main effects for condition [F (1.98, 53.51) = .345, ns] or group, [F (1, 27) = .1.70, n.s.] on accuracy data. Furthermore, the group by condition interaction was nonsignificant [F (1.98, 53.51) = .630, ns].

Study 1 and 2 Participant Comparison

To increase the power of the above response time analyses, Sample 1 and Sample 2 were pooled, and the analyses were repeated. First, however it was necessary to ensure that the two overall samples did not significantly differ on any of the participant characteristics or self-report measures. T-tests were conducted to compare the age, BDI-II score, Shipley scores, RRS scores, and DRS scores of the two samples. There were no significant differences between the samples on any of these variables, all $ts < 1.9$, n.s. (see Table 3 for means and standard deviations). The relative number of males and females in Samples 1 and 2 also did not differ significantly, $\chi^2(1) = 1.1$, n.s.. To test a group x sample interaction (i.e., if any differences existed between the depressed and nondepressed groups in Samples 1 and 2; see Table 4 for means and standard deviations) for age, BDI-II score, Shipley scores, RRS scores, and DRS, a univariate analysis of variance was performed. According to these analyses, there were no significant interactions between the sample and group, all Fs < 1.9, n.s., and thus the depressed and nondepressed groups did not differ significantly between each sample on age or scores on the self-report measures. The relative number of nondepressed males to depressed males in each sample did not differ significantly, $\chi^2(1) = .489$, n.s.; nor did the relative

number of depressed females to depressed males in each sample, $\chi^2(1) = .348$, n.s. (see Table 5 for counts and percentages).

The negative priming task RT and accuracy data (for number classification trials) were also compared between the two samples to ensure this data could be pooled. *T*-tests were used to compare differences between Sample 1 and 2 on all the variables used in the above ANOVAs for RT and accuracy. There were no significant differences between Sample 1 and Sample 2 for the reactions times and accuracy for distractor type, number type, or depression-related negative priming condition, all $t(73)$s < .80, n.s..

Pooled sample overall analyses

Based on the above comparison between Study 1 and Study 2, the data was safely pooled and all analyses were completed with the full sample.

Participant Characteristics

The pooled sample included 75 participants, with 44 participants in the nondepressed group and 31 participants in the depressed group. This sample contained 59 (78.7%) females and 16 (21.3%) males. The nondepressed group contained 33 (75.0%) females and 11 (25.0%) males, and the depressed group contained 26 (83.9%) females and 5 (16.1%) males. The gender of the nondepressed and depressed groups did not differ significantly, $\chi^2(1) = .853$, ns. The mean age of the entire sample was 24.93 ($SD = 8.02$). The mean age of the nondepressed ($M = 23.61$, $SD = .7.67$), and depressed ($M = 27.03$, $SD = 8.53$) groups did not differ significantly, $t(71.11) = 1.70$, n.s.

Self-Report Analyses

BDI-II. The pooled sample mean score on the BDI-II was 11.75 ($SD = 10.63$). The mean BDI-II score for the nondepressed and depressed group (see Table 6) differed

Table 3

Means and Standard Deviations for Sample 1 (n = 46) and 2 (n = 29) Participant Characteristics and Self-Report Data

	Mean		Standard Deviation	
Variable	Sample 1	Sample 2	Sample 1	Sample 2
Age	23.61	27.03	7.47	8.53
BDI-II	13.39	9.61	11.20	10.20
Shipley	32.59	32.00	2.47	2.26
RRS	1.90	1.91	.44	.48
DRS	2.30	2.26	.33	.46

Table 4

Means and Standard Deviations for Sample (1 and 2) and Group [Nondepressed (ND) and Depressed (Dep)] Participant Characteristics and Self-Report Data

	Mean				Standard Deviation			
	Sample 1		Sample 2		Sample 1		Sample 2	
Variable	ND	Dep	ND	Dep	ND	Dep	ND	Dep
Age	24.50	22.64	28.10	24.67	8.92	5.52	9.54	5.41
BDI-II	4.91	22.05	3.60	22.89	2.92	9.16	2.54	6.86
Shipley	33.83	32.32	31.75	32.67	2.33	2.64	2.55	1.32
RRS	1.58	2.24	1.76	2.27	.31	.28	.40	.46
DRS	2.36	2.23	2.31	2.17	.34	.32	.53	.30

Table 5

Number and Percent of Nondepressed and Depressed Males and Females in the Samples

	Nondepressed		Depressed	
Gender	Sample 1	Sample 2	Sample 1	Sample 2
Female *N*	19	14	19	7
Percent Females	79.2	70.0	86.4	77.8
Male *N*	5	6	3	2
Percent Male	20.8	30.0	13.6	22.2

significantly, with the depressed group scoring higher on the BDI-II than the nondepressed group, $t(34.68) = -11.40$, $p < .001$.

Shipley Institute of Living Scale – Vocabulary Scale. The overall mean on the Shipley-Vocabulary for the pooled sample was 32.37 ($SD = 2.32$). The means and standard deviations for the nondepressed and depressed group are located in Table 6. The groups did not differ significantly on this measure, $t(73) = -.139$, n.s. Again, the depressed and nondepressed samples did not differ significantly on estimated verbal IQ and any differences in response times between the groups to the verbal stimuli should not be attributed to differences in levels of verbal abilities.

Response Style Questionnaire. On the RRS, the pooled sample obtained a mean score of 1.90 ($SD = 0.45$). Again, as expected, the depressed group scored significantly higher on the RRS than the nondepressed group, $t(73) = -7.06$, $p < .001$ (see Table 6 for means and standard deviations). On the DRS, the pooled sample obtained a mean score of 2.29 ($SD = .39$). As with the previous samples on the DRS, there were no significant differences between the depressed group and nondepressed groups, $t(73) = 1.37$, n.s. (see Table 6 for means and standard deviations).

Response Time Analyses

The mean response times for the number classification task and LDT were .539 ($SD = .196$) and 1.010 ($SD = .311$), respectively. A t-test revealed that the response times for these two tasks were significantly different, $t(74) = 21.47$, $p < .001$. Thus, as with the separate samples, it took significantly longer for the participants to respond to the lexical decision task than the number classification task.

Consistent with Sample 1, the mean number classification raw RTs for the depressed group (M = .59, SD = .19) was significantly slower than the nondepressed group (M = .50, SD = 0.19), $t(73) = -2.09$, $p < .05$. Consistent with the analyses on the separate samples, the mean lexical decision task raw RTs for the depressed group (M = .1.14, SD = .31) did not differ significantly from the nondepressed (M = 1.07, SD = .31) group, $t(73) = -.90$, n.s.

Interference Effects. It was of interest to examine the effects of the distractors on response times to the number classification task. As both number classification response time and accuracy data were available for the pooled sample, these interference effects analyses were only conducted on the pooled sample. Thus, both response time and accuracy data could be subjected to the same analyses. This procedure allows us to check if any significant RT effects are also accounted for by significant accuracy effects, thus indicating a speed-accuracy trade-off.

The mean reaction times in seconds and z-score equivalents for the number classification trials with depression-related and neutral distractors are presented in Table 7. A mixed 2 (group; nondepressed vs. depressed) x 2 (distractor type; depressed vs. neutral) ANOVA was performed on the raw response time data. There was a significant main effect for distractor type, F (1, 73) = 8.87, $p < .005$, where it took participants less time to respond to the number classification task if the distractors were depression-related compared to neutral words. There was also a significant main effect for group, F (1, 73) = 4.01, $p < .05$, where nondepressed participants had faster response times for the number classification task than the depressed participants. Contrary to expectations, the distractor type by group interaction was not significant, $F(1, 73) = .245$, ns, and the response time difference between the groups for the depression-related and neutral distractors was equal. The same mixed design

Table 6

Participant Characteristics and Self-Report Data Means and Standard Deviations for the Pooled Sample by Group [Nondepressed (ND) and Depressed (Dep)]

	Mean		Standard Deviation	
Variable	ND (n = 44)	Dep (n = 31)	ND (n = 44)	Dep (n = 31)
Age	26.14	23.23	9.28	5.48
BDI-II	4.32	22.29	2.80	8.45
Shipley	32.34	32.42	2.47	2.32
RRS	1.66	2.25	.37	.34
DRS	2.34	2.21	.43	.31

ANOVA was conducted with *z*-scores, and a significant main effect for distractor was obtained, $F(1, 73) = 10.13$, $p < .003$, with again the nondepressed participants responding faster than the depressed participants. The main effect for group was not significant [$F(1, 73) = .013$, n.s.], nor was the group by distractor interaction [$F(1, 73) = 2.63$, n.s.].

Depression-related Negative Priming. The mixed 2 (group; nondepressed vs. depressed) x 3 (condition; D-D, D-N, N-D) ANOVA was conducted on the pooled sample's raw RTs and *z*-scores (see Table 8 for means and standard deviations). As with Sample 1 and Sample 2, there were no significant differences between response times for conditions [raw; F (1.91, 144.60) = .944, n.s., *z*-score; F (1.96, 143.69) = .799, n.s.]. Additionally, there was no evidence of differences between response times for the depressed and nondepressed participants [raw; F (1, 73) = 1.30, n.s., *z*-score; F (1, 73) = .583, n.s.]. Furthermore, the group by affective relation interaction was not significant [raw; F (1.91, 144.60) = .153, n.s., *z*-score; F (1.96, 143.69) = .177, n.s.].

Accuracy Data

The number classification task proportion accurate data were analysed for differences between the depressed and nondepressed group, and there were no significant differences, $t(73) = -.600$, n.s.

Interference Effects. A mixed 2 (group; nondepressed vs. depressed) x 2 (distractor type; depressed vs. neutral) ANOVA was conducted on these data. There were no significant main effects for distractor type, [F (1, 73) = 1.94, n.s.] or group, [F (1, 73) = .014, n.s.]. Additionally, the distractor type by group interaction was not significant [F (1, 73) = .955, n.s.]. Thus, there were no differences in accuracy on number classification trials

Table 7

Response Time Means and Standard Deviations in Seconds and Z-Scores for the Pooled Sample Depressed (n = 31) and Nondepressed (n = 44) Groups by Distractor Type for the Number Classification Task

	Distractor Type			
	Depression-related		Neutral	
Group	Mean	Standard Deviation	Mean	Standard Deviation
Depressed (Secs)	.5771	.1693	.5938	.2081
Nondepressed (Secs)	.4836	.1872	.5069	.2067
Depressed (Z Scores)	-.06262	.1217	-.02810	.1072
Nondepressed (Z Scores)	-.1003	.1201	.005970	.1161

Table 8

Response Time Means and Standard Deviations in Raw RTs and Z-Scores RTs for the Pooled Sample Depressed (n = 31) and Nondepressed (n = 44) Groups by Condition for the LDT

	Condition			
	D-D	N-D	D-N	N-N
Group	Mean (Standard Deviation)	Mean (Standard Deviation)	Mean (Standard Deviation)	Mean (Standard Deviation)
Depressed (Secs)	1.1403 (.3610)	1.1255 (.3550)	1.1539 (.3600)	1.1389 (.3824)
Nondepressed (Secs)	1.0610 (.3323)	1.0369 (.3280)	1.0546 (.3431)	1.0259 (.2979)
Depressed (Z Scores)	-.0331	-.0572	-.0350	-.0248
Nondepressed (Z Scores)	-.0476	-.0897	-.0595	-.1111

between the groups, between distractor types, or between groups for the distractor types. Therefore, the above reaction time results for the interference effects of the distractors are not accounted for by speed-accuracy trade-offs.

Correlations

It was originally planned to assess the relationship between ruminative response styles and mean response times for variables measured in the depression-related negative priming task. However, no significant effects were obtained in the previous analyses of negative priming, indicating that these indexes were not useful measures of selective attention. Instead, it was decided to use the distractor interference variables and the overall mean RTs and proportion accurate, as these variables provided significant effects for interference and group differences, respectively. Pearson product-moment correlation coefficients were calculated between the RRS and DRS and the variables of distractor interference (RTs and accuracy), mean RTs, and mean accuracy for the number classification and lexical decision tasks (see Table 9). The mean response times on the number classification task when the distractors were depression-related and neutral were significantly positively correlated with the RRS. Furthermore, the mean response times on the number classification task when the distractors were depression-related and neutral were significantly negatively correlated with the DRS. Similarly, the correlation between the overall mean response times to the number classification task was significantly positively correlated with the RRS and significantly negatively correlated with the DRS. The correlations between the mean response times on the LDT and the RRS and DRS were not significant. The correlations between the proportion of accurate trials and the RRS and DRS for distractor conditions and task type are presented in

Table 10. The only significant correlation was between neutral distractor types in the number classification task and RRS.

Discussion

The purpose of the present study was to investigate the defective inhibitory processing of depression-related information in both clinically depressed and nondepressed individuals. Based on the findings of previous research using negative priming tasks and depressed populations (Lemelin et al., 1996; Linville, 1994; MacQueen et al., 2000), it was hypothesized that the depressed group would show defective inhibitory processes compared to the nondepressed group. Based on findings with affective stimuli, this study further predicted that there would be inhibitory differences between the depressed and nondepressed groups for depression-related stimuli (Gotlib & Cane, 1987; Gotlib & McCann, 1984). Depression-related negative priming was examined by comparing response time differences between trials with depression-related prime and probe stimuli and the control trials. It was hypothesized that on this measure of depression-related negative priming, the depressed group would be faster (less negative priming) compared to the control trials and that the nondepressed group would not show such differences.

The findings of the present study, however, did not reveal differences in negative priming for depression-related stimuli between the groups. In the methodologically analogous design, Fox (1994a, Experiment 3) found significant differences in threat-related negative priming between her high anxious, low anxious, and repressor groups. Contrary to her predictions, however, she did not find that the high anxious group displayed less threat-relevant negative priming relative to the other groups. Instead, her findings indicated that high trait anxious participants were slower on the lexical decision task if they had just ignored a

Table 9

Correlations between RTs on the Information Processing Variables and the Measures of Ruminative and Distractive Responses

Variable	RRS	DRS
Distractor Condition		
Depressed	.33**	-.29*
Neutral	.30*	-.26*
Overall Response Times		
Number Classification Task	.335**	-.250*
Lexical Decision Task	.170	-.129

** = $p < .01$, *= $p < .05$

Table 10

Correlations between Accuracy on the Information Processing Variables and the Measures of Ruminative and Distractive Responses

Variable	RRS	DRS
Distractor Condition		
Depressed ($N = 75$)	-.062	.079
Neutral ($N = 75$)	-.261*	.045
Overall Response Times		
Number Classification Task ($N = 75$)	-.163	.024
Lexical Decision Task ($N = 29$)	-.091	.082

**= $p < .01$, * = $p < .05$

threat related distractor, regardless of what affective valence the probe had been (neutral or threat-related). It was concluded that for the high anxious individuals, the threat word in NCT seemed to have "captured attention". The inability to replicate these findings in the current study could be attributed to differences in the samples. Perhaps, unlike high or low anxious individuals, depressed and nondepressed individuals do not differ on depression-related negative priming.

Interestingly, there were also no significant negative priming effects for the sample overall. That is, there were no overall differences between the mean reaction times of the D-D, D-N, or N-D conditions. This finding conflicts again with Fox's methodologically analogous measure of threat-related negative priming. Fox (1994a, Experiment 3) had found significant differences for her conditions (as reported above) with respect to the group by condition differences. In light of the failure to replicate overall negative priming effects for the sample, methodological differences may provide further reasons for the lack of significant findings in the current study. The main methodological difference was the use of depression-related stimuli and not threat-related stimuli. The difference in stimuli may have limited the effects of the negative priming task for several reasons. It may be that negative priming effects are not observed with depression-related stimuli. Perhaps, the depression-related distractor-probe pairs do not form a coherent category compared to Fox's threat-related distractor-probes pairs. A coherent categorization between distractors and probes would be required for interference to occur from the distractor to the probe.

Analyses were also conducted on response times for the number classification task to test the interference effects of the distractor word types and the number types. It was found that participants were slower to classify the numbers when neutral stimuli were presented as

distractors, compared to depression-related distractors. A possible explanation for this finding is that neutral words captured more attention than did the depression-related words and caused interference on the number classification task. This interpretation may indicate that the neutral words were either more salient to the participants, or that it took participants longer to process these stimuli. An alternative explanation for the finding is that the depression-related words were inhibited more than the neutral words. This inhibition effect may have been due to the avoidance of depression-related words, or that these words were processed more readily. Unfortunately, it is difficult to disentangle whether attentional capture or inhibition were responsible for the interference caused by the neutral stimuli compared to the depression-related stimuli using the number classification task.

It should be noted that these interference findings are again inconsistent with Fox (1994a, Experiment 3). This author found the opposite effect, with response times to the number classification task being slower when distracting words were threat-related than when they were neutral. The inconsistency in findings may be due to the theoretical differences between threat-related and depression-related stimuli. Threat stimuli are associated with impeding danger and it would be adaptive for such stimuli to have greater salience than neutral stimuli. In contrast, depression-related information tends to be associated with longer-term problems and may increase negative affect when processed. Thus, in the current task it may actually be adaptive to inhibit depression-related stimuli compared to neutral stimuli, producing the opposite effect that Fox found with threat-related stimuli and neutral stimuli.

Overall differences in response times for the number classification task and the LDT were also investigated for group differences. Depressed participants were slower on the number classification task compared to the nondepressed group, with such differences not

observed on the lexical decision task. It was expected that depressed participants would be slower on both tasks, as previous research has found that depression contributes to an increase in perceptuomotor response times (Cooper, Sagar, Tidewell, & Jordan, 1994). The differences between the two tasks are the likely cause of these nonsignificant findings on the LDT. The two tasks differed with the classifying of a one digit odd/even number being simpler than classifying if a letter string makes up a word or not. This difference in difficulty is supported by the finding that the participants had faster response times and fewer errors on the number classification task compared to the LDT. However, the tasks also differed with the number classification task having distractor stimuli present. Perhaps the presence of distractor stimuli in the number classification task created group differences. Thus either the simplicity of the task or the presence of distractors, are compelling explanations for the increased response times for number classification in the depressed participants compared to nondepressed participants.

A final purpose of the current experiment was to assess the relationship between ruminative response styles and mean response times for the variables measured in the negative priming task. It was predicted that those who demonstrate lower levels of inhibition to neutral and negative stimuli (indicated by greater response times to the depressed-distractor, depressed-probe condition), would score higher on the RRS and lower on the DRS. As no significant effects were obtained for the depression-related negative priming conditions, the distractor type conditions were used as measure of cognitive interference. It was found that slower response times on the number classification task were correlated with a greater tendency to use ruminative response styles. Additionally, a significant correlation was obtained between faster response times on the number classification task and a greater

tendency to use distractive response styles. Since a significant relationship between mean response times and the ruminative and distractive response styles was not evident for the lexical decision task, it can be assumed that interference from the distractors (i.e., in the number classification task) was related to the ruminative response styles.

In interpreting these correlational results, several possible explanations exist. The RRS assesses the tendency to engage in ruminative thinking when feeling depressed. Example items are "Think about how alone you feel" and "Think about how sad you feel". It may be that individuals who engage in ruminative thoughts and are more prone to interference by the irrelevant distractor stimuli due to less control over attentional processes. The DRS on the other hand, assesses the tendency to distract or not think about depressive thoughts and feelings. Example items on this subscale include, "Think I'll concentrate on something other than how I feel" or "Concentrate on your work". Thus, those who tend to easily distract themselves or not think about their depressive thoughts or feelings may be less prone to interference by the irrelevant distractor stimuli. Indeed, this interpretation is in line with the relationship between inhibition and rumination proposed by Linville (1994). This author had suggested that ruminative thoughts are nonadaptive and persistent thoughts that should be inhibited from conscious thought for adaptive processing. The inability to inhibit such thoughts may reflect underlying defective inhibitory mechanisms in ruminative thoughts. An opposite interpretation is also possible, where the tendency to engage in ruminative thoughts leads to defective inhibitory mechanisms of distractor stimuli. Perhaps, engaging in ruminative thoughts eventually leads to a breakdown of selective attentional mechanisms. However, the current experiment did not attempt to establish a causal link between attentional

interference and rumination, and the hypothesized relationship between rumination and attentional processing was elucidated.

Summary, Limitations, and Considerations for Future Research

In summary, the findings of the present investigation suggest that clinically depressed students do not display defective inhibitory processes for depression-related distractor information using the current negative priming task. The lack of demonstrated defective inhibition in depressed individuals contradicts findings of previous research using negative priming tasks in depressed populations (Lemelin et al., 1996; Linville, 1994; MacQueen et al., 2000). Furthermore, the hypothesized depression-related negative priming effects were also not found. The current study was also unable to replicate the general finding of negative priming effects in the control (nondepressed) sample, which has been robustly shown in many studies using associated word stimuli (Fox, 1994a; Neumann & DeSchepper, 1992; Yee, 1991). The current study did, however, demonstrate that neutral stimuli interfered with the number classification task, compared to depression-related stimuli, and that the depressed group was slower on the number classification task, compared to the nondepressed group. Furthermore, a self-report measure of rumination was found to be positively correlated with cognitive interference, while a self-report measure of distraction was negatively correlated with cognitive interference.

Before attributing the lack of significant findings to a lack of selective attentional differences between depressed and nondepressed individuals, it is important to consider the methodological strengths and weaknesses of the current study. The current study had several methodological advantages over previous investigations of selective attentional biases in depression. Unlike previous investigations of selective attention biases in depression, (e.g.,

Emotional Stroop) the current study was one of the first of its kind to investigate defective inhibitory mechanisms for depression-related material that visually separated the to-be attended and to-be ignored stimuli. The use of such a negative priming task would allow distinctions to be made between the inhibitory effects of stimuli and the delayed processing effects of stimuli. Care was taken to select a task that would measure defective inhibition in depression to neutral stimuli and depressed stimuli. However, since the current study was unable to replicate general negative priming effects or find hypothesized depression-related negative priming effects, several components of the design may have been responsible for the lack of significant effects.

First, it seems likely with the current task that the distractors and probes were not coherently associated enough to produce negative priming effects. Perhaps the demands of the task were too high for participants causing distraction from the intended stimuli association. Participants were required to use the same computer keys to respond to the number classification task and the LDT, and thus needed to recall and distinguish which computer keys to use for each task. Additionally, the delay between the response on number classification task to LDT presentation (response-to-stimulus interval; RSI) was perhaps too quick at 300 ms. Thus, participants may have been cognitively loaded with having the two tasks so close together. Future investigators may wish to be cautious of the demands of both the task and the response method.

Secondly, the current methodology may have been compromised by the fact that the participants were aware of the distractor stimuli. Although when probed the participants did not recall distractors, the majority were aware that the distractor words were present. In Fox (1994, Experiment 3), no subjects were aware that letters (distractors) constituted words.

Supraliminal presentation of words in a number classification task may not produce effects on the subsequent probe stimuli because individuals may be able to ignore stimuli presented inside the threshold of awareness. Examining the effects of distractor awareness may provide a more decisive test of defective inhibition in depressed individuals.

Another possible methodological constraint was the use of affective word stimuli to measure negative priming. Previous investigations using negative priming to investigate defective inhibition in depression used colour and location manipulations between distractor and probe stimuli. For instance, MacQueen et al. (2000) manipulated colour, identification, and location features of a distractor and probe stimuli. These authors found reduced distractor inhibition in depressed subjects when colour was the repeated feature but not when the identity or location was the repeated feature. They interpreted these results as a greater general deficit in the inhibition of the colour feature of a stimulus. Similarly, Linville (1996) used colour as the repeated feature between distractors and probes, and found depressed participants had reduced inhibition of these stimuli, compared to controls. Thus, the use of word stimuli in the current negative priming task may not produce negative priming effects in depressed individuals. Future research should attempt to integrate colour features and affective features in a negative priming task to test the effect of depression-related stimuli on defective inhibition.

Another limitation of the current design was the failure to include a measure of general negative priming (e.g., to neutral stimuli). In Fox (1994, Experiment 3), semantically associated and nonassociated stimuli were used as an index of general negative priming. In the current design, general negative priming could have been measured by comparing affectively-associated (N-N, D-D) and nonaffectively associated (D-N, N-D) distractor-probe

pairs. The decision to use affectively-related stimuli for the general negative priming condition would have been based Fox's (1994a, Experiment 3) variation of the affective relation to measure threat-related stimuli (threat-related prime and probe, compared to neutral prime-threat probe, and threat prime-neutral probe) to measure threat-related negative priming. However, it was decided that the use of affectively-related primes and probes (depression-related and neutral related) would not provide a measure of negative priming. The main concern with this affective categorization was that neutral stimuli could not be considered affectively related. Thus, the affectively-related prime and probe conditions would not provide a coherent relation between the stimuli and in order to measure of negative priming. Future research should compare differences in general negative priming between depressed and nondepressed participants using semantically associated stimuli. In addition to Fox (1994b, Experiment 3), other studies have demonstrated negative priming effects with word stimuli using semantic relation (Fox, 1994a; Neumann & DeSchepper, 1992; Yee, 1991).

A further limitation is inherent in the loss of accuracy data for the first sample, requiring speed-accuracy trade-off analyses to be conducted on a smaller sample of participants. The use of nine depressed participants and 20 depressed participants may have lowered the power of the speed-accuracy trade-off analyses. However, in examining the means, there does not appear to be sufficient differences that greater statistical power would have detected.

Finally, a potential reason for the absence of differences between the depressed and nondepressed populations lies in the current sampling of the depressed group. The participants in this study were not obtained from a clinical population. Instead, the clinically depressed

participants were selected mainly from a population of university students (only two participants were not university students). Thus, the current sample may not be representative of the actual population of depressed individuals. Previous research has questioned the use of university students as representatives of a population suffering from psychopathology (Coyne, 1994; Henggeler & Randall, 2000). Indeed, it is probable that while having the required characteristics for minor depression, the university students used in this study systematically experience other factors that alter the characteristics of the disorder not experienced by the entire population. Examples of unique and systematic factors affecting first year university students are the relocation to a new environment that occurs in the first year and the frequent evaluation by means of tests and papers. Thus, these factors may indicate that the depression experienced is transient and that the university student participants (Coyne, 1994) experience a higher level of anxiety. However, the diagnostic interview is generally accepted the "gold standard" for overcoming the issues surrounding the use of university students for the study of depression (Coyne, 1994). Thus, in requiring that the depressed participant receive a diagnosis of depression in addition to scoring high on a self-report measure of depression, this study is presumably generalisable to the population of clinically depressed individuals.

References

Abramson, L.Y., Metalsky, G.I., & Alloy, L.B. (1989). Hopelessness depression: A theory-based subtype of depression. *Psychological Review, 96,* 358-372.

Allport, A. (1989). Visual attention. In M.I. Posner 9Ed.), *Foundations of cognitive science* (pp. 631-682). London: Massachusetts Institute of Technology.

Allport, A., Tipper, S.P., & Chimiel, N. (1985). Perceptual integration and post-categorical filtering. In M.I. Posner, & O.S.M. Martin (Eds.). *Attention and performance XI.* Hillsdale, NJ: Erlbaum.

Bargh, J.A. (1982). Attention and automaticity in the processing of self-relevant information. *Journal of Personality and Social Psychology, 43,* 425-436.

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

Beck, A.T., Brown, G., Steer, R.A., Eidelson, J.I., & Riskind, J.H., (1987). Differentiating anxiety and depression: A test of the cognitive content-specificity hypothesis. *Journal of Abnormal Psychology, 96,* 179-183.

Beck, A. T., & Emery, G. (1985). *Anxiety disorders and phobias: A cognitive perspective.* New York: Basic Books.

Beck, A. T., Rush, A. J., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy of depression.* New York: Guilford.

Beck, A.T., Steer, R.A., & Brown, G.K. (1996). *Beck Depression Inventory-Second Edition.* San Antonio: The Psychological Corporation.

Benoit, G. Fortin, L., Lemelin, S., LaPlante, L., Thomas, J., & Everett, J. (1992). L'attention selective dans la depression majuere: Ralentissement clinique et inhibition cognitive. *Canadian Journal of Psychology, 46,* 41-52.

Blaney, P.H. (1986). Affect and memory: A review. *Psychlogical Bulletin, 99,* 229-246.

Blier, P., & Bergeron, R. (1997). Early onset of therapeutic action in depression and greater efficacy of antidepressant treatments: Are they related? *International Clinical Psychopharmacology, 12,* S21-S28.

Bower, G.H. (1981). Mood and memory. *American Psychologist, 36,* 129-148.

Broadbent, D.E. (1958). *Perception and communication.* London: Pergamon.

Brown, G.W., & Harris, T. (1978). *Social origins of depression: A study of psychiatric disorder in women.* New York: Free Press.

Burgess, I.S., Jones, L.N., Robertson, S.A., Radcliffe, W.N., Emerson, E., Lawler, P., & Crow, T.J. (1981). The degree of control exerted by phobic and non-phobic verbal stimuli over the recognition behaviour of phobic and non-phobic verbal subjects. *Behaviour Research and Therapy, 19,* 223-234.

Cooper, J.A., Sagar, H.J., Tidewell, P. & Jordan, N. (1994). Slowed central processing in simple and go/no go reaction time tasks in Parkinson's disease. *Brain, 117,* 517-527.

Coyne, J.C. (1994). Self-reported distress: Analog or ersatz depression? *Psychological Bulletin,* 116, 29-45

Craighead, W.E., Hickey, K.S., & DeMonbreun, B.G. (1979). Distortion of perception and recall of neutral feedback in depression. *Cognitive Therapy & Research, 3,* 291-298.

Enright, S.J., & Beech, A.R. (1993). Reduced cognitive inhibition in obsessive-compulsive disorder. *British Journal of Clinical Psychology, 32,* 67-74.

First, M.B., Spitzer, R.L., Gibbon, M., & Williams, J.B. (1998). Structured Clinical Interview for DSM-IV Axis I Disorders-Patient Edition [SCID-I/P, Version 2.0 (1998 revision)], New York State Psychiatric Institute, New York: NY.

Foa, E.B., & McNally, R.J. (1986). Sensitivity to feared stimuli in obsessive compulsives: A dichotic-listening analysis. *Cognitive Therapy and Research, 10,* 447-485.

Fox, E. (1994a). Attentional bias in anxiety: A defective inhibition hypothesis. *Cognition and Emotion, 8,* 165-195.

Fox, E. (1994b). Interference and negative priming from ignored distractors: The role of selection difficulty. *Perception and Psychophysics, 56,* 565-574.

Gotlib, I.H. (1981). Self-reinforcement and recall: Differential deficits in depressed and nondepressed psychiatric inpatients. *Journal of Abnormal Psychology, 90,* 521-530.

Gotlib, I.H., & Cane, D.B. (1987). Construct accessibility and clinical depression: A longitudinal investigation. *Journal of Abnormal Psychology, 96,* 199-204.

Gotlib, I.H., & Hammen, C.L. (1992). *Cognitive aspects of depression: Toward a cognitive-interpersonal integration.* New York: John Wiley.

Gotlib, I.H., & MacLeod, C., (1997). Information processing in anxiety and depression: a cognitive-developmental perspective. In Burack, J.A., & Enns, J.T. (Eds.), *Attention, development and psychopathology.* Guilford Press: NY, pp.350-378.

Gotlib, I.H., & McCabe, S. B. (1992). An information-processing approach to the study of cognitive functioning in depression. In E. Walker, B. Cornblatt., & R. Dworkin (Eds.). *Progress on experimental personality and psychopathology research, 15,* 131-161, New York: Springer.

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

Gotlib, I.H., McLaughlan, A.L., & Katz, A.N. (1988). Biases in visual attention in depressed and nondepressed individuals. *Cognition and Emotion, 2,* 185-200.

Gotlib, I.H., Roberts, J.E., & Gilboa, E. (1996). Cognitive interference in depression. In I. G. Sarason, G. R. Pierce, & B. R. Sarason (Eds.), *Cognitive interference: Theories, methods, and findings* (pp. 325-344). Mahwah, NJ: Lawrence Erlbaum Associates.

Haaga, D.A., Dyck, M.J., & Ernst, D. (1991). Empirical status of cognitive theory of depression. *Psychological Bulletin, 110,* 215-236.

Henggeler, S.W, Randall, J. (2000). Conducting randomized treatment studies in real-world settings. In D. Dennis (Ed.). *Handbook of research in pediatric and clinical child psychology: Practical strategies and methods. Issues in clinical child psychology* (pp. 447-461). Dordrecht, Netherlands: Kluwer Academic Publishers.

Ingram, R.E., & Reed, M.R. (1986). Information encoding and retrieval processes in depression. Findings, issues, and future directions. In Ingram, R.E. (Ed). *Information processing approaches to clinical psychology. Personality, psychopathology, and psychotherapy series* (pp. 131-150). San Diego, CA, US: Academic Press.

Kanfer, R., & Ackerman, P.L. (1996). A self-regulatory skills perspective to reducing cognitive interference. In I. G. Sarason, G. R. Pierce, & B. R. Sarason (Eds.), *Cognitive interference: Theories, methods, and findings* (pp. 77-97). Mahwah, NJ: Lawrence Erlbaum Associates.

Lemelin, S., Baruch, P., Vincent, A., LaPlante, L., Everett, J., & Vincent, P. (1996). Attention disturbance in clinical depression: Deficient distractor inhibition or processing resource deficit? *Journal of Nervous Mental Disease, 184,* 114-121.

Linville, P. (1996). Attentional inhibition: Does it underlie ruminative thought? In R.S. Wyer Jr. (Ed.). *Ruminative thoughts: Advances in social psychology, Volume IX* (pp.121-133). Mahwah, NJ: Lawrence Erlbaum Associates.

Linville, P.W. (1994). *Inhibition gone awry: Negative priming effects with stress and depression.* Paper presented at the Society of Experimental Social Psychology, Reno, NV.

Linville, P.W., Connelly, L., & Hasher, L. (1994). *Inhibitory processes in stress and depression.* Unpublished paper, Duke University.

Loftus, E.F., & Hoffman, H.G. (1989). Misinformation and memory: The creation of new memories. *Journal of Experimental Psychology: General, 118,* 100-104.

Loftus, E.F., Miller, D.G., & Burns, H.J. (1978). Semantic integration of verbal information into visual memory. *Journal of Experimental Psychology: Human Learning and Memory, 4,* 19-31.

Lyubomirsky, S., & Nolen-Hoeksema, S. (1993). Effects of self-focused rumination on negative thinking and interpersonal problem-solving. *Journal of Personality and Social Psychology, 69,* 176-190.

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

MacLeod, C., & Mathews, A. (1988). Anxiety and the allocation of attention to threat. *The Quarterly Journal of Experimental Psychology, 40a,* 653-670.

MacQueen, G.M., Tipper, S.P., Young, L.T., Joffe, R.T., & Levitt, A.J. (2000). Impaired distractor inhibition in unmedicated, depressed subjects. *Psychological Medicine, 30,* 557-564.

Mann, J.J, & Kapur, S. A. (1995). Dopaminergic hypothesis of major depression. *Clinical Neuropharmacology, 18,* 57-65.

Matthews, A., & MacLeod, C. (1985). Selective processing of threat cues in anxiety states. *Behaviour Research and Therapy, 23,* 563-569.

Matthews, A., & MacLeod, C. (1986). Discrimination of threat cues without awareness in anxiety states. *Journal of Abnormal Psychology, 95,* 131-138.

McCabe, S.M., & Gotlib, I.H, (1993). Attentional processing in clinically depressed subjects: A longitudinal investigation. *Cognitive Therapy and Research, 17,* 359-377.

McCabe, S.M., & Gotlib, I.H, (1995). Selective attention and clinical depression: Performance on a deployment-of-attention task. *Journal of Abnormal Psychology, 104,* 241-245.

McCrae, R.P., & Costa, P.T. (1983). Social desirability scales: More substance than style. *Journal of Consulting and Clinical Psychology, 51,* 882-888.

Mogg, K., Bradley B. P., Williams, R., & Matthews, A.M. (1993). Subliminal processing of emotional information in anxiety and depression. *Journal Abnormal Psychology, 102,* 301-311.

Mogg, K., Mathews, A., May, J., Grove, M., Eynsenck, M., & Weinman, J. (1991). Assessment of cognitive bias in anxiety and depression using a color-perception task. *Cognition and Emotion, 5,* 221-238.

Morrow, J. (1990). *The effects of rumination, distraction, and negative mood on memories, evaluations, and problem solving*. Unpublished manuscript, Stanford University, Stanford, CA.

Morrow, J., & Nolen-Hoeksema, S. (1990). Effects of responses to depression on the remediation of depressive affect. *Journal of Personality and Social Psychology, 55,* 519-527.

Myers, J. (1980). *Self-reference and the encoding of personal information during affective episodes and remission.* Doctoral dissertation proposal, University of Calgary, Calgary, Alberta, Canada.

Needles, D.J., & Abramson, L.Y. (1990). *Response to depressed mood: Cognitive and affective effects of rumination and distraction.* Manual submitted for publication.

Neill, W.T. (1989). Lexical ambiguity and context: An activation suppression model. In D.S. Gorfein (Ed.), *Resolving semantic ambiguity (pp.63-83).* New York: Springer-Verlag.

Neumann, E., & DeSchepper, B.G. (1992). An inhibition based fan effect: Evidence for an active suppression mechanism in selective attention. *Canadian Journal of Psychology, 46,* 11-50.

Nisbett, R.E., & Wilson, T.D. (1977). Telling more than we can know. Verbal reports on mental processes. *Psychological Review, 84,* 231-259.

Nielson, S.L., & Saranson, I.G. (1981). Emotion, personality, and selective attention. *Journal of Personality and Social Psychology, 41,* 945-960.

Nolen-Hoeksema, S. (1987). Sex differences in unipolar depression: Evidence and theory. *Psychological Bulletin, 101,* 259-282.

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology,* 100, 569-582.

Nolen-Hoeksema, S., & Lyubomirsky, S. (1992). *Effects of ruminative and distracting responses on problem-solving and attiributions.* Manual submitted for publication.

Nolen-Hoeksema, S. & Morrow, J. (1993). Effects of rumination and distraction on naturally occurring depressed mood. *Cognition and Emotion, 7,* 561-570.

Nolen-Hoeksema, S. & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta earthquake. *Journal of Personality & Social Psychology, 61,* 115-121.

Nolen-Hoeksema, S., Morrow, J., & Fredrickson, B.L. (1993). Response styles and the duration of episodes of depressed mood. *Journal of Abnormal Psychology, 102,* 20-28.

Othmer, E., & Othmer, S.C. (1989). *The clinical interview using DSM-IV, Vol. 1: Fundamentals.* Washington, DC: American Psychiatric Press, Inc.

Paulhus, D.L. (1991). Measurement and control of response bias. In Robinson, J.P., & Shaver, P.R. (Eds.). *Measures of social psychological attitudes, 1,* (pp. 17-59). San Diego, CA, US: Academic Press, Inc.

Ray, C. (1979). Examination stress and performance on a colour word interference test. *Perceptual Motor Skills, 49,* 400-402.

Rokke, P.D., Arnell, K.M., Koch, M.D., & Andrews, J.T. (2002). Dual-task attention deficits in dysphoric mood. *Journal of Abnormal Psychology, 111,* 370-379.

Stroop, J.R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18,* 643-662.

Schotte, D.E., McNally, R.J., & Turner, M.L. (1990). A dichotic-listening analysis of body weight concern in bulimia nervosa. *International Journal of Eating Disorders, 9,* 109-113.

Tabachnick, B.G. & Fidell, L.S. (1996). *Using multivariate statistics-3rd ed.* New York, NY: HarperCollins College Publishers.

Teasdale, J.D. (1985). Psychological treatments for depression: How do they work? *Behavior Research and Therapy, 23,* 157-165.

Thorndike, E.L., & Lorge, I. (1944). *The teacher's word book of 30,000 words.* New York, NY: Teachers College, Columbia University.

Tipper, S.P. (1985). The negative priming effect: Inhibitory effects of ignored primes. *Quarterly Journal of Experimental Psychology, 37A,* 571-590.

Tipper, S.P. (1991). Less attentional selectivity as a result of declining inhibition in older adults. *Bulletin of the Psychonomic Society, 29,* 45-47. *Quarterly Journal of Experimental Psychology, 37A,* 571-590.

Tipper, S.P., & Cranston, M. (1985). Selective attention and priming: inhibitory and facilitory effects of ignored primes. *Quarterly Journal of Experimental Psychology, 37A,* 591-611.

Treisman, A.M. (1969). Strategies and models of selective attention. *Psychological Review, 76,* 22-299.

Watts, F.N., McKenna, F.P., Sharrock, R., Trezise, L. (1986). Colour naming of phobia related words. *British Journal of Psychology, 77,* 97-108.

Wechler, D. (1981). *Manual for the Wechsler Adult Intelligence Scale-Revised.* San Antonio: The Psychological Corporation.

Williams, J.M.G., & Broadbent, K. (1988). Distraction by emotional stimuli: Use of a Stroop task with suicide attempters. *British Journal of Clinical Psychology, 25,* 101-110.

Williams, J. M.G., Watts, F.N., MacLeod, C., Matthews, A. (1997). *Cognitive psychology of emotional disorders (2nd ed.).* New York: John Wiley & Sons.

Wong, J. (1993). Comparison of the Shipley versus WAIS-R subtests and summary scores in predicting college gradepoint average. *Perceptual and Motor Skills, 76,* 1075-1078.

Wood, J.V., Salzberg, J.A., Neale, J.M. Stone, A.A., & Rachmiel, T.B. (1990). Self-focused attention, coping responses, and distressed mood in everyday life. *Journal of Personality and Social Psychology, 58,* 1027-1036.

Yee, P.L. (1991). Semantic inhibition of ignored words during a figure classification task. *Quarterly Journal of Experimental Psychology, 43A,* 127-153.

Zachary, R.A. (1986). *Revised manual for the Shipley Institute of Living Scale.* Los Angeles, CA: Western Psychological Services.

Appendix A: Beck Depression Inventory-Second Edition

Instructions: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today.** Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including item 16 (Changes in Sleeping Pattern) or item 18 (Changes in Appetite).

1. Sadness

0 I do not feel sad.
1 I feel sad much of the time.
2 I am sad all the time.
3 I am so sad or unhappy that I can't stand it.

2. Pessimism

0 I am not discouraged about my future.
1 I feel more discouraged about my future than I used to be.
2 I do not expect things to work out for me.
3 I feel my future is hopeless and will only get worse.

3. Past Failure

0 I do not feel like a failure.
1 I have failed more than I should have.
2 As I look back, I see a lot of failures.
3 I feel I am a total failure as a person.

4. Loss of Pleasure

0 I get as much pleasure as I ever did from the things I enjoy.
1 I don't enjoy things as much as I used to.
2 I get very little pleasure from the things I used to enjoy.
3 I can't get any pleasure from the things I used to enjoy.

5. Guilty Feelings

0 I don't feel particularly guilty.
1 I feel guilty over many things I have done or should have done.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.

6. Punishment feelings

0 I don't feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

7. Self-Dislike

0 I feel the same about myself as ever.
1 I have lost confidence in myself.
2 I am disappointed in myself.
3 I dislike myself.

8. Self-Criticalness

0 I don't criticize or blame myself more than usual.
1 I am more critical of myself than I used to be.
2 I criticize myself for all of my faults.
3 I blame myself for everything bad that happens.

9. Suicidal Thoughts or Wishes

0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10. Crying

0 I don't cry anymore than I used to.
1 I cry more than I used to.
2 I cry over every little thing.
3 I feel like crying, but I can't.

11. Agitation

0 I am no more restless or wound up than usual.
1 I feel more restless or wound up than usual.
2 I am so restless or agitated that it's hard to stay still.
3 I am so restless or agitated that I have to keep moving or doing something.

12. Loss of Interest

0 I have not lost interest in other people or activities.

1 I am less interested in other people or things than before.
2 I have lost most of my interest in other people or things.
3 It's hard to get interested in anything.

13. Indecisiveness
0 I make decisions about as well as ever.
1 I find it more difficult to make decisions than usual.
2 I have much greater difficulty in making decisions than I used to.
3 I have trouble making any decisions.

14. Worthlessness
0 I do not feel I am worthless.
1 I don't consider myself as worthwhile and useful as I used to.
2 I feel more worthless as compared to other people.
3 I feel utterly worthless.

15. Loss of Energy
0 I have as much energy as ever.
1 I have less energy than I used to have.
2 I don't have enough energy to do very much.
3 I don't have enough energy to do anything.

16. Changes in Sleeping Pattern
0 I have not experienced any change in my sleeping pattern.
1a I sleep somewhat more than usual.
1b I sleep somewhat less than usual.
2a I sleep a lot more than usual.
2b I sleep a lot less than usual.
3a I sleep most of the day.
3b I wake up 1-2 hours early and can't get back to sleep.

17. Irritability
0 I am no more irritable than usual.
1 I am more irritable than usual.
2 I am much more irritable than usual.
3 I am irritable all the time.

18. Changes in Appetite
0 I have not experienced any change in my appetite.
1a My appetite is somewhat less than usual.
1b My appetite is somewhat greater than usual.
2a My appetite is much less than before.
2b My appetite is much greater than usual.
3a I have no appetite at all.
3b I crave food all the time.

19. Concentration Difficulty
0 I can concentrate as well as ever.
1 I can't concentrate as well as usual.
2 It's hard to keep my mind on anything for very long.
3 I find I can't concentrate on anything.

20. Tiredness or Fatigue
0 I am no more tired or fatigued than usual.
1 I get more tired or fatigued more easily than usual.
2 I am too tired or fatigued to do a lot of things I used to do.
3 I am too tired or fatiguedto do most of the things I used to do.

21. Loss of Interest in Sex
0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I am much less interested in sex now.
3 I have lost interest in sex completely.

Appendix B: Shipley Institute of Living Scale – Vocabulary Scale

Instructions: In the test below, the first word in each line is printed in capital letters. Opposite it are four other words. Circle the *one word* which means the *same thing*, or most nearly the same thing, as the first word. If you don't know, guess. Be sure to circle the *one word* in each line that means the same thing as the first word.

EXAMPLE:

LARGE	red	big	silent	wet
(1) TALK	draw	eat	speak	sleep
(2) PERMIT	allow	sew	cut	drive
(3) PARDON	forgive	pound	divide	tell
(4) COUCH	pin	eraser	sofa	glass
(5) REMEMBER	swim	recall	number	defy
(6) TUMBLE	drink	dress	fall	think
(7) HIDEOUS	silvery	tilted	young	dreadful
(8) CORDIAL	swift	muddy	leafy	hearty
(9) EVIDENT	green	obvious	sceptical	afraid
(10) IMPOSTOR	conductor	officer	book	pretender
(11) MERIT	deserve	distrust	fight	separate
(12) FASCINATE	welcome	fix	stir	enchant
(13) INDICATE	defy	excite	signify	bicker
(14) IGNORANT	red	sharp	uninformed	precise
(15) FORTIFY	submerge	strengthen	vent	deaden
(16) RENOWN	length	head	fame	loyalty
(17) NARRATE	yield	buy	associate	tell
(18) MASSIVE	bright	large	speedy	low
(19) HILARITY	laughter	speed	grace	malice
(20) SMIRCHED	stolen	pointed	remade	soiled
(21) SQUANDER	tease	belittle	cut	waste
(22) CAPTION	drum	ballast	heading	ape
(23) FACILITATE	help	turn	strip	bewilder
(24) JOCOSE	humorous	paltry	fervid	plain
(25) APPRISE	reduce	strew	inform	delight
(26) RUE	eat	lament	dominate	cure
(27) DENIZEN	senator	inhabitant	fish	atom
(28) DIVEST	dispossess	intrude	rally	pledge
(29) AMULET	charm	orphan	dingo	pond
(30) INEXORABLE	untidy	involatile	rigid	sparse
(31) SERRATED	dried	notched	armed	blunt
(32) LISSOM	mouldy	loose	supple	convex
(33) MOLLIFY	mitigate	direct	pertain	abuse
(34) PLAGIARIZE	appropriate	intend	revoke	maintain
(35) ORIFICE	brush	hole	building	lute
(36) QUERULOUS	maniacal	curious	devout	complaining
(37) PARIAH	outcast	priest	lentil	locker
(38) ABET	waken	ensue	incite	placate
(39) TEMERITY	rashness	timidity	desire	kindness
(40) PRISTINE	vain	sound	first	level

Appendix C: RSQ

People think and do many different things when they feel sad, blue, or depressed. Please read each of the items below and indicate whether you never, sometimes, often, or always think or do each one when you feel sad, down, or depressed. Please indicate what you generally do, not what you think you should do.

1	2	3	4
Never	Sometimes	Often	Always

1. Ask someone to help you overcome a problem. _____
2. Think about how alone you feel. _____
3. Think "I won't be able to do my job/work because I feel so badly". _____
4. Think about your feelings of fatigue and achiness. _____
5. Think about how hard it is to concentrate. _____
6. Try to find something positive in the situation or something you learned. _____

7. Take recreational drugs of drink alcohol. _____
8. Think "I'm going to do something to make myself feel better". _____
9. Help someone else with something in order to distract yourself. _____
10. Think about how passive and motivated you feel. _____
11. Remind yourself that these feelings won't last. _____
12. Analyze recent events to try to understand why you feel sad. _____

13. Think about how you don't seem to feel anything anymore. _____
14. Think "Why can't I get going?" _____
15. Think " Why do I always react this way?" _____
16. Got to a favorite place to get your mind off your feelings. _____
17. Go away by yourself and think about why you feel this way. _____
18. Talk it out with someone whose opinions you respect (i.e. friend/family/clergy). _____

19. Think "I'll concentrate on something other than how I feel". _____
20. Write down what you are thinking about and analyze it. _____
21. Do something that has made you feel better in the past. _____
22. Think about a recent situation, wishing it had gone better. _____
23. Think "I'm going to go out and have some fun". _____
24. Make a plan to overcome a problem. _____

25. Stay around people. _____
26. Concentrate on your work. _____
27. Think "Why do I have problems other people don't have?" _____
28. Do something reckless or dangerous. _____
29. Think about how sad you feel. _____
30. Think about all your shortcomings, failings, faults, mistakes. _____

31. Do something you enjoy. _____
32. Think about how you don't feel up to doing anything. _____
33. Do something fun with a friend. _____
34. Analyze your personality to try to understand why you are so depressed. _____
35. Take your feelings out on someone else. _____
36. Go someplace alone to think about your feelings. _____

37. Deliberately do something to make yourself feel worse. _____
38. Think about how angry you are with yourself. _____
39. Listen to sad music. _____
40. Isolate yourself and think about the reasons why you feel sad. _____
41. Try to understand yourself by focusing on your depressed feelings. _____

Appendix D: Stimulus Words

N-N	D-N	N-D	D-D
CORNER-UNDERSTAND	QUARRELS-BUILDING	HORSE-BLUE	DEFEAT-RUINED
FLOOR-FOLLOWS	TERRIBLE-PALE	FURTHER-DEFEATED	ALONE-GLUM
CHAIR-DOGS	DESTROYED-CLOTHES	JOB-WEAK	SAD-DISCONTENTED
EXCHANGE-MATERIAL	LOW-SOMETHING	MAID-AWFUL	EMPTY-ASHAMED
EDITORIALLY-CARPENTER	FORLORN-AROUND	DRAWER-GRIEVE	HURT-FOOLISH
PROFESSION-THRESHOLD	DEPRIVED-FURNISHED	GEOMETRY-DOWNHEARTED	SUFFERING-DISAPPOINTED
OPERATIC-MINERALS	GRIM-EMBLEM	HYDRAULIC-DREADFUL	TORTURED-SORROWFUL
PREDOMINANT-CARPET	BARREN-FRINGE	BATH-UNFORTUNATE	UPSET-LOST
GAMBLE-MISSOURI	LAZY-BOOKCASE	FOUNTAIN-USELESS	CARELESS-LONELY
INCOME-MARBLE	HOPELESS-MOMENTARILY	BRAMBLE-GUILTY	DOOMED-DISCOURAGED
RESIDENT-PRELIMINARY	HORRIBLE-SIMULTANEOUS	BOLT-DESPAIR	MISERY-DESERTED
INSTRUMENTAL-CRYSTALS	UNHAPPY-CARDBOARD	HARMLESS-DREARY	REJECTED-FAILURE
WARDROBE-INTERMITTENT	TORMENTED-ENSEMBLES	DIVES-HUMILIATED	DESOLATE-SOLITARY
GENTLY-CRAWL	BROODING-CRUISE	ASSOCIATE-WILTED	INFLEXIBLE-WORTHLESS
BOWL-RECTANGULAR	OBNOXIOUS-ALPHABET	HISTORIC-DEVASTATED	DISMAL-DEATH
PARALLEL-WET	LIFELESS-CORD	MAGNETIC-REPULSIVE	INADEQUATE-CHILDISH
PEAR-INVENTOR	DEGRADED-TYPEWRITER	DISGUISE-ISOLATED	DEPRESSED-MELANCHOLIC
CLIMATE-MOMENTUM	GLOOMY-EMERGE	EXPENSIVE-MEDIOCRE	DEJECTED-OPPRESSION
ACTOR-CHERRY	INSIGNIFICANT-CONTEMPORARY	MONASTERY-BLEAK	INCOMPETENT-MISERABLE
DOMESTIC-ABORIGINAL	DULL-HORIZONTAL	FEATHER-UNSUCCESSFUL	DEFEAT-RUINED
CORNER-UNDERSTAND	QUARRELS-BUILDING	HORSE-BLUE	CONFORMING-CONDEMNED

Appendix E: Information/Consent Form

Principal Investigators:

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The current study is an investigation of how people's ability to pay close attention over a period of time and classify numbers and letter strings (lexical decision task) is related to how they are feeling. This study will be completed in two sessions. In the first session you will be asked to fill out a brief questionnaire about mood and some experiences you may have had and leave your name and phone number. This questionnaire will be picked up in the next class or you can leave it in a drop box, you may then be called to participate in a second session. In the second session you will be asked to complete a computer task where you indicate whether a number is odd or even and then decide if a letter string is a word or non-word. In order to learn about your mood and some experiences that you've had, we will have some questionnaires for you to fill out after the computer task. Also, we will ask that you complete a brief structured interview about moods or other experiences you may have had. You will receive half an experimental credit for your participation in the first session and a full credit for participating in the second session of this study. You will also be placed in a draw for $100.

Participation in each session is completely voluntary. The first session will take 10 minutes, while the second session will take no more than 60 minutes. You may withdraw from the study at any time without explanation or loss of experimental credit by simply verbally informing the investigator. There are no known physical or psychological risks associated with the procedures to be used. The direct benefits of participating in this study are receiving experimental credits and learning about psychological research. The indirect benefits are being a part of research that could advance knowledge about important psychological issues. All information you provide will be considered confidential and would be available only to the investigators. Your name will not be associated with any information collected and will be replaced by a number to ensure your anonymity. The data will be kept in this form in a locked research area for seven years, after which any paper copies will be shredded, and electronic destroyed.

This project has been reviewed and given ethics clearance through the Research Ethics Board at Lakehead University. If you have any questions or concerns resulting from your participation in this study, or would like more information please contact the investigators.

I agree to participate in the attention and personality study being conducted by Professor D. Mazmanian and Rosleen Mansour of the Department of Psychology. I have made this decision based on the information I have read above and have had the opportunity to receive any additional details I wanted about the study.

Participant's name (print): _____

Participant's signature: _____

Date: _____

Appendix F: Debriefing Form

Project Title: Defective Cognitive Inhibition in Depression

Principal Investigators:
Rosleen Mansour, Graduate Student, Department of Psychology, 343-8476
Dr. D. Mazmanian, Assistant Professor, Department of Psychology, 343-8257

We are interested in how mood affects the type of information that a person attends to. Based on your score on the questionnaire you completed in the first session of this study, you were assigned to one of two groups, depending on your mood. The questionnaire and the computer task you completed will help us determine whether defective inhibition plays a role in sadness.

Previous research has shown that people who are not sad tend to not pay attention to distracting stimuli. People who are experiencing sad moods seem to lose the ability to inhibit irrelevant information, and thus pay attention to distracting stimuli. Thus, sad persons may have defective inhibitory mechanisms.

In this study we are interested in looking at differences in inhibitory mechanisms in those experiencing sad moods and those who are not. On each trial when you saw an odd or even number, there were also distractor words above and below the numbers. These distractor words were either negative or positive and were sometimes affectively related to the words in the next task. This next task was a lexical decision task, which had you decide if a letter string was a word or nonword. The purpose of the lexical decision task was to test if your responses would be faster if the lexical task words were affectively matched to the distractor words. That is, on some trials a negative distractor word was followed by negative lexical task-word and on some other trials a neutral distractor word sometimes being followed by a neutral lexical task-word. If a person responds more quickly to these trials, it means they did not inhibit the distractor word and were able to process the word. We were especially interested in testing if this facilitation was more the case with sad participants, and if the facilitation effect was greater for sad participants when the words were negative. We believe that this finding would indicate that individuals experiencing a sad mood might feel the way they do because they are unable to inhibit negative thoughts.

We want to thank you for your participation in this study. You have provided us with much valuable information. We hope that with your participation we will gain a deeper understanding into how people process information in different affective states. If you have any further questions or require information about this study you can contact either Rosleen Mansour (343-8476) or Dr. D. Mazmanian (343-8257).

There are three final points we would like to mention. First, your responses will remain absolutely confidential. When we begin to analyze the data, your names will be converted into code numbers so that no one will be able to connect your name to your responses. Second, we ask that you not tell others about the details of this study. The reason for this is that if potential participants knew what this study is about, this information may influence their responses, and we would obtain misleading information from them. Therefore, it is important that you do not talk about this study to your friends or to other people who may be in the experiment in the future, or have contact with potential participants. And lastly, if participating in this study or completing the questionnaires distressed you or has raised some personal issues that you would like to discuss, or if you just need someone to talk to, the following organizations are available: LU Health and Counselling Centre (343-8361), Peer Support Line (343-8255), Chaplain (343-8018), and the Career Counselling Services (343-8018). Thank you very much.