# ATTENTION IN DEPRESSION: THE EFFECT OF DISTRACTOR TYPE ON SIGNAL DETECTION PERFORMANCE


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## PREFACE

The current study is an attempt to provide empirical support for the common observation that there is an attentional dysfunction in depression. One of the most frequent complaints made by depressed patients is that they have difficulty concentrating. Some theories of depression also propose that one reason that people have difficulty overcoming their depression is that they construe the world and negativistic terms. The main hypothesis in this study is that during depression patients may selectively attend to negative aspects of the environment which may preclude their obtaining a more balanced picture of the world.

Mild to moderately depressed college students and controls were given an auditory attention task in which they were to identify a selected target speech sound. Distractors of varying hedonic tone were randomly inserted into the list of auditory stimuli. Subjects' ability to detect targets preceeded by positive, negative and neutral distractors was assessed using a method designed to separate out perceptual deficits from response bias.

Few differences between groups or distractor types were observed. The two groups were generally able to identify

most targets; it appears that the task was not adequately challenging. Therefore, if group differences do exist, the task may have been unable to discriminate between the groups. Nevertheless, many relationships were in the expected direction. Depressed subjects may have experienced a mild disorganization when negative distractors preceeded targets.

I wish to express my sincere thanks to a special mentor and friend, Dr. Joan Holloway, who provided gentle guidance and lots of confidence. Also, this study would not have been possible without the considerable assistance of Dr. Larry Hochaus who not only advised me but wrote the computer programs critical for this study. Many thanks to other committee members Dr. Kenneth Sandvold and Dr. Joseph Weber for meeting not only twice, but three times to help me plan this study. I would like to thank Steve Carver for designing the necessary hardware--a truly herculean task! Finally, thanks to Dr. Allan Finkelstein in Albany for helping with the analyses.

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# CHAPTER I

## INTRODUCTION

Clincians have long relied upon disturbances in cognitive functioning in the diagnosis of depression because depressed patients almost universally report problems in thinking. The Revised Diagnostic and Statistical Manual of Mental Disorders (DSM III-R; American Psychiatric Association, 1987) includes "decreased attention, concentration, or ability to think clearly" as one of the primary diagnostic indicators of major depression. Despite the well accepted notion that disturbances of cognition are central to the depressive syndrome, efforts to clearly define deficits have resulted in few if any characteristics of thought which are pathognomic for depression. Instead, the majority of research indicates nonspecific problems in mentation which are often manifest in other, non-affective disorders (McAllister, 1981; Miller, 1975). Some of the confusion has been attributed to the fact that stage theories of information processing don't always adequately differentiate between memory, learning, and attention. More research is needed which stresses the point at which processing appears to be breaking down during depression, the context in which processing occurs, and characteristics of the stimuli being processed (Cohen, Weingartner, Smallberg, Pickar, & Murphy, 1982).

Most of the research on the cognitive deficits associated with depression has focused on memory. Early studies suggested a general memory deficit, however, more recent research suggests that problems in memory may be caused by difficulties in the encoding process. The trend has been to focus on problems that occur earlier in the information processing sequence which may be ultimately manifest as a memory deficit, i.e., attention.

Despite the fact that the DSM III-R criteria include attentional problems as important parts of the depressive syndrome, there is only a small body of research to support this claim. Several researchers have used the signal detection methodology to assess attentional problems because of this method's ability to separate out deficits in detection of a stimulus from observer bias. The results of these studies are equivocal. While some studies have indicated a perceptual deficit in depression (Malone & Helmsely, 1977) it is possible that attentional deficits reflect a conservative response strategy and not a decreased perceptual sensitivity.

The current study is an attempt to assess the attentional deficit in depression using the signal detection methodology. Perceptual sensitivity and response bias were assessed under differing conditions to determine if depressed

depressed subjects' attention was disrupted differently than control subjects' attention.

Previous studies have shown that depressed subjects demonstrate a deficit in the recall of positively toned information (Teasdale & Fogarty, 1979; Breslow, Kocsis, & Belkin, 1981). Others have observed a relatively greater recall of negative information than positive information in depressed subjects (Dunbar & Lishman, 1984). These data suggest that there may be a bias for attending to information with a negative emotional tone and therefore depressed subjects might be expected to show a greater attentional deficit in the presence of negatively toned emotional distractors than distractors which are emotionally positive. Thus the current study was designed to determine if depressed subjects demonstrate a selective attentional deficit by comparing their performance with normals on an attentional task in which information of varying hedonic tone was used to disrupt attention on a primary task.

The following review is intended to provide the reader with a background on the current research on the cognitive correlates of depression. Following a review of memory and attentional deficits in depression, research which focuses on cognitive deficits associated with specific stimulus charactersitics will be presented.

# Cognitive Correlates of Major Depression

## Memory

The vast majority of research on the cognitive deficits associated with depression have focused on memory. Problems in any or all phases of memory have been proposed, however, the strongest evidence points to problems in short-term, effortful memory processes.

Sternberg and Jarvik (1976) investigated three theoretical divisions of memory in an attempt to assess where along the continuum a deficit might be occurring. Depressed subjects demonstrated significant impairments in registration but not in retention. In other words, the immediate reproduction of material was impaired in depressed subjects but information that did manage to get registered showed no difference relative to normals in the degree of forgetting. The authors attributed these results to interference in registration caused by ruminative thoughts. They concluded that "...in depressives, the defect in registration seems to occur at the earliest stage, that is, at the level of perception...the learning impairment in depression is based on a lowering of awareness" (Sternberg & Jarvik, 1976 p. 223). Thus this study suggests that earlier information processing deficits are central in depression.

Hart, Kwentus, Taylor and Harkins's (1987) study of rates of forgetting in dementia and depression yielded similar findings. Depressed subjects demonstrated normal rates of forgetting relative to control subjects. However, the depressed subjects required a longer stimulus exposure time than control subjects to acquire the same amount of information. The authors suggest that the additional exposure time is necessary to compensate for ineffective learning which is secondary to attentional problems. Thus memory deficits can be masked if depressed subjects are given additional time for stimulus processing.

Stromgren's (1977) findings are only partially supportive of an attentional deficit in depression. In this study the Wechsler Memory Scale (WMS) was used to assess varying phases of memory and attentional functions before and after electroconvulsive therapy (ECT). Prior to ECT depressed subjects demonstrated impairment in three components of memory; registration, retention, and forgetting. Depressed subjects were most impaired on the Mental Control Subtest which requires the subject to perform a series of tasks; counting backwards, repeating the alphabet and counting by 3's. This subtest appears likely to require a high degree of concentration and might also be expected to suffer from interference from internal ruminations. This this study provides some evidence for impaired registration secondary to impaired attention but also suggests that a more global memory impairment may occur in depression.

Breslow, Kocsis and Belkin (1980) also used the WMS to assess memory and attention in depressed patients. Similar to the subjects in Stromgren's (1977) study, the depressed subjects obtained significantly lower scores on the Mental Control subtest than the control subjects. Depressed subjects' performance on subtests of short-term and long-term memory was less, although significantly, impaired relative to normals. The authors suggest that attention and alerting are most impaired in depression and that subtests which rely on overlearned material, i.e., paired associate learning and general orientation, reduce the need for sustained attention and are relatively unaffected by depression. Therefore, it may be concluded that internal ruminations would be less likely to interrupt processing of an automatic nature or to interfere with the processing of overlearned information.

Krames and MacDonald (1985) attempted to test the hypothesis that depressive schemata or ruminations occupy short-term memory space and reduce the depressive's capacity to attend to incoming information. In this study subjects were instructed to attend to and write down a series of digits which were then followed by a brief delay in which words were presented. Subjects' recall for words and digits were assessed. Contrary to normal subjects, depressed subjects' recall of lists of words actually increased with the number of digits presented. They recalled more interference words with greater numbers of to-be-remembered digits. These authors concluded that their data indicated that short-term memory capacity is not impaired during depression but that there is interference from depressive thoughts which interrupts the processing of other information in short-term memory. With low interference (one digit), depressed subjects' attention was presumably focused on internal ruminations and interfered with processing of other information most notably. When task demands increased, depressed subjects were forced to attend to more information and ruminations were suspended in favor of processsing dual task demands.

The research reviewed thus far suggests that memory deficits may occur at the earliest level of processing although there is some evidence for impaired short-term and long-term recall. Weingartner, Cohen, Murphy, Martello and Gerdt (1981) attempted to determine if differences in retention are attributable to problems in the encoding of information. They found that depressed subjects were unable to take advantage of elaborate encoding strategies and thus, unlike normal subjects, did not show a recall advantage when provided with semantic over acoustic cues. Additionally, depressed subjects were less able than normals to generate organizational strategies for recall of words. The inability to use elaborate or perhaps "effortful" strategies was linked to a disruption in brain state arousal and activation.

Although most studies have indicated some type of memory deficit in depression, several investigations have produced negative results. One early study of memory used the signal detection methodology to compare recognition memory in elderly patients with either depression or dementia with normal elderly subjects (Miller & Lewis, 1977). Two measures, d' and beta, were used to determine if group differences in recognition were the result of an impairment in perception of the stimuli during presentation (d') or the result of a response bias during the assessment phase (beta). Subjects were shown a series of geometric designs and then asked to select the previously presented stimuli from a list of previously presented and new designs. Depressed subjects' d', or "memory efficiency", did not differ from controls. This result suggests that elderly depressed subjects' discrimination of and memory for the to-be-remembered designs did not differ from normal elderly subjects. Nevertheless, depressed subjects adopted a significantly higher criterion, or beta value, for recognition of previously presented designs indicating that they were unwilling to identify a design as having been presented earlier without a high degree of certainty. The authors concluded that an unwillingness to guess, or a changed response strategy, might account for previously observed "memory" impairment in depressed patients. The finding that depressed subjects were hesitant to identify designs is intuitively attractive and would seem to fit with the idea that during depression people often have difficulty making decisions and lack confidence in their choices. In fact, difficulty making decisions is a hallmark of depression.

Another study also failed to find a memory deficit in depression (Davis & Unruh, 1980). Depressed and control subjects' performance on recognition memory, free recall, and organized multitrial free recall of abstract nouns were compared. Experimental and control subjects' memory scores did not differ. In fact, patients with depressions of a short duration actually performed better than controls on free recall and multitrial free recall.

Despite these negative findings, most other investigators have found evidence for a memory impairment in depression. Several authors have suggested that internal ruminations interrupt attention and that this then produces an apparent memory impairment in depression. The following section reviews those studies which have specifically assessed attention, rather than memory, in depression.

## Attention

In recent years researchers have attempted to study attention directly, with less emphasis on the memory component. These studies indicate that attentional problems may vary with both anxiety and the severity of depression.

Malone and Helmsley (1977) used an auditory signal detection task to study attention. Sugjects' ability to detect a tone both during and after a depressive episode was assessed. Subjects' d' scores were lowered during depression, indicating decreased perception of stimuli. The authors concluded that the results could not distinguish whether differences reflect a real sensory difference or a disturbance in selective attention.

Byrne (1977) used the signal detection method to assess attention in 20 hospitalized patients with depression. Subjects heard a 30 minute series of randomly spoken digits and were required to detect three odd digits in sequence. Signal detection, as measured by the proportion of odd number sequences detected (hit rate), was significantly negatively correlated with self rated depressive affect and severity of depression. Thus measures of affect and attention were found to be correlated.

Byrne (1976b) also reported the results of this study in a separate article in which betweeen group comparisons of controls and neurotic and psychotic depressives were presented. Both types of depressives demonstrated lower hit rates than control subjects but psychotic depressives had significantly lower hit rates than neurotic depressives. Neurotic depressives had significantly more false positive errors than either other subject group. Finally, psychotic depressive's had a faster performance decrement rate than the other two groups. In other words, psychotic subjects' vigilance decreased faster over time than did the other subjects' vigilance. These results not only suggest that there is an attentional deficit in depression, but that it is more pronounced in psychotic depression. It should be noted however, that this result might also merely suggest that the extent of attentional deficit is a function of the severity of illness (Cornell, Suarez, Berent, 1984).

The results of a study by Cornell et al., (1984) similarly suggest that cognitive deficits may depend upon the subtype of depression. This study was designed to separate out the cognitive and motor components of psychomotor retardation, a symptom which is closely related to attention. Both melancholic and nonmelancholic subjects were impaired on simple reaction time tasks but only melancholic subjects were impaired on a reaction time task with greater cognitive load compared to controls.

Other researchers have attempted to determine the effect of anxiety, either alone or in combination with depression, on attention. Watts and Sharrock (1985) assessed depressed subjects' concentration problems during a reading task and then had subjects rate the concentration problems they were experiencing during everyday activities. They predicted that depression would be associated with "mind blanking" while anxiety would produce "mind wandering". Subjects reported their concentration lapses during a reading task and if these were of the "mind wandering" or mind blanking" type. The total number of concentration lapses was correlated with both anxiety and depression. Depressed subjects more often reported "mind wandering" than "mind blanking" and that their mind wandered more to the past than the future, to personal things versus everyday things and to unpleasant events more than pleasant events. However, when anxiety level was partialled out the correlations were no longer significant. The authors concluded that contrary to their prediction, depression is associated with problems with internal distractions which cause mind wandering. They also felt that their results could not disentangle the components of anxiety from depression in attentional lapses but they concluded that anxiety may be an important determinant of concentration problems in depression.

Wyrick and Wyrick (1977) assessed depressed subjects' focus of attention in a study designed to investigate their perception of time. The results indicated that when compared to normals, depressed subjects were preoccupied most with past events and less with present and future events.

Other researchers have also studied the focus of the depressive's thought and have found that attention directed towards the self may prevent adequate attending to external stimuli. Smith and Greenberg (1981) assessed the relationship between depression and self-focused attention in college students. Subjects completed the Dempsey D scale of the Minnesota Multiphasic Personality Inventory (MMPI) and a self consciousness scale which includes three primary factors; private self-focused self consciousness, public self consciousness, and social anxiety. Depression and private self consciousness were significantly correlated. However, both the other factors were also correlated with depression and thus the results did not suggest that self-focused attention is more important than other types of cognitive preoccupation.

In a follow-up study Ingram and Smith (1984) assessed the number of self-focused, external focused, ambivalent, and neutral responses on The Self-Focus Sentence Completion Scale in depressed and nondepressed undergraduates. Not only did depressed subjects give more self-focused and fewer externally focused responses, but they produced more negative and fewer positive self-focused responses than control subjects. The two groups did not differ in the frequency of positive and negative externally focused responses. It appears that depressive's negativity is primarily concerned with the self as opposed to external stimuli. This preoccupation presumably might prevent adequate monitoring of external events.

Given the proposed problems in attentional focus, several authors have attempted to redirect subjects' attention and have then measured their performance on cognitive tasks. Brockner and Hulton (1978) proposed that persons with low self esteem are more vulnerable to the effects of self-focused attention on task performance than persons with high self esteem. They gave subjects with high and low self esteem a concept formation task in each of three conditions; in the presence of an audience where self-focused attention is presumably high, in a control condition with no special instructions, and in a condition where they were instructed to concentrate on the task. Subjects with low self esteem performed worse than subjects with high self esteem when an audience was present but actually performed better when their attention was directed towards the task. The authors concluded that the manipulation lowered anxiety and therefore increased performance in subjects with low self esteem.

Coyne, Metalsky and Lavelle (1980) used an attentional redirection technique to attenuate the effects of a learned helplessness induction on anagram solving performance. Error rates and response latencies were decreased for subjects who were instructed to imagine a mountain scene after being given a pretreatment failure paradigm.

## Stimulus Attributes Which Affect Attention

The research discussed thus far has focused on the general hypothesis that depression, anxiety, and low self esteem are associated with attentional deficits. Some of the studies also indicate that attentional impairments may be the result of a tendency to be self-focused on internal ruminations.

The following is a review of other, related deficits in processing associated with depression. In these studies the authors have attempted to discern more carefully those characteristics of stimuli and how they are differentially processed by depressed subjects.

Lewinsohn (1973) has proposed that depression is caused by a decrease in environmental reinforcement and an increase in punishment brought about by the depressed persons' social skill deficits. He and his colleagues have demonstrated that depressed subjects report fewer positive and more negative events than controls (Youngren & Lewinsohn, 1980). Buchwald (1977) questioned whether the depressive's self report is accurate and designed a study to determine if low estimates of reinforcement frequency are actually a type of cognitive distortion. Depressed and nondepressed undergraduates were given either 80% or 20% correct feedback about their performance on a learning task. Depressed subjects tended to underestimate the amount of correct feedback they received. Buchwald's results are therefore supportive of the hypothesis that some aspect of the depressive's cognitive processing leads them to distort information about the external world.

Nelson and Craighead (1977) also assessed depressed subjects' distortion in their recall of positive and negative feedback. As Buchwald (1977) found, depressives tended to underestimate the amount of positive reinforcement they received. In addition, depressives' overestimated the amount of punishment they received. Therefore both of these studies suggest that depressed subjects' recall is selectively biased in the negative direction.

Teasdale and Fogarty (1979) hypothesized that the above results occur because depressed mood increases the accessibility of unpleasant memories. They tested this hypothesis by measuring the speed and accuracy of retrieval of positive and negative events using a mood induction procedure. They found that depressed mood decreased the accessibility of pleasant memories but did not appear to increase the accessibility of unpleasant memories.

Breslow, Kocsis and Belkin (1981) found similar results with a sample of clinically depressed patients. Depressed patients recalled significantly fewer positive elements of astory than control subjects. However, they did not differ from controls in the number of negative or neutral themes. The authors questioned whether the results reflected a perceptual impairment or response bias, e.g., it is unclear whether subjects failed to perceive stimuli or report stimuli.

Weingartner and Silberman (1982) explained this phenomena as support for the theory that mood acts as a context at the time of encoding and that similarity between mood at the time of encoding and mood during retrieval increases accessibility. Because negative thoughts predominate, counterdepressive cognitions are inaccessible and the depressive is continually focusing attention on thoughts which further induce depression (Teasdale & Fogarty, 1979).

Other authors have explained this phenomena in terms of schemata (Derry & Kuiper, 1981). The depressive is thought to use a negative schemata, or set of negative attitudes, with which to evaluate the world and self. Derry and Kuiper (1981) asked groups of depressed patients, psychiatric patients, and normal controls to make a series of decisions about adjectives on a structural basis, a semantic basis or a self referent basis. They measured the time to make the decision and later measured the subjects' incidental recall for the words. Response time was used as an index for the efficiency of processing while recall provided insight into the content of the subjects' schemata. Although depressed subjects' structural and semantic judgements did not differ from the other groups, their ratings of depressed and nondepressed words as self referents differed from the other groups. Depressive subjects recalled more depressed than nondepressed self referent words than psychiatric or normal controls. They did not differ in the time necessary to make the initial judgement. Derry and Kuiper (1981) explained this result as support for the theory that depressives have a coherent and efficient schemata for evaluating the self which is composed of negative descriptors. The schemata enhances information processing by providing a structure for encoding and storing future information. Information which is consistent with the tone of the schemata is more likely incorporated into long term stores. Ingram, Smith and Brehm (1983) reported similar findings but further concluded that depressed invididuals have difficulty accessing positive self schemata.

Zuroff, Colussy, and Wielgus (1983) used signal detection methodology to determine if depressive's recall bias for negative information about the self is a function of a perceptual (d') or response bias (beta). Although depressive's d' or pure memory for negative self referents did not differ from normals, they employed a more liberal criterion value for judgements. Thus depressed subjects' obtained a greater beta value. Dunbar and Lishman (1984) similarly used the signal detection methodology to assess memory for words of varying hedonic tone. Relative to controls, depressed subjects had significantly lower d' values for good words and significantly higher d' values for bad words. Furthermore, depressives had higher beta values for good and neutral words.

Gotlib and McCann (1984) attempted to determine if the bias for negative information could be observed at an earlier stage of information processing, i.e., prior to recall. Depressed and nondepressed undergraduate students were given a version of the Stroop Color Naming Task via tachtistiscope. Subjects were asked to name the color of depressed, neutral or manic content words and their response latencies were measured. Depressed subjects took significantly longer to name the colors for depressed content words than for neutral or manic content words. Nondepressed subjects' latencies did not differ across conditions. Gotlib and McCann argue that these results indicate that negative schemata are more accessible than positive schemata and therefore produce more disruption in secondary processing, i.e., recall, than positive schemata.

Williams and Broadbent (1986) likewise used the Stroop Color Naming Test as a measure of attentional biases. Subjects who had recently overdosed showed the greatest reduction in color naming when the content of the words was specific to overdose themes. Whereas all subjects demonstrated an impairment to emotional words, the specific nature of the content for the overdose subjects produced the most impairment.

## Rationale and Hypotheses

The literature reviewed suggests that 1. depressives demonstrate distortion in their recall of information by overreporting negative events and underreporting positive events, 2. memory deficits may be a function of attentional deficits, and 3. the source of distraction may be negative, ruminative information.

The aim of the present study was to assess whether negative information would disrupt attention on a secondary task, when subjects are instructed not to attend to the information. Furthermore, the distracting information was presented auditorially, in a mode which may more closely resemble the way in which naturally occurring depressive ruminations impair attention in depression. Therefore, the main question to be addressed by this study was "will depressed subjects' performance on a signal detection task be more adversely affected by negative distractor words than normal subjects' performance?"

## Baseline

Hypothesis #1. Depression is thought to produce an attention deficit. Therefore, the depressed group will have a lower mean hit rate and d' value than controls indicating that these subjects perceptual accuracy is decreased during depression perhaps as a result of interfering ruminations.

Hypothesis #2. The depressed group will obtain fewer false positive errors and a higher mean log beta value than the controls as a result of a conservative response bias e.g., an unwillingness to guess.

Hypothesis #3. The depressed group will demonstrate a longer mean response latency to target and non-target stimuli than controls as a result of psychomotor retardation.

## Experimental

Hypothesis #4. The control group's mean hit rate and mean d' values will not differ across conditions. However, the depressed group will demonstrate a smaller mean hit rate and d' value in the negative distractor condition than the other two conditions because the negative distractors will cause a shift in attention away from the target stimuli. Conversely, depressed subjects are predicted to obtain higher hit rates and d' values in the positive condition because these words, which are not salient for them, will not be attended to and their performance will consequently be less disrupted.

Hypothesis #5. The control group's response bias as indicated by the mean false alarm rate and mean log beta values will not differ across conditions. However, the depressed group is expected to demonstrate a more stringent criterion, e.g., fewer false positives, and a higher mean log beta in the negative distractor condition because the negative distractors will decrease attention to stimuli thus decreasing false alarms. Conversely, depressed subjects will essentially "ignore" positive words so these distractors will not impair performance.

Hypothesis #6. The depressed group will recognize more negative than positive words because the negative words will have been attended to while they will have ignored the positive words.

## CHAPTER II

## METHOD

### Subjects

The thirty-two subjects were undergraduate psychology students who were given extra credit points for completing a screening measure during class and additional extra credit and $2.00 payment if they participated in the full study. Volunteers completed the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) during class with the instructions that they might be asked to further participate in the study.

The BDI is a 21 item self report measure of depressive symptomatology which is widely used to select depressed subjects for research and to assess the intensity of depression (Beck, Steer, & Garbin, 1988). Scores can range from 0 to 63. Scores of 0-10 indicate none to minimal depression, 10-18 mild to moderate depression, 19-29 moderate to severe depression and 30-63 severe depression. Numerous studies using the BDI have been conducted with college students. Some recent investigations have obtained means of 7.28 (S.D. = 6.28; Lightfoot & Oliver, 1985), 7.90

(S.D. = 6.62; Junko Tanaka-Matsumi & Kameoda, 1986) and 7.47 (S.D. = 5.89; Gotlib, 1984) in college populations.

In the current study 202 undergraduate psychology students including including 111 females and 91 males volunteered and completed the BDI during class. The mean age of the subjects for the entire sample was 21.02 years (S.D. = 5.02). The mean Beck score was comparable to other recent studies ($\underline{M}$= 7.64; S.D. = 6.53). From this large group two groups of subjects were selected to further participate in the study based on their scores on the BDI The control group was defined as those subjects who received scores in the none to minimal range of depression (0-9). Depressed subjects were those subjects who scored in at least the mild to moderate range of depression (10-18).

One hundred and thirty-four (66%) subjects received scores in the none to mild range of depression, 59 (29%) fell in the mild to moderate range, 7 (3%) were in the moderate to severe range and 2 subjects (1%) obtained scores in the severe range of depression.

Thirty-nine subjects were selected to further participate in the study as either control or experimental subjects. All subjects who scored in the severe or moderate to severe range of depression on the BDI were contacted and asked to participate. All of these subjects (9) participated.

Subjects in the mild to moderate range who had scores of at least 16 were also contacted and asked to participate.

Fifteen subjects in this range were called and 12 (80%) agreed to participate.

Control subjects were those subjects with scores in the none to minimal depression category who most closely matched the depressed subjects in terms of age and sex. Twenty-one control subjects were called and 18 agreed to participate (85%).

Five depressed subjects were eliminated from the analyses after having completed all of the procedures; one subject's physical disability precluded accurate assessment of response latency, three subjects had previous histories of head injury or seizure and one subject scored below the designated criteria on a measure of depression administered on the day of the study. Two subjects originally recruited as control subjects were not used in the analyses because each reported a history of head injury. Therefore, a total of 16 depressed and 16 control subjects are included in the analyses.

A third group of clinically depressed outpatients (n=1) and inpatients (n=4) also completed all of the measures to provide some exploratory data on the performance of a non-analog population. The clinically depressed group was composed of 2 females and 3 males who carried diagnoses of major depression. Because there were so few clinical subjects these data were not analyzed but means are provided as comparisons with the other groups.

## Measures

The Zung Self-Rating Depression Scale (Zung, 1965) is a 20 item scale which measures the frequency of depressive symptomatology. This measure was used to provide a current measure of depressive symptomatology and was administered at the time that subjects completed the tasks. On the Zung Scale subjects are required to indicate how frequently a symptom is occurring for them on a 4 point scale that ranges from "a little of the time" to "most of the time".

The Speilberger State Anxiety Scale (Speilberger, Gorusch, & Luschen, 1970) is a 20 item checklist designed to measure current symptoms of anxiety. Subjects are instructed to indicate how strongly a feeling applies to them (e.g., I feel upset) on a four point scale that ranges from "not at all" to "very much so". Scores can range from 20 to 80 with 80 indicating strong state anxiety. Because anxiety frequently occurs with depression, the Speilberger State Anxiety Scale was administered to subjects to determine if group differences in anxiety might explain group differences on task performance.

The Shipley Institute of Living Scale (Shipley, 1940), is a brief measure of cognitive functioning which contains a 40 item vocabulary scale and a 20 item abstraction scale. The test provides measures of vocabulary age, abstraction age, mental age and a conceptual quotient. Subjects completed the Shipley to determine if there were group differences in premorbid functioning. Also, it was hypothesized that cognitive dysfunction in depressed subjects might impair performance on the conceptual quotient items. Vocabulary items were not expected to differ between groups as vocabulary skill is less likely to change as a result of ongoing psychopathology.

The schedule for Affective Disorders and Schizophrenia (SADS; Endicott & Spitzer, 1978), a structured interview, was used to assess depression and to determine whether subjects had a history of major depression.

## Apparatus

### Audiotape

An audiotape containing two separate sets of stimuli was created. The first or baseline set was a random ordering of fifteen instances of four sounds, eeth, eef, eeb and eek. The duration of this set was approximately 2 minutes.

The second set contained 60 instances of each of the four sounds in a random order for a total of 240 speech sounds. This yielded an overall signal rate of 25% as the signal, "eeth" occurred 60/240 times. Fifty percent (120) of all signals were preceeded by a distractor. Each of the four sounds was preceeded by equal numbers of positive, negative and neutral distractors. The stimuli were recorded on a cassette tape in a male voice at the rate of one speech sound every three seconds. Distractors were randomly inserted into the list in keeping with the above restrictions.

Distractors were obtained by having four graduate students rate 300 words on a 5 point scale from 1 (positive emotional tone) to 5 (negative emotional tone). The midpoint, 3, represented words "neutral" in emotional tone. Forty words from each of three categories (positive, negative and neutral) were selected based on these ratings and a one way ANOVA indicated that the three groups obtained significantly different ratings from each other, $F(2, 118) = 2197.07$, $p < .0001$. To insure that the word types did not differ in terms of familiarity, the three word types were equated for frequency of use in the English language. An analysis of variance of mean frequencies for the three groups was nonsignificant, $F(2, 118) = .09$, $p < .91$. The negative ($M = 4.63$) and positive ($M = 1.42$) mean emotional tone ratings were roughly equivalently deviant from the mean rating for the neutral work group ($M = 2.95$), indicating approximately equal valence. Finally, the mean word length was equivalent across the three word type groups, $F(2, 118) = 1.57$, $p < .21$ (See Appendix A for list of distractors.

## Computer

An Apple IIc computer was used to record the latency and accuracy of subjects' responses. A device was inserted between the computer and the tape recorder which started a software clock with the onset of each speech sound and reset the clock prior to the next speech sound. A software program recorded the latency of subjects' responses to each of the different categories of stimuli and calculated hit and false alarm rates (See Appendix B).

## Performance Indices

Separate performance indices were calculated for the baseline and experimental conditions. For each condition the following measures were obtained; hit rate, false alarm rate, response latency for hits, response latency for false alarms, d' and log beta. The hit rate is defined as the number of times the subject responded to the target "eeth" divided by the number of times the target was presented. The false alarm rate is the number of times the subject responded to a nontarget speech sound (eef, eek or eeb) divided by the number of nontarget speech sounds presented. The response latency measure for hits and false alarms is the time elapsed from the onset of the sound to the depression of the space bar and is presented in milliseconds.

Beta is a measure of the theoretical criterion level set by a subject above which the subject will respond in the affirmative, "yes a signal occurred". This measure is ostensibly free from the influence of the subject's ability to actually perceive the stimulus. It is a measure of the subject's response bias and may be affected by variables like the costs of various responses. For example, if a subject was to be paid one dollar for every correct identification of a stimulus then the false alarm proportion would be expected to increase because subjects would try to maximize the number of hits with little consequence for a large false alarm rate. The beta value can also vary with the signal frequency because in situations wehre the signal is frequent, the subject develops the expectation that ambiguous signals were likely to have been targets and therefore responds in the affirmative. Conversely, if the signal rate is low, then ambiguous signals are less likely to be interpreted as targets and subjects are thus less likely to respond. The larger the value of beta the more stringent the criterion; smaller values of beta are indicative of a lax criterion and a bias towards responding "yes". In order to perform inferential statistics with beta the natural logarithm was taken, a transformation which allows the values to be averaged (Gardner & Boice, 1986). In the present study the log beta values are reported and analyzed.

The measure called d' was used to measure subjects' sensitivity in detecting the signal which is independent from response bias. Theoretically, sensitivity refers to the difference in sensations experienced by the subject with and without the signal present. A sensitive subject perceives clear differences under the two conditions while and insensitive subject fails to make the discrimination. No sensitivity is represented by a d' value of 0, with increased sensitivity the value increases.

The measures are based upon subject's proportion of hits and false alarms. A program written for the Apple computer was used to calculate values of log beta and d' (Gardner & Boice, 1986; See Appendix C).

## Procedure

Subjects were contacted by telephone within three days of the initial contact during class and asked if they would volunteer to further participate in the study. Eighty-six percent of subjects contacted agreed to participate in the study. All subjects were scheduled and seen within ten days of the original contact in the classroom.

Subjects were seated in a small room with few visual or auditory distractors. The plan of the study and the consent forms were explained to all subjects (See Appendix D). All subjects agreed to full participation; no subjects opted to prematurely discontinue participation.

All subjects first completed the Zung Self Rating Depression Scale which served as a second measure of depression and provided a current level of depressive symptomatology. A score of .50 is considered the cutoff score for depression (Zung, 1965). Therefore, one subject who was originally selected for inclusion in the clinical group was eliminated as the Zung score did not meet this criterion. All other clinical subjects obtained scores above .50.

Zung (1963) reported that the mean score for normal control subjects is .33, therefore all control subjects in the present study were required to obtain a score below .33. No subjects selected as controls on the basis of the BDI scored above this criterion.

After having completed the Zung Scale subjects were given the instructions that they were to listen to two sections of audiotape during which they would be required to respond to the sound "eeth" by pressing the space bar on the computer keyboard. They were asked to respond with both maximum speed and accuracy. The experimenter left the room while the subjects completed the task.

After the computer task subjects were immediately asked to complete a recognition task for the distractor words to determine if there were group differences in the processing of different word types. The 120 distractor words and an additional 30 words were printed on a sheet of paper (See Appendix E). Subjects were asked to circle any words that they recalled having heard on the audiotape. Subjects then completed the Shipley Institute of Living Scale to provide a measure of general intellectual ability with which to equate the two groups.

The final phase of the study was a brief interview during which substance use, current medication, and history of head injury were explored with each subject so that subjects who might demonstrate impairment on the task as a result of other factors could be eliminated. More complete information on psychiatric symptoms was obtained using the SADS. Patients were debriefed and paid $2.00.

# CHAPTER III

# RESULTS

## Subjects

The mean age ($M$ = 21.8 S.D. = 4.2) and education ($M$ = 14.1 S.D. = 1.2) for the depressed group was not significantly different from the control group's mean age ($M$ = 20.0 S.D. = 1.8) or education ($M$ = 13.8 S.D. = 1.3), $F(1, 31) = 2.43$, $p < .12$; $F(1, 31) = .47$, $p < .47$. Equivalent numbers of males and females were included in each group with each group comprised of 11 females (68%) and 5 males (32%). The two groups contained significantly different proportions of right and left hand dominant subjects, 2(1, $N$ = 32) = 4.5, $p < .03$. The depressed subjects were all right hand dominant while the control group contained 4 (25%) left hand dominant subjects.

The depressed and control groups obtained comparable mean scores on all measures of intellectual functioning derived from the Shipley Hartford Scale including IQ (Depressed Group $M$ = 121.7; Control Group $M$ = 117.4), $F(1, 31) = 1.65$, $p < .20$, Conceptual Quotient (Depressed Group $M$ = 106.8; Control Group $M$ = 103.0), $F(1, 31) = .64$, $p < .41$, Mental Age (Depressed Group $M$ = 17.4; Control Group $M$ = 16.7, $F(1, 31) = 1.77$), $p < .19$, Vocabulary Age (Depressed Group $M$ = 16.7; Control Group $M$ = 16.3), $F(1, 31) = .87$, $p < .35$, and Abstraction Age (Depressed Group $M$ = 17.6; Control Group $M$ = 16.7), $F(1, 31) = 1.24$, $p < .27$, (See Table 1).

As expected the Depressed Group obtained a significantly greater mean on the BDI ($M$ = 21.5) than the Control Group ($M$ = 1.18), $F(1, 31) = 129.3$, $p < .0001$. The Depressed Group continued to obtain significantly higher depression scores on the day of assessment using the Zung ($M$ = .61) than the control group ($M$ = .28), $F(1, 31) = 143.8$, $p < .0001$. The Depressed Group's mean score on the Speilberger State Anxiety Questionnaire ($M$ = 52.6) was significantly greater than the control group's mean ($M$ = 24.3), $F(1, 31) = 89.27$, $p < .0001$, indicating that the depressed subjects also endorsed items indicative of greater anxiety than control subjects (See Table 2).

Fifteen of the sixteen depressed subjects met the SADS criteria for major depression which require that the person has been experiencing symptoms for at least one week, that they have either sought help or noticed a change in functioning and that the person manifest at least four of the nine symptoms. One depressed subject failed to meet the criteria because he had not felt consistently depressed for one week although he had experienced five of the nine symptoms for one week. The depressed group endorsed an average of 5.7 of the nine symptoms while the control group

TABLE 1

MEAN INTELLIGENCE SCORE AS A FUNCTION OF GROUP

| Score | Depressed | | Control | | df | F | p |
|---|---|---|---|---|---|---|---|
| | M | S.D. | M | S.D. | | | |
| Speilberger IQ | 121.7 | 8.6 | 117.4 | 9.8 | 1,31 | 1.65 | .20 |
| Conceptual Quotient | 106.8 | 14.8 | 103.0 | 10.4 | 1,31 | .64 | .41 |
| Mental Age | 17.4 | 1.2 | 16.7 | 1.4 | 1,31 | 1.77 | .19 |
| Vocabulary Age | 16.7 | 1.4 | 16.3 | 1.3 | 1,31 | .87 | .35 |
| Abstraction Age | 17.6 | 2.1 | 16.7 | 2.0 | 1,31 | 1.24 | .27 |

TABLE 2

MEAN DEPRESSION AND ANXIETY SCORE AS A FUNCTION OF GROUP

| | Depressed | | Control | | df | F | p |
|---|---|---|---|---|---|---|---|
| | M | S.D. | M | S.D. | | | |
| Beck Score | 21.50 | 7.00 | 1.18 | 1.20 | 1,31 | 129.3 | .0001 |
| Zung Score | 00.61 | 0.09 | 0.28 | 0.03 | 1,31 | 143.8 | .0001 |
| Speilberger State Anxiety Score | 52.60 | 10.90 | 24.30 | 4.70 | 1,31 | 89.2 | .0001 |

endorsed an average of .25 symptoms. Twelve of the depressed subject's interviews suggested that they had experienced a major depression in the past while four of the control subjects appeared to have experienced a major depression.

## Group Differences on Baseline Task Performance

Individual *t* tests for differences between groups were conducted for all dependent measures of performance on the baseline task. The two groups' performances were not significantly different on any of the measures including hit rate $t(30) = 0$, $p < 1.0$, false alarm rate $t(30) = -1.58$, $p <$ .12), response latency for hits $t(30) = 1.30$, $p < .20$, response latency for false alarms $t(30 = .03$, $p < .96$, d' $t(30) = 1.78$, $p < .09$ or log beta $t(30) = 1.91$, $p < .07$, (See Table 3).

All of the subjects obtained hit rates of 100%; both experimental and clinical subjects easily identified all targets. Although nonsignificant, the control group made more false positive errors and was slightly more biased towards yes responses than the clinical group. Similarly, the clinical group obtained a greater d' than the control group, suggesting greater perceptual accuracy or less forgetting. Nevertheless, the two groups did not obtain statistically significant differences on any measures of task

TABLE III

MEANS AND STANDARD DEVIATIONS FOR MEASURES OF BASELINE TASK PERFORMANCE BY GROUP

| | Depressed | | Control | | | | |
|---|---|---|---|---|---|---|---|
| | M | S.D. | M | S.D. | df | t | p |
| Hits | 100% | 0.0 | 100% | 0.0 | 30 | 0 | 1.0 |
| False Alarms | 17% | 14 | 25% | 11 | 30 | -1.58 | .12 |
| Latency for Hits (ms) | 728. | 121. | 672. | 120. | 30 | 1.30 | .20 |
| Latency for False Alarms (ms) | 850. | 411. | 764. | 229. | 30 | .03 | .96 |
| d' | 2.95 | .67 | 2.49 | .43 | 30 | 1.78 | .09 |
| Log Beta | -.81 | .85 | -1.20 | .41 | 30 | 1.91 | .07 |

performance for the baseline task. Therefore, none of the first three hypotheses were supported.

## Group Differences On Measures of Task Performance

Separate Group (depressed vs control) X Condition (positive, negative, and neutral) ANOVAs were computed for each of the measures of task performance where condition represented a repeated measure.

### Hit Rate

Both groups obtained nearly perfect hit rates in all conditions with the exception that the depressed group obtained only a 96% mean hit rate in the negative distractor condition. However, the interaction between Group and Condition was nonsignificant, $F(2, 60) = 2.05$, $p < .13$. Nevertheless, this finding is consistent with the prediction that depressed subjects perform poorly in the presence of negative distractors. Neither the Group or Condition main effects were significant for hit rate, $F(1, 30) = 2.19$, $p < .14$; $F(2, 60) = 1.31$, $p < .27$ (See Tables 4 and 5).

TABLE IV

ANOVA TABLE FOR HIT RATE

| Effect | *df* | *F* | *p* |
|---|---|---|---|
| Group | 1,30 | 2.19 | .14 |
| Condition | 2,60 | 1.31 | .27 |
| Group*Condition | 2,60 | 2.05 | .13 |

TABLE V

MEAN HIT RATE AS A FUNCTION OF
GROUP AND DISTRACTOR TYPE

| | Distractor Type | | | | | |
|---|---|---|---|---|---|---|
| | Positive | | Negative | | Neutral | |
| | M | S.D. | M. | S.D. | M | S.D |
| Depressed | 99.3% | 2.4 | 96.8% | 5.8 | 98.1% | 7.2 |
| Control | 99.3% | 2.4 | 100.0% | 0.0 | 98.7% | 3.3 |

## Response Latency for Hits

Condition was a significant effect for subjects' response latency for hits, $F(2, 60) = 4.19$, $p < .01$. Duncan's Multiple Range Test for differences between condition means indicated that the mean response latency for hits where a neutral distractor was present ($M = 727.34$) was significantly slower than when a positive ($M = 688.72$) or negative ($M = 688.75$) distractor preceeded the target ($p <$ .01). The Group X Condition interaction effect was nonsignificant, $F(2, 60) = 1.36$, $p < .26$. The group effect was also nonsignificant $F(1, 30) = .81$, $p < .37$ (See Tables 6 and 7)

## False Alarm Rate

Means for all of the cells were between 16% and 18% with one exception; the depressed group obtained a mean false alarm rate of 20% in the negative condition; the Group X Condition interaction effect for the proportion of false alarms was nearly significant $F(2, 60) = 2.40$, $p <$ .09. The main effect for Condition was also nearly significant $F(2, 60) = 2.10$, $p < .13$. Group was not a significant effect, $F(1, 30 = 0.00$, $p < .95$. (See Tables 8 and 9)

TABLE VI

ANOVA TABLE FOR RESPONSE LATENCY FOR HITS

| Effect | df | F | p |
|---|---|---|---|
| Group | 1,30 | .81 | .37 |
| Condition | 2,60 | 4.19 | .01 |
| Group*Condition | 2,60 | 1.36 | .26 |

TABLE VII

MEAN RESPONSE LATENCY FOR HITS AS A FUNCTION OF GROUP AND DISTRACTOR TYPE (in ms.)

| | Distractor Type | | | | | |
|---|---|---|---|---|---|---|
| | Positive | | Negative | | Neutral | |
| | M | S.D. | M. | S.D. | M | S.D |
| Depressed | 711.1 | 140.3 | 698.4 | 144.6 | 762.4 | 177.8 |
| Control | 666.2 | 136.8 | 679.0 | 153.7 | 162.2 | 140.0 |

TABLE VIII

ANOVA TABLE FOR FALSE ALARM RATE

| Effect | df | F | p |
|---|---|---|---|
| Group | 1,30 | 0.00 | .95 |
| Condition | 2,60 | 2.10 | .13 |
| Group*Condition | 2,60 | 2.40 | .09 |

TABLE IX

MEAN FALSE ALARM RATE AS A FUNCTION OF GROUP AND DISTRACTOR TYPE

| | Distractor Type | | | | | |
|---|---|---|---|---|---|---|
| | Positive | | Negative | | Neutral | |
| | M | S.D. | M. | S.D. | M | S.D |
| Depressed | 16% | 16 | 20% | 17% | 17% | 16 |
| Control | 18% | 16 | 17% | 16 | 17% | 16 |

## Response Latency for False Alarms

Some subjects did not obtain any false alarms in one or more of the conditions, therefore, the following analyses are based on unequal numbers of subjects in the six cells. Nevertheless, group membership and distractor type had no effect on the latency for false alarms. The Group X Condition, Group and Condition effects were all nonsignificant, $F(2, 37) = 1.77$, $p < .18$; $F(1, 23) = .01$, $p < .91$; $F(2, 37) = .24$, $p < .79$. (See Tables 10 and 11).

## d'

The Group X Condition interaction effect for d' was not significant, $F(2, 60) = 2.43$, $p < .09$. Neither Condition, $F(2, 30) = 2.72$, $p < .07$ nor Group $F(1, 30) = .05$, $p < .82$ were significant effects. Nevertheless, the pattern of results is consistent with the predicted hypotheses. The type of distractor did not impact control subjects' perceptual sensitivity; the mean d' values for these subjects were all essentially the same. However, it appears that depressed subjects' perceptual sensitivity was

TABLE X

ANOVA TABLE FOR RESPONSE LATENCY FOR FALSE ALARMS

| Effect | df[a] | F | p |
|---|---|---|---|
| Group | 1,23 | .01 | .91 |
| Condition | 2,37 | .24 | .79 |
| Group*Condition | 2,37 | 1.77 | .18 |

[a] Unequal n resulted because some subjects did not have any false alarms.

TABLE XI

MEAN RESPONSE LATENCY FOR FALSE ALARMS AS A FUNCTION OF GROUP AND DISTRACTOR TYPE (in ms.)

| | Distractor Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Positive | | | Negative | | | Neutral | | |
| | n | M = | S.D. | n | M. | S.D. | n | M | S.D |
| Depressed | 15 | 834.0 | 357.4 | 10 | 799.9 | 233.6 | 12 | 735.0 | 216.5 |
| Control | 16 | 697.2 | 137.8 | 10. | 769.6 | 253.6 | 11 | 780.0 | 271.6 |

Note: Unequal n as a consquence of some subjects failing to make false alarm errors.

somewhat decreased by negative words relative to positive words. (See Tables 12 and 13).

## Log Beta

Examination of means indicates that the beta values for both groups across conditions were all similar and are contained within a very narrow range. The Group X Condition interaction effect was not significant, $F(2, 60) = .55$, $p < .58$. The Group or Condition effects were also nonsignificant, $F(1, 30) = 0.01$, $p < .94$; $F(2, 60) = .38$, $p < .68$. Therefore, the criterion was not only unaffected by group membership, the differing distractor types had little effect. (See Tables 14 and 15).

## Word Recognition

Subjects were required to identify the 120 distractor words from a list that included 30 other words. The number of "hits", i.e., correctly identified target words, was compared for depressed and control subjects to see if they differed in accuracy for different types of words. A 2 X 3 repeated measures ANOVA (Group X Word Type) indicated that word type was a significant effect $F(1, 60) = 14.4$, $p < .0001$. Duncan's Multiple Range test for between group means

TABLE XII

ANOVA TABLE FOR d'VALUES

| Effect | df | F | p |
|---|---|---|---|
| Group | 1,30 | .05 | .82 |
| Condition | 2,60 | 2.72 | .07 |
| Group*Condition | 2,60 | 2.43 | .09 |

TABLE XIII

MEAN d' VALUE AS A FUNCTION OF
GROUP AND DISTRACTOR TYPE

| | Distractor Type | | | | | |
|---|---|---|---|---|---|---|
| | Positive | | Negative | | Neutral | |
| | M | S.D. | M. | S.D. | M | S.D |
| Depressed | 2.85 | .80 | 2.61 | .87 | 2.73 | .90 |
| Control | 2.80 | .81 | 2.81 | .82 | 2.79 | .77 |

TABLE XIV

ANOVA TABLE FOR LOG BETA VALUES

| Effect | df | F | p |
|---|---|---|---|
| Group | 1,30 | .01 | .94 |
| Condition | 2,60 | .38 | .68 |
| Group*Condition | 2,60 | .55 | .58 |

TABLE XV

MEAN LOG BETA VALUES AS A FUNCTION OF GROUP AND DISTRACTOR TYPE

| | Distractor Type | | | | | |
|---|---|---|---|---|---|---|
| | Positive | | Negative | | Neutral | |
| | M | S.D. | M. | S.D. | M | S.D |
| Depressed | -.23 | 1.08 | -.27 | 1.04 | -.29 | .94 |
| Control | -.28 | 1.11 | -.34 | 1.02 | -.25 | 1.11 |

for the different word types indicated that subjects correctly identified significantly more negative ($M$ = 12.7) than either positive ($M$ = 9.7) or neutral ($M$ = 8.3) distractors. The Group and Word Type X Group effects were not significant, $F(1, 30) = .45$, $p < .50$; $F(2, 60) = 1.91$, $p < .15$. (See Table 16).

## Comparisons With Clinically Depressed Sample

The clinically depressed group's data were not formally analyzed, therefore the following observations are clearly speculative. This group's performance was only partially supportive of the hypotheses. There were few apparent differences between conditions. However, some of the values generally conformed to predictions. This group's hit and false alarm rates were generally lower than the other groups', suggesting a reduced ability to respond. They also obtained larger log beta values than the other groups perhaps suggesting a more conservative approach. The clinically depressed subjects also had longer latencies on all conditions than either of the other groups. Slowed latencies would be consistent with psychomotor retardation which might be expected given a more severely depressed group. (See Table 17).

TABLE XVI

MEAN NUMBER OF CORRECTLY IDENTIFIED DISTRACTOR WORDS AS A FUNCTION OF GROUP

| Distractor Type | Depressed | | Control | |
|---|---|---|---|---|
| | *M* | S.D. | *M* | S.D. |
| Positive | 8.3 | 5.0 | 11.1 | 5.8 |
| Negative | 12.3 | 6.4 | 13.2 | 4.2 |
| Neutral | 8.5 | 6.4 | 8.1 | 5.7 |

TABLE XVII

MEANS AND STANDARD DEVIATIONS FOR PERFORMANCE MEASURES FOR CLINICALLY DEPRESSED GROUP

| | Positive | | Negative | | Neutral | |
|---|---|---|---|---|---|---|
| | M | S.D. | M. | S.D. | M | S.D |
| Hits | 94% | 4.8 | 96% | 8.0 | 92% | 7.4 |
| False Alarms | 11% | 13 | 13% | 13 | 13% | 16 |
| Latency Hits | 981.6 | 161.6 | 919.4 | 171.0 | 959.0 | 152.9 |
| Latency False Alarms | 918.33 | 174.8 | 1372.5 | 336.5 | 1070.0 | 420.0 |
| D' | 2.83 | .68 | 2.81 | .89 | 2.86 | 1.12 |
| Log Beta | .20 | .92 | -.03 | .63 | .35 | .69 |

# CHAPTER IV

# DISCUSSION

The results of the study suggest that mild to moderately depressed college students' performance on the attentional task is not significantly different from college student controls' performance. There were no significant differences between the two groups on performance measures with both groups easily identifying most target sounds and obtaining a moderate number of false alarms.

The few significant relationships observed in the data were actually a function of the condition and not of group membership. One of the significant differences was for all subjects, regardless of group, to respond least reapidly to targets preceeded by neutral distractors. This suggests that highly affectually charged words may have served as primes that a stimulus was approaching. Thus alerted, subjects responded more rapidly than they did in the presence of a neutral distractor.

The other condition effect observed indicated that subjects recognized more negative than positive or neutral distractor words. This finding is inconsistent with previous research which suggests that normals recognize more positive words and depressed subjects recognize more negative words (Dunbar & Lishman, 1984). Although efforts were made to equate the negative and positive words, perhaps the negative words chosen for this study differed in strength or salience from words used in previous research and therefore all subjects recognized more negative words.

Despite the fact that the two groups responded very differently on measures of depression and anxiety, they failed to differ on either the baseline or experimental signal detection tasks. Therefore, the subjective experience of depression was not reflected in performance on the task. This could indicate that the task has poor discriminability. The extremely high hit rates and relatively small standard deviations in performance measures are evidence that the task might have been too easy and therefore a "ceiling effect" was observed.

One method of increasing the task difficulty and perhaps the discriminability, would be to use a white noise mask. Another way to improve the task would be to shorten the latency between stimuli so that subjects do not have as much time to prepare. Shortened interstimulus intervals would also decrease the probability that boredom is impairing performance.

Making the conditions more different might increase the likelihood of observing differences between depressed and nondepressed subjects. Recent research on the disruption of processing by differing word types has used words which are more specific to the affective state to increase the disruption effect (MacLeod, Mathews, & Tata, 1986) Selecting depressed content words that are specific for each subject might increase the disrupting effect. Similar to the "cocktail party phenomenon" in which people selectively attend to their own name, it may be that by selecting specific concerns for individual subjects the effect would be enlarged. This would also more clearly simulate the phenomenon originally proposed; that is, when people are depressed they may be likely to selectively attend to aspects of their environment that match their current concerns which in turn prevents adequate processing of other information.

Another explanation for the failure to find group differences is that the two groups were not adequately "different" enough on the independent measure. Although the group of depressed college students was clearly deviant in their responding to the inventories relative to their peers, high BDI scores in a college population may reflect maladaptive functioning (Beck, Steer & Garbin, 1988) or general psychological distress (Gotlib, 1984) and not clearly depression. Also, it is unclear just how depressed the college subjects were. Despite the deviant scores on the self report inventories and the generally high ratings on the SADS, it is possible that these subjects were not clinically depressed. The most compelling argument against these subjects being clinically depressed is the fact that these subjects were continuing to function adequately enough to remain in school. Further evidence that they were continuing to function at a high level is the observation that their scores on the abstraction portion of the Shipley Hartford were no different from controls'. Therefore, these subjects' cognitive functioning appears not to have been impaired to the extent often observed during more severe depression. This group may represent some statistically deviant portion of the distribution for whom cognitive functioning remains relatively unimpaired.

Another possible difference between these subjects and subjects with more severe depression is that these students' depressed moods might have been time-limited changes largely determined by current situational factors; these students were assessed during finals week of the spring semester. Therefore, these two factors argue against these subjects having had serious depression. Consequently, large decrements in cognitive functioning might not have been present.

Future studies might more clearly address the effect of anxiety on performance. It was originally proposed that the anxiety scores on the Speilberger would be used as covariates to examine the contribution of anxiety to between group differences. Because the groups failed to differ on performance measures it was not used in this manner. Nevertheless, the data indicate that the depressed group was significantly more anxious than the control group. Although the Beck and Speilberger inventories are known to be highly correlated (Gotlib, 1984) anxiety alone could also disrupt performance on the attention task. Future research should include groups of subjects endorsing anxiety and depression alone to discern differences between these states.

Another important change in the design would be the addition of a control group of nondepressed psychiatric patients to insure that any observed differences do not simply reflect illness. The current study only addresses differences between mild to moderately depressed college students and student controls; the data from the clinically depressed sample is difficult to interpret given the small sample size. Given the current design any differences observed between groups may be nonspecific and simply represent impaired processing by any group with significant pathology.

Although there were no significant group differences, there were some indications that with the above changes group differences in performance might be observed. Nearly significant interaction effects for both the hit rate and false alarm rate were obtained. It appeared that the differing distractors had little effect on the control group's performance. However, the data suggest slight increases in the false alarm rate and slight decreases in the hit rate in the negative condition for depressed subjects. It is possible that depressed subjects could experience a mild disorganization under this condition and that with a better design these might be more evident.

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APPENDIX A

LIST OF DISTRACTOR WORDS

Distractor Words

decorate
safe
hope
scan
charm
haven
star
elate
memo
glee
layer
approve
berate
puncture
tomb
fear
prime
maim
morbid
crisis
suffer
revive
attack
hanger
pure
dive
illness
print
trail
best
cheerful
honest
jail
buddy
genius
kiss
image
cattle
crime

gentle
cruel
beauth
infer
phrase
patch
lazy
glove
jealous
pull
tragedy
chair
leaf
goat
bend
adore
efficient
elbow
oppress
impress
sin
hearse
slope
abuse
perish
disfigure
deaf
critical
boat
praise
paradise
ache
arrest
blind
burn
banish
unfold
smile
ankle

heal
kind
panel
champion
hero
frog
care
fight
vibrant
closet
atlas
help
array
liar
merit
rage
frighten
gear
mark
paralyze
faith
play
calm
motor
press
clean
relax
pave
film
hoist
fat
injury
perch
hit
battle
refresh
bully
meter
bliss

# APPENDIX B

## PROGRAM TO TABULATE PERFORMANCE MEASURES

```
10     Home
20     DIM P(61), S(241), RT(2, 241)
30     LL (1) = 60:LL(2) = 240
40     REM  BEGIN TRIALS
50     FOR I - 1 TO 2
60     PRINT "TO START PROCEDURE, PRESS ANY KEY"
70     POKE - 16368,0
80     GET A$
90     FOR J = 1 TO LL(I)
100    PRINT  :  PRINT "TRAIL # ";J
110    IF PEEK ( - 16285)   128 THEN 110
120    IF PEEK ( - 16285) |  127 THEN 120
130    POKE - 16368,0
140    GOSUB 280
150    RT(I,J) = PEEK (986) + 256 * PEEK (987)
160    NEXT J, I
170    REM SAVE THE DATA
180    HOME  :  VTAH 5:  PRINT "F I N I S H E D"
190    PRINT  :  INPUT  "ENTER SUBJECT NAME:";N$
200    REM  DISK CONTROL CHARACTER
210    D$ = CHR$ (4)
220    F$ = "8." + N$
230    PRINT D$:"OPEN";F$
240    PRINT D$:"WRITE";F$
250    FOR I = 1 TO 2: FOR J = 1 TO LL(I) : PRINT RT(I,J):
       NEXT J,I
260    PRINT D$:CLOSE:;F$
270    GOTO 290
280    POKE 985, 180: POKE 986,0: POKE 987,0: POKE 988,128:
       POKE 98
290    REM
```

```
2       INPUT "CRITERION? (E.G., 2560)":CRIT
10      DIM P(60),S(240), RT(2,240)
20      LL(1)  =  60:LL(2)  =  240
30      REM  READ CATEGORY LABELS
40      FOR I  =  1 to 8:  READ L$(I) : NEXT
50      DATA "TARG DIST POS"
60      DATA "TARG DIST NEG"
70      DATA "TARG DIST NEU"
80      DATA "TARG NONDISTR"
90      DATA "NONT DIST POS"
100     DATA "NONT DIST NEG"
110     DATA "NONT DIST NEU"
120     DATA "NONT NONDISTR"
130     FOR I  = 1 TO 60:  READ P(I):  NEXT
140     FOR I  =  1 TO 240:  READ S(I):  NEXT
150     REM  READ PRACTICE PROTOCOL
160     DATA  8,8,8,4,8,8,8,4
170     DATA 8,8,4,8,8,8,8,8,4,8
180     DATA 8,4,8,8,8,8,8,4,8,8
190     DATA 8,4,8,8,8,8,4,8,8,4
200     DATA 8,4,8,4,8,8,4,8,4,8
210     DATA 8,8,8,8,8,8,4,8,4,8,8
220     REM  READ EXPERIMENTAL  PROTOCOL
230     DATA 8,7,8,6,1,7,6,3,4
240     DATA 8,7,4,8,8,8,8,7,7,8
250     DATA 5,4,5,8,3,5,4,8,1,2
260     DATA 5,8,2,8,2,6,8,8,8,8
270     DATA 4,8,8,8,6,7,4,5,8,2
280     DATA 8,6,5,6,2,1,8,6,8,8
290     DATA 5,8,8,7,8,3,6,4,8,4
300     DATA 4,8,3,4,1,7,4,2,8,3
310     DATA 8,8,1,8,5,8,7,8,3,8
320     DATA 7,1,5,7,5,8,5,7,7,4
330     DATA 8,5,2,5,4,8,5,8,8,6
340     DATA 5,4,5,8,4,8,5,5,5,7
350     DATA 6,8,7,6,8,4,8,5,1,7
360     DATA 3,3,6,8,7,4,8,8,1,8
370     DATA 7,4,5,6,8,7,8,8,3,6
380     DATA 4,8,7,8,6,4,6,7,8,5
390     DATA 8,6,4,5,8,2,5,8,8,8
400     DATA 5,6,8,6,4,8,8,7,4,4
410     DATA 8,7,2,6,7,6,8,8,8,8
420     DATA 4,4,5,2,6,8,4,8,8,8
430     DATA 6,5,4,1,8,6,8,8,5,6
```

```
440   DATA 8,8,8,7,8,8,1,3,8,6
450   DATA 7,8,6,7,7,5,6,8,8,4
460   DATA 8,7,8,4,7,8,6,5,8,6,9
470   INPUT "SUBJECT NAME?":N$
480   F$  =  "E." + N$
490   REM  DISK CONTROL CHARACTER (D$)
500   D$  =  CHR$ (4)
510   PRINT D$;"OPEN";F$
520   PRINT D$;"READ";F$
530   FOR I  =  1 TO 2:  FOR J = 1 TO LL(i): INPUT RT(I,J):
      NEXT J
540   PRINT D$;"CLOST";F$
550   FOR I  =  1 TO 2: FOR J  =  1 to LL(I)
560   IF I  =  2 THEN 590
570   K  =  S(J)
580   GOTO 610
590   K  = S(J)
600   REM  GET # TRIALS FOR EACH CATEGORY
610   KNT(I,K)  = KNT(I,K)  +  1
611   REM  IF OVER TIME LIMIT KEEP A SEPARATE TALLY
612   IF RT(I,J)  |  (CRIT  -  1) THEN LK(I,K)  =
      LK(I,K)  +  1
613   REM  IF WITHIN TIME LIMIT KEEP A SEPARATE TALLY
614   IF RT(I,J)    CRIT THEN SK(I,K)  = SK(I,K)  +  1
615   REM  IF WITHIN TIME LIMIT FINT TOTAL RT
616   IF RT(I,J)     CRIT THEN T(I,K)     T(I,K)  +  RT(I,J)
670   NEXT J,I
680   REM  FIND MEAN RT (MSEC) IN EACH CATEGORY
690   FOR I  =  1 TO 2:  FOR J  =  1 TO 8
691   IF SKI(I,J)  =  0 THEN 694
692   M(I,J)  + INT ((T(I,J)  /  SK(I,J)  *  100  +  .5)
      /  100
694   NEXT J,I
700   PRINT  :  PRINT  "SUBJECT:  ";N$
710   PRINT  :  PRINT "PRACTICE:"
720   PRINT  :  FOR J  =  4 TO 8 STEP 4: PRINT L$(J);"
      MISSES  +  "; LK(1,J);"  RT  =  ";M(1,J);" # PRESSES
      =  ";SK(1,J)
722   NEXT J
730   PRINT "EXPERIMENTAL:"
740   PRINT  :  FOR J  =  1 TO 8:  PRINT L$(J);"  MISSES  =
      ";LK(2,J);"  RT  =  ";M(2,J);"  # PRESS ES  =
      ";SK(2,J)
742   NEXT J
```

# APPENDIX C

## PROGRAM TO CALCULATE D' AND BETA

```
10      TEXT
20      NORMAL
30      C0  =  2.515517
40      C1  =  0.802853
50      C2  =  0.010328
60      D1  =  1.432788
70      D2  =  0.189269
80      D3  =  0.001308
90      DEF  FN L(X)  =  SQR   ( LOG (1  /  (X)  *  X)))
100     DEF  FN N(X)  =  C0  +  C1  *  FN L(X)  +  C2  *  FN
        L(X)  2
110     DEF  FN D(X)  =  1  +  D1  *  FN L(X)  +  D2  *  FN
        L(X)   2  +  D
120     DEF  FN A(X)  =  FN L(X)  -  FN N(X)  /  FN D(X)
130     DEF  FN Z(X)  =  FN  Z(1 - X)  *  (X  |  .5)  -  FN
        A(X)  *  (X   .
140     PI  =  4  *  ATN  (1)
150     K  =  SQR  (1  /  (2  *  PI)
160     DEF  FN  G(X)  =  K  *  EXP (  -  (X  *  X)  /2)
170     DEF  FN R(X)  =  INT  ((X  *  1000)  +  .5)  /  1000
180     DEF  FN  X(X)  =  (X  *  35)  +  140
190     DEF  FN  Y(X)  =  160 - X  *  350
200     HOME
350     HOME
360     INPUT "ENTER HITS PROPORTION";H
370     IF H    0 DR H  |  1 THEN GOSUB 1000:  GOTO 360
380     IF H  =  0 OR H  =  1  THEN GOSUB 2000
390     IF H  =  0 THEN H  =  1  /  (2  *  N)
400     IF H  =  1 THEN H  =  1  -  1  /  (2  *  N)
410     INPUT "ENTER FALSE ALARM PROPORTION  ";F
420     IF F    0 OR 5  |  1 THEN  GOSUB 1000:  GOTO 410
430     IF F  =  0 OR F  =  1 THEN GOSUB 2000
440     IF F  =  0 THEN F  =  1  /  (2  *  N)
450     IF F  =  1 THEN F  =  1  -  1  /  (2  *  N)
460     HOME
470     VTAB 24: PRINT "WORKIN..."
480     Z1  =  FN X(H)
490     Z2  =  FN Z(F)
```

```
500   VTAB 22:  HTAB  1
510   PRINT "HIT PROP.  ":H:
520   BE  =  FN G(Z1)  /  FN G(Z2)
530   HTAB 25
540   PRINT "BETA  =  "; FN R(BE);
550   VTAB 23:  HTAB 1
560   PRINT "F/A PROP.  ":F;
570   HTAB 25
580   DP  =  Z1  -  25
590   PRINT "D PRIME  =  ";  FN R(DP);
600   VTAB 24:  HTAB  25
610   PRINT "LN(BETA)= "; FN R  LOG (BE));
620   GOSUB 5000
630   VTAB 24: HTAB 1
640   INVERSE
650   INPUT "PRESS  RETURN|":X$
660   NORMAL
670   TEXT
680   GOTO 350
1000  PRINT "ALL PROPORTIONS MUST BE |=0 AND   =1"
1010  RETURN
2000  REM  CREATE ADJUSTED PROPORTION
2010  PRINT
2020  PRINT "IF A PROPORTION OF 1 or 0 EXISTS, A"
2030  PRINT "PROPORTION WILL BE ASSUMED BASED ON THE"
2040  PRINT "NUMBER OF TIMES THE STIMULUS WAS"
2050  PRINT "PRESENTED."
2060  PRINT
2070  INPUT "ENTER THE NUMBER OF TIMES THE STIMULUS WAS
      PRESENTED  ";N
2080  IF N    2 THEN  GOTO 2070
2090  PRINT
5000  REM  PLOT ROUTINE
5010  HCOLOR= 7
5020  HGR
5030  HPLOT 0,0 TO 279,0 TO 279,1 59 TO 0,159 TO 0.0
5040  FOR I  =  - 6 TO 6
5050  X1  =  FN X(I):  GOSUB 5300
5060  HPLOT X1,0 TO X1,5
5070  NEXT I
5080  HPLOT 140,0 TO 140,159
```

```
5090  X1  =  FN  X(Z1)
5100  Y1  =  FN Y(  FN G(0))
5110  HPLOT X1,0 TO X1,Y1
5112  Y1  =  FN Y(  FNG(Z1))
5114  HPLOT 140,Y1 TO 279,Y1
5116  FL  =  - Z1 - 4:FH  =  FL  +  8
5120  FOR Z  =  FL TO FH  =  FL  +  8
5120  FOR Z  =  FL TO FH StEP .1
5130  X1  =  FN X(Z  =  Z1)
5140  Y1  =  FN Y( FN G(2))
5150  GOSUB 5300
5160  IF Z  =  FL THEN  HPLOT X1,Y1
5170  HPLOT  TO X1,Y1
5180  NEXT Z
5190  X1  =  FN X(Z2)
5200  Y1  =  FN Y(  FN G(0))
5210  HPLOT X1,0 TO X1,Y1
5212  Y1  =  FN Y(  FN G(Z2))
5214  HPLOT 140,Y1 TO 2/9,Y1
5216  FL  =  -  Z2  -  4:FH  =  FL  +  8
5220  FOR Z  =  FL TO FH STEP .1
5230  X1  =  FN X(Z  +  Z2)
5240  Y1  =  FN Y( FN B(Z))
5250  GOSUB 5300
5260  IF Z  =  FL THEN  HPLOT X1,Y1
5270  HPLOT  TO X1,Y1
5280  NEXT Z
5290  RETURN
5300  IF X1   0 Then X1  =  0
5310  IF X1 | 279 THEN X1  =  279
5320  IF Y1   0 THEN Y1  = N
5330  IF Y1 | 159 THEN Y1 = 159
5340  RETURN
```

APPENDIX D

CONSENT FORM

# INFORMED CONSENT

## Oklahoma State University

I,______________________________, voluntarily consent to participate in a research project which is designed to assess how moods impact people's attention. I hereby agree to participate in this investigation being conducted by Lilly Epler, M.A., under the supervision of Joan Holloway, PhD.

I understand that the interviewer will gather information about me by asking questions about my emotional history, by my completing several questionnaires and a task designed to measure attention.

All the results and information about me will be kept confidential and my name will not be recorded with any of the information. The information about me will only be identified by a code number. Additionally, all data will e reported only by groups. No individual data will be reported.

The main risk in participating in this research is that my identity and facts about my life will be known to the investigator. However, every effort and precaution will be taken to protect my privacy and confidentiality as designated in the Code of Ethics for Psychologists as specified by the American Psychological Association. Another possible risk is that I may be embarassed or uncomfortable when asked about my behavior, feelings, thoughs, facts about my life or medical history. Again, all information will be kept confidential.

The benefits of participating in this study include the knowledge that I hae contyributed to the understanding of the effects of moods on people's thinking processes. Such an understanding might lead to benefits in the prevention, treatment and rehabilitation of individuals who suffer from mood disorders.

Should I experience any adverse effects from this research or if I have any questions, I can contact Lilly Epler, M.A., or her advisor, Joan Holloway, PhD., Department of Psychology, Oklahoma State University, Stillwater, Oklahoma 74078, (405) 624-5975 to discuss these concerns and/or ask questions. If necessary, I will be referred to a qualified psychologist to discuss these problems further.

I have been informed of the risks and benefits and given an opportunity to ask questions. I voluntarily agree to participate in this research. I understand that refusal to participate in this research will involve no penalty or loss of benefits to which I am otherwise entitled. I understand that I will receive two extra credit points and two dollars after completing the measures and that I am free to withdraw my consent to participate at any time but that I will only receive the credit and money upon completion of all measures.

PARTICIPANT'S SIGNATURE DATE EXPERIMENTER'S SIGNATURE

APPENDIX E

DISTRACTOR RECOGNITION SHEET

PLEASE CRCLE THE WORDS THAT YOU HEARD ON THE CASSETTE TAPE

| | | |
|---|---|---|
| FATH | DEAF | HOPE |
| BATLE | PRIME | BEAUTY |
| WCN | EFFICIENT | REVIVE |
| KSS | FRIGHTEN | HEARSE |
| BNISH | HELP | BLIND |
| RFRESH | BERATE | MARBLE |
| LAGE | LEAF | WRENCH |
| UFOLD | ARRAY | HIT |
| ULLY | PUNCTURE | WORRIED |
| OY | GOAT | PAINT |
| ATTLE | GEAR | GENIUS |
| CRUEL | PRESS | BURN |
| FISH | LOVELY | CHAIR |
| BLISS | SHAPE | SMILE |
| STRANGE | WONDERFUL | ARROW |
| GOLVE | DELIGHT | METER |
| SCARED | PRINT | CRIME |
| FIGHT | CRITICAL | PLAY |
| MEMO | PERISH | ATTACK |
| JEALOUS | PURE | BUDDY |
| WIND | CHEERFUL | ANKLE |
| VIBRANT | PARADISE | LAMP |
| BULL | FAT | GENTLE |
| HARSH | AVERAGE | OLD |
| COLD | MORBID | HEAL |
| GLEE | OPPRESS | PANEL |
| PULL | SELFISH | SCAN |
| CLOSET | MARK | INFER |
| LAYER | LIAR | CHAMPION |
| TRAGEDY | FEAR | CHARM |
| ATLAS | ADORE | PHRASE |
| ODD | RATE | HERO |
| RACK | ILLNESS | HAVEN |
| APPROVE | CLEAN | PATCH |
| OVERCOME | DISFIGURE | FROG |
| ACHE | DIVE | STAR |
| INJURY | PAIN | LAZY |
| SLOPE | MOTOR | CARE |
| KIND | ABUSE | BOAT |
| JAIL | HANGER | MAIM |
| PERCH | GEESE | ELBOW |
| SAFE | RELAX | APPLE |
| SIN | TOMB | FUNNEL |
| ARREST | BEND | TRAIL |
| FILM | BLOW | PRAISE |
| BEST | MERIT | HOIST |
| ELATE | CRISIS | HONEST |
| DECORATE | LAWN | DOWN |
| IMPRESS | PARALYZE | PAVE |

VITA

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Doctor of Philosophy

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