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Explicit and implicit memory for affectively valenced material in depression

Denny, Elizabeth Byrd, Ph.D.

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U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

EXPLICIT AND IMPLICIT MEMORY FOR AFFECTIVELY

VALENCED MATERIAL IN DEPRESSION

by

Elizabeth Byrd Denny

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Depressed (n=20) and nondepressed (n=24) subjects' memory for affectively valenced words was assessed with either an explicit test (cued recall) or with an implicit test (word fragment completion). Memory cues were held constant across these test conditions. Under cued recall instructions, depressed subjects recalled significantly more negatively toned than positively toned words, whereas the opposite pattern was observed in nondepressed controls. The differential effect of word valence was absent, however, when memory was tested implicitly, as depressed and nondepressed subjects exhibited equivalent priming of positive and negative words. These data are consistent with Williams, Watts, MacLeod, and Mathews' (1988) model of depression.

Subjects in the fragment completion condition were also given a recognition test. Performance was expected to mirror that in cued recall; however, this hypothesis was not supported. Instead, depressed subjects provided significantly fewer responses overall than did nondepressed subjects. Further, depressed subjects were significantly less likely to produce false alarms to positive than to negative items. Possible reasons for these results are discussed.

APPROVAL PAGE

This dissertation has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Dissertation Advisors ______________________

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Committee Members ______________________

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CHAPTER 1

INTRODUCTION

The last several decades have witnesssed a burgeoning empirical interest in cognitive deficits associated with various psychopathological states. Perhaps nowhere has this been more apparent than in the study of depressive disorders as numerous investigations have examined memory functioning in depression. Johnson and Magaro (1987) and Blaney (1986) provide excellent reviews of the literature in this area.

Of particular relevance to the present discussion are empirical investigations that have measured depressives' memory for affectively laden materials. In general, these studies have relied on a traditional test of memory such as free recall. A key feature of this kind of test is that explicit reference is made to some prior learning experience; and, therefore, conscious recollection is measured. For example, in a typical experimental paradigm, Derry and Kuiper (1981) asked clinically depressed, psychiatric control, and normal control subjects to provide self-referent (does it describe you?), semantic (does it mean the same as a given word?), or structural (does it have small letters?) judgments for a series of depressed- and nondepressed-content adjectives. Immediately following the judgment task, subjects were given an incidental free recall test. Although no within-group differences were observed for words receiving structural or semantic judgments, differences emerged for words receiving self-reference judgments. Depressed subjects evidenced superior recall of self-referenced, depressed-content adjectives relative to the nondepressed-content adjectives. Conversely, nondepressed psychiatric control and normal control subjects evidenced superior recall for self-referenced, nondepressed-content adjectives. The finding that depressives tend to show biased recall of negative material while normal control subjects tend to show biased recall of positive material has been replicated in a number of studies utilizing traditional tests of memory (Bradley & Mathews, 1983; Breslow, Kocsis, & Belkin, 1981; Mathews & Bradley, 1983; McDowell, 1984).

These data appear quite consistent with Beck's well-known model of depression (Beck, 1967; Beck, Rush, Shaw, & Emery, 1979; Kovacs & Beck, 1978). In his model, Beck proposes that depression involves the activation of latent, negatively valenced schemata. These schemata, or knowledge structures, influence the screening, encoding, and organization of incoming information. Although by their very nature schemata are inherently idiosyncratic, Beck suggests that depressive schemata share several common characteristics. Specifically, Beck posits that these schemata contain negative beliefs about the self, the world, and the future. Because negative material is consistent with depressives' current thought processes, richly encoded memory traces result. Thus, from this perspective, negatively biased recall would be expected.

Recently, experimental paradigms have been developed that allow memory for information to be assessed indirectly. Unlike in traditional experimental paradigms, subjects are not asked to recall information; rather, after a study phase, they are asked instead to perform a task such as word fragment completion or stem completion. Memory for information presented in the study phase is measured by comparing performance on those items to performance on new items. This facilitation in performance has been labeled direct or repetition priming (e.g., Cofer, 1967). In contrast to traditional tests believed to measure "explicit" memory, these latter kinds of tasks are thought to measure "implicit" memory, descriptive labels suggested by Graf and Schacter (1985).

In the field of cognitive psychology, research has demonstrated notable performance dissociations when explicit and implicit measures were employed. In other words, a variable may affect performance on an explicit test, and yet exert no apparent influence on performance on an implicit test. For example, in a typical experiment, Jacoby and

Dallas (1981) asked college students to provide either semantic or structural judgments about a series of familiar words, a standard levels of processing manipulation. Following the incidental study phase, memory was assessed by both yes/no recognition, an explicit test, and perceptual identification, an implicit test. In both test conditions performance was enhanced, which indicates the effects of prior experience. However, as expected on the basis of numerous previous experiments involving levels of processing manipulations (e.g., Craik & Tulving, 1975), recognition performance was higher following semantic judgments than structural judgments. Presumably, performance was enhanced for items receiving semantic judgments because relative to the structural task, this type of judgment task induced more elaborative encoding. In contrast, although priming effects were observed, performance on perceptual identification was not affected differentially by type of study task.

The null effect of levels of processing on implicit measures has been replicated in a number of studies utilizing a variety of implicit measures (e.g. Graf & Mandler, 1984; Graf, Mandler, & Haden, 1982; Kirsner, Milech, & Standen, 1983, Expt. 2 & 3). Taken together, these results indicate that implicit memory, unlike explicit memory, is not enhanced by study tasks that induce elaborative processing, although effects of prior experience are clearly apparent. These findings are pertinent to the issue of depressives' memory for affectively valenced material.

When examining depressives' memory for affectively neutral material, recent research has also demonstrated striking dissociations between explicit and implicit measures. For example, Hertel and Hardin (1990) reported dissociations in performance on implicit and explicit tests as a function of induced depressed mood. These authors reported that deficits on an explicit measure (recognition) occurred following depressive induction while performance on an implicit measure (spelling homophones) was not affected by the mood induction procedure. Similarly, Danion, Willard-Schoeder, Zimmerman, Grange, Schlienger, and Singer (1991) reported that compared to that of normal controls, the performance of clinically depressed subjects was severely impaired on a test of explicit memory (free recall), whereas performance on an implicit test (stem completion) was equivalent across the two groups. In both of these cases, the explicit/implicit nature of the test appeared to be a critical factor when assessing memory functioning.

The aforementioned studies utilized affectively neutral material when comparing depressives' performance on explicit and implicit tests. The central focus of the present study, however, involved the question of differential effects of affectively laden material when explicit versus implicit memory tests were employed. It has been shown that Beck's model of depression can easily account for the observed tendency towards enhanced memory for negative material when explicit measures are employed. In contrast, it is exceedingly difficult to derive unambiguous predictions from his theory regarding the effects of affective valence on implicit memory tests. On the one hand, Beck clearly argues that self-schema congruent information receives greater elaborative processing than incongruent information, a position that may be thought of as the "facilitation" version of his theory. On the other hand, at times, Beck appears to assign an even stronger role to schemata, arguing that self-schemata may effectively filter or screen out incongruent information, a position that may be thought of as the "filtering" version of his theory. These two positions result in identical predictions regarding explicit memory, but yield diametrically opposing predictions regarding implicit memory performance.

Beck's first argument would suggest that no implicit memory bias will occur as a function of affective valence. Recall that research with normal subjects has indicated that implicit memory, unlike explicit memory, is not enhanced by study tasks that induce elaborative processing. Thus, although negative material receives greater elaboration by depressives than positive material, this elaboration should not enhance performance on an implicit memory test. In contrast, Beck's second argument, the "filtering" version, would suggest that a negative bias will be apparent when employing implicit as well as explicit measures. If self-schema incongruent information is not processed at all, or in other words, is preattentively filtered, then a negative bias would be expected in implicit memory. As Williams, Watts, MacLeod, and Mathews (1988, Chapter 10) have pointed out, Beck's theory is unclear on the question of where in the processing chain affectively biased processing occurs. However, a theoretical model put forth by Williams and his colleagues does clearly specify the location of biased processing. Because the model developed by these authors allows straightforward predictions to be made concerning the effects of affective valence on implicit memory, a brief overview of their ideas is presented.

Williams et al. put forth an integrative model intended to explain cognitive aspects of depression and anxiety. These authors argue that different pathological mood states (i.e., depression versus anxiety) exert effects on different components in the information processing sequence. In their model, it is proposed that both encoding processes and retrieval processes involve an automatic component and an active strategic component, a proposition consistent with more general theories of memory and cognition (e.g., Hasher & Zacks, 1979; Jacoby & Hollingshead, 1990; Schneider & Shiffrin, 1977).

At the encoding stage, it is assumed that a number of cognitive operations may occur preattentively. Williams et al. further assume that, at this level of processing, a decision mechanism exists that is capable of assessing incoming information on affective dimensions and orienting attentional resources toward or away from that information. In pathological states of anxiety, Williams et al. propose that resources are oriented towards the location of threatening stimuli. This hypothesis is consistent with data showing that incidentally presented threat words interfere with anxious subjects' performance on other tasks such as visual probe detection (MacLeod, Mathews, & Tata, 1986).

In contrast, attentional biases of this sort do not appear to be strongly associated with depression. For instance, in the aforementioned study carried out by MacLeod et al., incidental presentation of depressed content words did not interfere with depressives' performance on the visual probe task. Thus, Williams et al. hypothesize that in depression, the processing bias favoring negative material occurs after the preattentive stages of processing, and instead influences elaboration of the information. In other words, they suggest that depressed individuals tend to react to the output from the preattentive decision mechanism at the elaboration stage. Because additional resources are deployed, negative material tends to be more elaboratively encoded.

Williams et al. also suggest that retrieval from memory involves both an automatic, passive component and a strategic component that is consciously controlled. The automatic component determines which memories merely "come to mind," while the strategic component directs active memory searches. The preattentive stages of processing at encoding discussed above are thought sufficient to influence the automatic stage of retrieval, but strategic processes of retrieval are dependent upon elaborative processes at encoding. Again, the authors point out that some mood states may affect the passive component, while others affect the strategic component. Finally, Williams et al. suggest that explicit memory tests involve strategic retrieval, whereas implicit tests of memory can be accomplished by automatic processes. The suppositions put forth by these authors are certainly consistent with theory and data from studies examining explicit versus implicit memory in normal subjects (i.e., Jacoby & Dallas, 1981; Jacoby & Hollingshead, 1990).

From the assumptions set out in the above theoretical model, one would predict that affective valence will produce a negative bias in recall but no effect on implicit memory of depressives. In a study by Denny and Hunt (1992), this prediction was tested. Clinically depressed female inpatients and nondepressed control subjects were presented with positively and negatively valenced words and asked to perform a self-reference rating task. Each subject then completed both a fragment completion test and a free recall test, given in balanced order. The experimental question concerned the effect of word valence as a function of type of test and subject group. The results indicated that under free recall instructions depressed subjects recalled significantly more negatively valenced than positively valenced words while the opposite pattern was observed in nondepressed control subjects. These results replicate those previously reported in the literature (Bradley & Mathews, 1983; Breslow, Kocsis, & Belkin, 1981; Derry & Kuiper, 1981; Mathews & Bradley, 1983; McDowell, 1984). When memory was tested implicitly, however, the differential effect of word valence was absent. That is, depressed and nondepressed subjects exhibited equivalent priming of positive and negative words.

These results are consistent with predictions derived from Williams et al.'s model of depression. The null effect of word valence when memory was measured indirectly suggests that for depressed and nondepressed individuals, positive and negative information is equally available. Furthermore, the negative bias observed for depressed subjects under free recall instructions supports the notion that unlike positive information, negative information receives deep or elaborative encoding thereby rendering this kind of information more accessible for conscious retrieval. Taken together, these data indicate that depressives' encoding and retrieval processes are influenced by affective information; however, the notion that positive information is screened or filtered out at the encoding stage, as a "filtering" version of Beck's theory might suggest, is clearly unwarranted.

Although these data are consistent with overall predictions derived from Williams et al.'s theory, they cannot speak unequivocally to the authors' speculation about the nature of thought processes in depression. In their theoretical model, Williams and his colleagues suggest that retrieval from memory involves both an automatic, passive stage of "coming to mind" and a consciously controlled, strategic stage. If one could assume that the critical variable affecting performance was the differing instructions, then one might conclude that strategic, controlled processes were responsible for the test dissociation reported by Denny and Hunt. Unfortunately, such an assumption must be tentative because instructions were confounded with another potentially critical variable. In particular, cue support as well as instructions varied across memory task conditions. Unlike in the free recall condition, in the word fragment completion condition, subjects were given word fragments; these fragments could have functioned as cues to "bring information to mind." More specifically, it could be the case that positive words were less likely to "come to mind" than negative words for the depressed subjects in the free recall condition, whereas exposure to the fragments in the fragment completion condition served to increase the availability of the positive words. If indeed the fragments functioned in this manner, then the observed test dissociation should properly be ascribed to the automatic rather than the strategic processes of retrieval in Williams et al.'s theory.

As previously mentioned, the ideas put forth by Williams et al. are consistent with more general notions about memory. Of particular relevance is the "generate/recognize" model recently proposed by Jacoby and Hollingshead (1990). In their model, two bases for memory decisions are postulated, generation and recognition. Generation is thought to underlie performance on indirect tests of memory such as stem or fragment completion, whereas performance on direct tests such as cued recall also includes recognition processes. In terms of the dichotomy set forth by Williams at al. and others, generation may be thought of as an automatic process, and recognition, a strategic process.

In a series of studies, Jacoby and Hollingshead garnered empirical support for a generate/recognize model of recall. In their work utilizing college students as subjects, interactions between test conditions and prior processing were successfully predicted by their model. For example, the probability of providing an "old" word was higher in a stem completion test condition than in a cued recall condition when target words were read earlier than when they were presented as anagrams to be solved. If one conceptualizes the read/anagram processing manipulation as similar to a levels of processing manipulation, these results are not surprising. The idea here is that words that were read, or shallowly processed, received less elaboration than words that were presented as anagrams to be solved. Unlike stem completion, cued recall involves both generation processes and recognition processes; therefore, shallow processing would result in performance deficits because of effects upon recognition processes.

Further, in one study, Jacoby and Hollingshead (1990, Exp. 1) included a generate/recognize condition that was contrasted with the cued recall and stem completion conditions described above. In the generate/recognize condition, subjects were asked to provide recognition memory judgments for words they produced as stem completions, immediately after completion of each stem. The results indicated that requiring a recognition judgment did not affect generation processes as the probabilities of providing target words did not differ across the stem completion and generate/recognize conditions, a finding that further supports the notion of separable effects of generation and recognition.

Statement of Purpose

The purpose of the study was twofold. First, a comparison was made between explicit (cued recall) and implicit (fragment completion) memory for affectively valenced materials in depression. Second, a measure of recognition performance was included to attempt to sort out the relative contributions of generation and recognition processes across tasks.

The results obtained earlier by Denny and Hunt using an explicit measure, free recall, replicated those previously reported in the literature. That is, depressives evidenced a recall bias favoring negatively toned material while nondepressed subjects evidenced a recall bias favoring positively toned material. Conversely, when asked to complete word fragments with the first words that came to mind, ostensibly an implicit memory task, the differential effect of word valence disappeared. Depressed and nondepressed subjects exhibited equivalent levels of priming for positive and negative words. As previously discussed, however, these results are not without interpretive difficulties because both level of cue support and instructions were varied across memory task conditions. Thus, in the present study, cue support was held constant across memory task conditions while instructions were varied.

In this study, depressed and nondepressed subjects were asked first to provide self-reference judgments about a series of positively and negatively valenced words. Then the memory tests were given. In the explicit memory condition (cued recall), subjects were given a list of word fragments and asked to use these fragments as cues to help them remember the list of words presented in the study task. In the implicit memory condition (fragment completion), subjects were asked to complete the fragments with the "first word that comes to mind." After completion of the latter memory task, subjects were asked to identify the fragments completed as words seen in the rating task, a recognition task.

Consistent with previous research, in the explicit memory condition, it was expected that depressives would show enhanced recall of negatively toned words relative to positively toned words. Conversely, nondepressed subjects were expected to show enhanced recall of positively toned words relative to negatively toned words.

These predictions regarding an explicit memory bias were derived from findings from previous research and are consistent with predictions derived from Beck's (1967) model of depression. Similarly, the predicted pattern of results may be interpreted in terms of the model of depression put forth by Williams, Watts, MacLeod, and Mathews (1988). In the latter model, the processing bias favoring negative material in depression is posited to occur after the preattentive stages of processing and influences elaboration. Consequently, Beck's model and Williams et al.'s model yield compatible predictions regarding explicit memory performance.

As previously discussed, potential differences between these two theoretical positions emerged in terms of predictions regarding implicit memory performance. Although the results from Denny and Hunt are problematic in some ways, nonetheless, they do suggest that the "filtering" version of Beck's theory is untenable. In addition, predictions derived from Williams et al.'s model are quite clear-cut. Because these authors posit that preattentive filtering does not occur, a negative bias will not occur. In the current experiment, it was predicted that depressed and nondepressed subjects would exhibit equivalent levels of priming for positive and negative words, in other words, no implicit memory bias. This prediction is consistent with Williams et al.'s theory and the "facilitation" version of Beck's theory.

The recognition measure approximated the generate/recognize condition described by Jacoby and Hollingshead. The recognition data were expected to reveal the following pattern of results. When judging "new" words, depressed and nondepressed subjects were not expected to differ as a function of word valence. When judging "old" words, depressed subjects were expected to recognize more negative than positive words, whereas nondepressed subjects were expected to recognize more positive than negative words. This pattern mirrors the pattern expected in cued recall. However, the recognition task was thought to provide a more stringent test of the hypothesis that the explicit bias is due to controlled recognition processes rather than generation processes. Because differences in generation were not expected as a function of group and word valence on the fragment completion task, an observed performance dissociation between fragment completion and recognition would argue strongly for the contribution of controlled recognition processes to the effects of affective valence in the cued recall condition.

CHAPTER II

METHOD

Design

A comparison between patterns of explicit and implicit memory performance as a function of diagnostic group (depressed versus nondepressed) and word valence (positive versus negative) was of primary interest in the study. However, implicit and explicit performance levels cannot be compared directly in one experiment because of the lack of a common ground on which to scale the dependent variables. Therefore, the study actually consisted of two experiments and involved two independent groups of subjects. One experiment measured explicit memory performance as reflected by cued recall. The other experiment measured implicit memory performance as reflected by fragment completion, and also included a measure of recognition memory. For the sake of simplicity, however, in most subsections of the Method section, this procedural division is not emphasized.

Subjects

Twenty depressed and twenty-four nondepressed women served as subjects in the study[1]. Within each group, subjects were assigned randomly to the two experiments.

Potential subjects for the depressed group were paid $15 and were recruited from several sources which are described below. The following criteria were used to select subjects for the depressed group. First, these subjects received diagnoses of either Major Depression or Dysthymia[2]. Second, they did not qualify for diagnoses of Generalized Anxiety Disorder, Panic Disorder, Panic Disorder with Agoraphobia, Agoraphobia, Social Phobia, or Obsessive-Compulsive Disorder. These diagnostic decisions were based on administration of the Mood and Anxiety Modules of the Structured Clinical Interview for DSM-III-R-Patient Version (SCID-P; Spitzer, Williams, Gibbon, & First, 1988; see Appendix A for a sample of this measure)[3]. Third, these subjects scored 12 or above on the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961; see Appendix B for a sample of this measure). Finally, these subjects had not received electroconvulsive therapy (ECT) during the past three months.

Subjects for the nondepressed control group were recruited from the introductory psychology pool at the University of North Carolina at Greensboro (UNC-G) and received experimental credit for their participation. For this group, the following criteria were used. First, these subjects did not qualify for diagnoses of Major Depression, Dysthymia, Generalized Anxiety Disorder, Panic Disorder, Panic Disorder with Agoraphobia, Agoraphobia, Social Phobia, or Obsessive-Compulsive Disorder[2] based on administration of the SCID-P (Spitzer et al., 1988). Second, they reported having no previous inpatient psychiatric hospitalizations, and no outpatient psychiatric treatment within the past six months. Finally, these subjects scored 9 or below on the BDI (Beck et al., 1961).

Because Williams et al. propose that depression and anxiety exert effects on different components in the information processing sequence, care was taken to insure that the experimental results were not confounded by anxiety. Although the depressed subjects scored significantly higher than nondepressed subjects (see Appendix D; Table 2) on the Minnesota Multiphasic Personality Inventory (Welsh, 1956; see Appendix C), depressed subjects were not included in the study if they qualified for an anxiety disorder diagnosis, as was previously mentioned. However, average correlations of .61 between measures of depression and measures of anxiety have been reported in the literature (Dobson, 1985). Although the selection procedures used in this experiment served to truncate the overall range of anxiety scores, as well as to truncate the within group ranges of depression scores, nonetheless, correlations between depression and anxiety may be of interest to some readers. In this study, when depressed subjects from both groups were combined, a correlation of .34 between BDI scores and MMPI Anxiety Scores was observed, whereas when nondepressed subjects from groups were combined, a correlation of .12 was observed. Neither of these correlations differed significantly from zero (observed p values .14 and .56, respectively; Table 1, Appendix D.)

In this study, the experimenter was not blind to recruitment sources; thus, to avoid suggestions of "experimenter biasing" effects, actual assessments were not carried out until the conclusion of the experimental sessions. In addition, although administration and scoring of the SCID-P is very straightforward, prior to subject inclusion/exclusion, an independent judge who was blind to the experimental hypotheses rated 70% of the written SCID-P protocols. Inter-rater reliability was found to be 100%.

Based on the criteria described above, it was necessary to discard 26 subjects who did not meet the criteria for membership in either group. Most commonly, subjects were discarded because they scored above 12 on the BDI and yet did not qualify for diagnoses of either Major Depression or Dysthymia (n=12). Further, seven of the discarded subjects qualified for concomitant mood and anxiety disorder diagnoses.

As previously mentioned, several methods were used to recruit depressed subjects. The final sample of 20 subjects contained eight who responded to an advertisement in the local paper (see Appendix E), four who were referred through the Psychology Clinic at UNC-G, seven who were referred through other on-going studies in the UNC-G Psychology Department, and one who responded to a notice (Appendix E) posted at the Counseling Center at UNC-G.

The two groups were matched on age and level of education because these variables may be associated with differences in memory functioning. The means and statistical comparisons of these variables are displayed in Appendix D, Table 2. In addition, all subjects were female, native English speakers. Although gender differences have occasionally been reported in the memory literature, the vast majority of studies examining explicit memory for affective information in depression have utilized female subjects only (Blaney, 1986). In view of the primary goal of this study, it appeared prudent to employ a population similar to that utilized in prior research.

Materials

Forty-eight words were selected from those used in previous research measuring depressives' memory for affectively toned materials (Badawi, 1985; Denny & Hunt, 1992; Kuiper, Derry, & MacDonald, 1982). The negative words used were not merely negative in tone, but were also depression-related. The complete word list appears in Appendix F.

Two lists of 24 words were constructed for use in the study task. These lists appear in Appendix G. Each list contained 12 positively and 12 negatively valenced words. Word length and word frequency were equated as a function of valence both within lists and across lists. Assignment of the two word lists was counterbalanced across conditions.

Word fragments. A word fragment with a unique solution was created for each of the 48 words. These fragments appear in Appendix H. Efforts were made to insure that the fragments were of comparable difficulty. For example, the initial letter was provided for an equal number of positive and negative fragments. Further, the ratios of omitted letters to total letters were equivalent for the positive and negative fragments. Finally, these constraints were balanced for the fragments corresponding to the words on each study list.

Study booklets. For use in the study task, booklets were prepared. For each study list, the words were typed in lowercase letters, six words to a page. A 6-point Likert scale appeared below each word, anchored at the lower end with "does not describe me at all," and at the upper end with "describes me very well." A sample page appears in Appendix I.

For each list, two presentation orders were derived randomly with the restriction that no more than three words of the same affective valence appeared in a row. Due to the size of the sample, assignment of presentation orders was incompletely counterbalanced across conditions.

Test booklets. For use in the memory tests, booklets were prepared. Each fragment was typed on a 1 1/2 x 8 inch sheet of paper. For each subject, the fragments were arranged in a randomly derived order with the restriction that no more than three fragments representing the same word valence or study list condition appeared in a row.

Procedure

Subjects were tested individually and were told that the experiment consisted of a number of paper and pencil tasks involving words. They were asked to sign a consent form which appears in Appendix J. First, all subjects engaged in the study phase. Subjects were given word list booklets and were told that the experimenter was interested in judgments people make about words. They were asked to circle numbers on the scales below the words to indicate how applicable the words were to themselves. Subjects were not informed that memory for these words would be tested.

Subjects in the cued recall condition were given booklets containing the word fragments and were asked to use the fragments as cues to help them remember the words from the study task. For each of these subjects, half of the fragments corresponded to the words seen in the study phase. The remaining fragments represented new items, that is, items from the non-studied list. Subjects were told that some of the fragments corresponded to words that did not appear on the studied list. They were told to report a solution only if they were actually able to recall the word from the study list. Subjects were allowed 20 seconds per item for cued recall.

Subjects in the fragment completion condition were also given booklets containing the word fragments. They were told that the experimenter was collecting data regarding the words that people generate to word fragments. They were asked to write the "first word that comes to mind" for each fragment. For each of these subjects, half of the fragments corresponded to words seen in the study phase ("old" items) while the remaining fragments represented items from the non-studied list ("new" items). Subjects were allowed 20 seconds per item for fragment completion. Following the fragment completion task, subjects were asked to circle the completed fragments that they remembered seeing in the study task.

After completion of the memory tests, a short distractor task was given. Subjects read the opening paragraph of F. Scott Fitzgerald's short story, "The Rough Crossing" (1929, uncollected; 1951; see Appendix K) and were asked to guess which body of water the traveler was preparing to cross. This task was included to insure that later assessments would be free of any potential effects induced by the experimental tasks.

Following the distractor task, subjects completed the Beck Depression Inventory (BDI; Beck et al.; 1961) and the Anxiety Scale from the Minnesota Multiphasic Personality Inventory (Welsh, 1956). The experimenter then administered the Mood and Anxiety Modules of the Structured Clinical Interview for DSM-III- R- Patient Version (SCID-P; Spitzer et al., 1988). Debriefing followed. The complete debriefing statement appears in Appendix L.

CHAPTER III

RESULTS

Means tables, analysis of variance (ANOVA) tables, and t-test statistics for all tests performed appear in Appendix D. Thus, unless nonsignificant results are particularly germane to the experimental hypotheses, they are not reported below. A .05 significance level was used in all cases.

Cued Recall

Mean cued recall scores are presented in Table 3. Recall data were subjected to a 2 X 2 analysis of variance (ANOVA) with group as a between-subjects variable and word valence as a within-subjects variable. No main effects were revealed; more importantly, however, a significant Group X Word Valence interaction was detected, $F(1,20)=5.00$, $p<.04$ (Table 4). Because predictions were made a priori, matched one-tailed t-tests were performed. These tests revealed that, as expected, depressed subjects recalled more negative (mean=.62) than positive (mean=.55) words, $t(9)=-2.36$, SEd=.09, $p<.02$, whereas nondepressed subjects recalled more positive (mean=.65) than negative (mean=.56) words, $t(11)=2.58$, SEd=.13, $p<.01$.

A preliminary analysis indicated that the depressed and nondepressed groups differed on level of anxiety, $t(20) = 3.04$, $SEm = 3.02$, $p < .01$ (Table 2), although it must be noted that the clinical significance of the above difference in anxiety scores is highly questionable. When the depressed group's raw MMPI Anxiety scores are converted to T-scores (Dahlstrom, Welsh, & Dahlstrom, 1972), a mean of only 59 results. This score is far below that which is typically considered indicative of clinically significant anxiety (Graham, 1987). Nonetheless, one might ask if the above significant cued recall results could be explained by the observed between-group difference in anxiety. Because the correlations (reported in the Method section; see also Table 1) between depression and anxiety did not attain significance in either group, one may safely dismiss this possibility.

Word Fragment Completion

Word fragment completion data are presented in Table 5. A preliminary analysis revealed no differences in performance on new words; that is, no differences in baseline performance (Table 6). As is standard practice, priming scores were then computed by subtracting the percentage of new fragments completed from the percentage of old fragments completed. These scores were then subjected to a 2 X 2 ANOVA with group as a between-subjects factor and word valence as a within-subjects factor. The results revealed no main effects, and more importantly, as predicted, no Group X Word Valence interaction, $F(1,20)=.08$, $p<.78$ (Table 7). This lack of interaction indicates that priming of positive and negative material was equivalent across groups.

Recognition

Recognition data are presented in Table 8. Because subjects made recognition judgments only for items they completed in the fragment completion condition, recognition scores were conditionalized on the number of fragments completed in each category. Conditionalized recognition data were subjected to 2 X 2 X 2 ANOVA with group as a between-subjects variable and word valence and judgment type as within-subjects variables (Table 9). Not surprisingly, a highly significant main effect for judgment type was detected, $F(1,20)=29.53$, $p<.0001$, indicating that all subjects were more likely to recognize old words (i.e., "hit") than new words (i.e., "false alarm"). Somewhat surprisingly, a main effect for group was also detected, $F(1,20)=8.62$, $p<.008$, indicating that depressed subjects were less likely than nondepressed subjects to indicate recognition of all items. This effect was qualified, however, by an unexpected Group X Word Valence interaction which approached significance, $F(1,20)=3.08$, $p<.09$.

Although further statistical comparisons were inappropriate, informal inspection of the observed pattern of means suggests that the weight of this marginal interaction was due to unexpected group differences on new words, rather than on old words as was predicted.

CHAPTER IV

DISCUSSION

Depressed and nondepressed subjects' memory for affectively valenced material was assessed with both cued recall, an explicit test, and word fragment completion, an implicit test. As predicted, under cued recall instructions, depressed subjects recalled more negatively than positively toned words, whereas nondepressed subjects recalled more positively than negatively toned words. These results replicate previous findings utilizing free recall instructions (Denny & Hunt, 1992) and, more importantly, indicate that depressives' robust tendency to recall negative information under explicit memory instructions is not ameliorated by the presence of positive word fragment cues. In addition, these results are consistent with findings which were reported after this work was begun (Watkins, Mathews, Williamson, & Fuller, 1992). Although there are a number of methodological differences between the current study and that which was reported by Watkins et al., the converging results suggest that depressives' negatively biased explicit memory performance is a function of strategic, controlled processes, rather than automatic processes. This conclusion is consistent with the model put forth by Williams and his colleagues.

Results obtained in the fragment completion condition provide complementary support for this conclusion because, as predicted, depressed and nondepressed subjects exhibited equivalent levels of priming of positive and negative words. Recall that performance on implicit tasks is not thought to be affected by elaborative encoding tasks, nor is it a function of consciously controlled processes at retrieval. Consequently, these results argue that, despite differential degrees of elaboration, recently acquired positive and negative information remains equally likely to automatically "come to mind" for depressed and nondepressed individuals. Although these priming effects were of principal experimental interest, the observed lack of baseline differences also suggests that, a priori, the availability of positively and negatively valenced material did not differ across groups.

A final auxillary point concerning the fragment completion results may be made. In his accompanying commentary, Roediger (Roediger & McDermott, 1992) pointed out that implicit memory results from both Denny and Hunt (1992) and Watkins et al. (1992) evidenced hints of small, albeit nonsignificant, effects which paralleled these authors' explicit findings. These mood-congruent implicit effects ranged in size from 2 percent to 6 percent across experiments and led Roediger to hypothesize tentatively that the small sample sizes in these experiments may have obscured a true interaction between group and word valence. Although it is admittedly quite risky to assign critical empirical weight to nonsignificant findings, it is worth noting that in the current experiment both depressed and nondepressed subjects exhibited a slight memorial advantage for positive words (2 percent and 5 percent, respectively). Therefore, at the very best, these results provide equivocal support for Roediger's conjecture.

To summarize thus far, the results from the explicit test (cued recall) and the implicit test (fragment completion) converge nicely. More specifically, the observed test dissociation supports the notion that depressives' selective memory deficits are a function of controlled, strategic processes rather than automatic processes.

Interpretation of results obtained in the recognition memory condition is more problematic, however. If, indeed, as Jacoby and Hollingshead (1990) have suggested, retrieval from memory involves separable, but temporally dependent, automatic (generation) and strategic (recognition) phases, then logically one would have expected depressed subjects to evidence negatively biased memory when asked to make recognition judgments regarding "old" items that were previously generated. Yet an examination of the recognition scores in Table 12 reveals no hint of within-group differences in correct recognition as a function of valence. As such, these findings neither provide support for the above specific hypothesis nor for the generate/recognize model in general.

Prior to discussing these results in detail, it is interesting to note that Jacoby (Jacoby, Toth, & Yonelinas, 1993) has discarded the generate/recognize model in favor of an independence model of retrieval. Recall that when proposing a dependence model, Jacoby and Hollingshead (1990) successfully used the additive product of stem completion and recognition memory performance to predict cued recall performance. In his more recent work, however, Jacoby (Jacoby et al., 1993) suggests that certain assumptions that Jacoby and Hollingshead made about the nature of their tasks may have been unfounded and may have led to spurious findings. More specifically, he reminds us that stem completion was assumed to represent a process-pure measure of generation, whereas recognition was assumed to represent a process-pure measure of strategic recollection. In reality, stem completion performance could have been contaminated by the involvement of explicit recollection processes. If this hypothesized contamination did in fact occur, then Jacoby and Hollingshead were essentially using a disguised measure of cued recall in order to predict cued recall. As a solution to these difficulties, Jacoby (Jacoby, 1991; Jacoby et al., 1993) has proposed the adoption of a process-dissociation procedure, and thus far, has utilized data gathered under this type of procedure to argue for an independence model of retrieval.

A complete discussion of Jacoby's process-dissociation experimental paradigm and his resultant model is beyond the scope of this manuscript; however, several points may be made concerning the relevance of his above argument to the current findings. First, like Jacoby and Hollingshead, in this experiment, word fragment completion was assumed to represent a relatively pure measure of generation processes. Second, the possibility of contamination of this measure by explicit strategic retrieval processes cannot be ruled out unequivocally. Nevertheless, if contamination did occur, one would not have anticipated the pattern of fragment completion data obtained; instead, one would have expected depressed subjects to produce more negative word completions and nondepressed subjects to produce more positive word completions. Inherent in this argument, of course, is the assumption that the differences observed in cued recall should properly be attributed to differences in conscious, strategic recollection processes.

Although Jacoby's specific criticisms of Jacoby and Hollingshead's work do not appear applicable here, his ideas do suggest a plausible account for the current pattern of recognition data. It may be the case that these data were contaminated by automatic influences of memory. If one seriously entertains this hypothesis, then the observed pattern of data is certainly not surprising.

Before accepting such a conclusion, one must necessarily ask why such contamination might have occurred. One explanation concerns particular aspects of the experimental procedure. Although Jacoby and Hollingshead reported that requiring a recognition judgment after each stem completion did not affect generation processes, the present overall empirical question required a more stringent defense against potential contamination by controlled processes. To this end, subjects in the implicit condition first attempted to complete the 48 word fragments under "first word that comes to mind" instructions. Following completion of this task, these subjects were asked to make recognition judgments. Accordingly, for these subjects, a delay period of up to 17 minutes occurred between generation (fragment completion) and recollection (recognition). In addition, and perhaps more importantly, the retention interval between study list exposure and the explicit memory test differed across the recall and recognition conditions. One might be tempted to argue that this delay period is not of great magnitude, and admittedly, it is not. Studies have shown, however, that on both word fragment completion (Tulving, Schacter, & Stark, 1982) and word identification tests (Jacoby & Dallas, 1981), priming effects tend to persist over time, whereas recognition memory declines. Furthermore, a second point concerning this temporal confound may be made. Given that the delay period did not simply represent a delay, but rather a period in which fragment completion subjects engaged in mental activity, a general form of retroactive inhibition could have played a role in these subjects' later performance. Indeed, one study has shown that both proactive and retroactive interference impair explicit recall and recognition, but do not affect priming (Graf & Schacter, 1987).

The above points suggest that, due to the delay period, recollection may have been more degraded in the recognition condition than in the cued recall condition. Furthermore, it has been shown that automatic effects of memory would be relatively impervious to the aforementioned delay period. If, in actuality, recognition subjects experienced considerable difficulty remembering the items on the study list, nevertheless they could have performed quite credibly by basing their judgments on a sense of familiarity or fluency; in other words, recognition performance may more accurately reflect primary reliance on automatic, unconscious influences of memory, rather than on strategic, consciously controlled processes.

Thus far, this discussion has focused exclusively on the correct recognition results. Based on these results alone, the preceding argument has been shown to be somewhat persuasive. However, one must also consider the errors subjects made, namely, the false alarm data. Examination of the means in Table 12 reveals that both depressed and nondepressed subjects exhibited relatively high rates of false alarms. In other words, all subjects tended to "recognize" words that were not rated during the study task. Does the argument presented provide a suitable explanation for this finding? The answer is a resounding yes. Not only can the argument satisfactorily explain high false alarm rates, but one would necessarily have predicted these data. In this experiment, "new" words were not distractors in the typical sense, rather, they represented new, successfully completed items on the fragment completion test. Therefore, subjects had been exposed to these items, and this prior exposure would been been sufficient to produce a feeling of familiarity when these items were later encountered on the recognition task. If, as hypothesized, subjects were relying on familiarity when making recognition judgments, relatively high rates of false alarms would result.

Further, recall that a highly significant main effect for hits versus false alarms was observed. One might be tempted to suggest that this main effect disarms the above argument. Upon closer examination, however, this counterargument is untenable. First, it has not been suggested that subjects had absolutely no ability to recollect the study list. Instead, it has been proposed that due to the experimental procedure, recollection was degraded. Second, and perhaps more importantly, subjects had been exposed to the old words twice -- once during the study phase and once during fragment completion; exposure to the new words was limited to one occasion -- the fragment completion test. Increased repetition would have increased the availability and familiarity of the old items relative to the new items, and would have resulted in superior "recognition" of old items.

Although overall rates of false alarms can be explained satisfactorily within the preceding framework, this experiment also revealed a marginal interaction involving group and word valence, as well as a main effect for group. As previously discussed, the weight of these effects was due to a group difference on positive false alarms. It is clear that the argument put forth thus far cannot easily explain these results. To aid in the interpretation of these results, it is necessary to turn to extant empirical findings regarding recognition memory in depression.

In contrast to the consistent findings which have been reported concerning depressives' recall, a review of the literature, unfortunately, reveals controversial findings regarding depressives' recognition memory (Calev & Erwin, 1985; Cole & Zarit, 1984; Davis & Unruh, 1980; Dunbar & Lishman, 1984; Hertel & Hardin, 1990; Martin & Clark, 1986; Miller & Lewis, 1977; Silberman, Weingartner, Laraia, Byrnes, & Post, 1983; Watts, Morris, & MacLeod, 1987; Zuroff, Colussy, & Wielgus, 1983). Several studies have revealed a significant effect of depression on correct recognition (Dunbar & Lishman; 1984; Miller & Lewis, 1977; Hertel & Hardin, 1990; Silberman, Weingartner, Laraia, Byrnes, & Post, 1983, Watts, Morris, & MacLeod, 1987) while others have not (Cole & Zarit, 1984; Davis & Unruh, 1980; Zuroff, Colussy, & Wielgus, 1983). For purposes of the present discussion, studies that have examined depressives' hit rates, as well as false alarm rates may be relevant. In addition, only studies utilizing affectively valenced material are reviewed.

Silberman and his colleagues (1983) reported that depression reduced hit rates, but found no effect of depression on false alarm rates. Conversely, Zuroff and his colleagues (Zuroff et al., 1983) reported that hit rates were unaffected by depression, whereas negative false alarm rates were increased. Finally, Dunbar and Lishman (1984) found that depression decreased both hit and false alarm rates. Despite the preceding inconsistent findings, some agreement was reached in the above studies which employed signal detection analysis (Dunbar and Lishman, 1984; Zuroff et al., 1983). In both of these studies, depression was found to affect beta (a measure of response bias), but not d' (a measure of recognition sensitivity). These results suggest that depressives' memory deficits may be a function of response bias.

In the present experiment, subjects made recognition judgments only for items that were successfully completed during the word fragment completion test. Therefore, the proportion of old versus new items was not equivalent across subjects. As a result, a signal detection analysis cannot be carried out on the present data. Nonetheless, one must consider the possibility that the current experimental results may be attributable to response bias. Certainly the cued recall data could be interpreted within this framework, as depressed subjects may have simply been more willing to report negative self-descriptive information than positive self-descriptive information. However, if a response bias were operative, the recognition data are somewhat puzzling. In order to argue for the existence of a response bias, one should be able to demonstrate differential performance, in other words, bias. In the current experiment, a negative bias was evident for depressed subjects when judging "new" words, but not when judging "old" words.

Recall that Zuroff and his colleagues reported that hit rates were unaffected by depression, whereas negative false alarm rates were increased, results which appear similar to the current findings. Thus, a closer examination of their findings may prove informative. First, as Martin and Clark (1986) have pointed out, in all of the Zuroff et al. analyses, positive and negative material was examined separately. Second, in their signal detection analyses, it appears that positive material was omitted from statistical testing. In addition, the means reported by Zuroff et al. reveal that depressed subjects produced more positive item false alarms than did nondepressed subjects, and had lower beta values than nondepressed subjects for both positive and negative items. Taken together, these results suggest that Zuroff et al.'s claim that depressives' preferential memory for negative information results from a response bias is unwarranted. Rather, it may be the case that when faced with a recognition task, depressives adopt a more conservative response criterion, regardless of the affective valence of the material involved.

The results of the current experiment may be consistent with the above hypothesis. It is certainly the case that, overall, depressives were significantly less likely to indicate that they recognized items than were nondepressives. These results are consistent with the notion that regardless of information valence, depressives may adopt a more conservative response criterion. However, it is also the case that the current results suggest that depressives' performance may differ as a function of valence when judgments involve new items. In other words, within the depressed group, new positive material appeared less likely to elicit incorrect recognition (i.e., false alarm) judgments than did new negative material. Because the observed interaction between group and word valence did not attain statistical significance, this must remain an open question and suggests directions for future research.

Although the recognition condition presented a puzzle yet to be solved, the cued recall results were rather clear-cut. In this experiment it was shown that depressives' robust tendency to recall negative information under explicit memory instructions is not ameliorated by the presence of positive word fragment cues. Further, these results suggest that depressives' negatively biased explicit memory performance is a function of strategic, controlled processes, rather than automatic processes.

Results obtained in the fragment completion condition provided further support for this conclusion because, as predicted, depressed and nondepressed subjects exhibited equivalent levels of priming of positive and negative words. Consequently, these results argue that, despite differential degrees of elaboration, recently acquired positive and negative information remains equally likely to automatically "come to mind" for depressed and nondepressed individuals.

Clinical Implications

From the standpoint of the development of clinical theory, as well as the development of effective intervention strategies, an understanding of cognitive processes associated with depression may hold important implications. In particular, the present results suggest that the self-reports of clinically depressed clients are likely to be negatively biased. If one were attempting to assess, for example, rates of pleasant events, assessment data gathered from clients would likely be inaccurate. This suggests the need to involve family members or friends in assessment processes. Further, the results of cued recall indicate that positive information was not recalled by depressives despite the presence of positive cues. Thus, providing homework cues may not be as effective as many therapists assume. Finally, the results of fragment completion indicate that despite an explicit memory bias, positive material is processed by depressed individuals. Although it remains a goal of future research to determine the precise behavioral implications this holds, one could speculate that less directive therapy techniques might be of use when treating depression. For example, although cognitive therapy, a relatively directive approach, has been shown to be an effective treatment, it might be possible to increase compliance by utilizing less directive assignments early in the treatment process.

Suggestions for Future Research

The results of the present study revealed that depressives' robust tendency to recall negative information under explicit memory instructions is not ameliorated by the presence of positive word fragment cues. Further, these results suggest that depressives' negatively biased explicit memory performance is a function of strategic, controlled processes, rather than automatic processes.

Further support for this conclusion was garnered because, as predicted, depressed and nondepressed subjects exhibited equivalent levels of priming of positive and negative words in the fragment completion condition. Consequently, these results argue that, despite differential degrees of elaboration, recently acquired positive and negative information remains equally likely to automatically "come to mind" for depressed and nondepressed individuals.

The results obtained in the recognition condition were much less clear-cut and suggest the need for further research. Although the present data do not support the generate-recognize model of retrieval, these data can be explained by several competing hypotheses. On the one hand, it may be the case that when faced with a recognition task, depressives adopt a more stringent response criterion, regardless of information valence. On the other hand, the observed, marginal interaction between group and word valence suggests that valence may, in fact, affect performance on a recognition memory task. Finally, it may be the case that, due to aspects of the experimental procedure, all subjects relied more heavily on automatic rather than on strategic processes when making recognition judgments.

In future research, several approaches could be used to discriminate between the above alternatives. First, as previously discussed, the design of the present experiment precluded the use of signal detection analysis. Although conflicting results have been reported in the literature when this analysis has been employed, in general, these studies have not also included a measure of recall. Thus, it is not possible to determine if the conflicting results inform us of true variance in depressives' recognition memory, or rather simply represent variance in subject groups, procedures, and/or materials. Because the tendency of depressives towards negatively biased recall appears to be an extremely robust finding, one might use this as a conceptual "standard", or "baseline" when evaluating depressives' performance on other tasks.

A second approach that could be adopted involves the use of Jacoby's process-dissociation procedure (e.g., Jacoby, 1991; Jacoby et al., 1993). As previously discussed, his basic notion is that tasks are not process-pure, and, therefore, comparing tasks is not informative if one is actually interested in underlying processes. In his procedure, a comparison is made between an "inclusion" condition in which automatic and strategic processes produce the same effect, and an "exclusion" condition in which automatic and strategic processes exert opposing effects. Through the use of simple algebra and observed probabilities, it is possible to obtain estimates of the contributions of automatic and strategic processes. One could hypothesize that the recognition task used in the present experiment more accurately represented an "inclusion" condition, and that the absence of an "exclusion" condition necessarily limits interpretation of the data. Further, given the muddled state of the literature concerned with depressives' recognition memory, adoption of Jacoby's approach could prove fruitful.

Finally, the present study is limited in the conclusions that can be drawn regarding the relationship between depression and anxiety. Although depressives' memory performance was of primary interest in this study, a full test of Williams et al.'s model would involve inclusion of clinically anxious, as well as clinically depressed subjects. Moreover, inclusion of dual diagnosis subjects could shed light on the relationship between depression and anxiety.

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NOTES

[1] To determine the sample size necessary to detect the hypothesized interaction between group and word valence in the cued recall condition, an expected effect size was estimated based on free recall data from Denny and Hunt (1992). A subsequent power analysis indicated that 5 subjects per group was adequate to detect this interaction. Differences were possible between free recall and cued recall in terms of magnitude of effect, however. Therefore, this estimate was revised upward resulting in the use of 10 depressed and 12 nondepressed subjects in the cued recall condition.

At the time this research was begun, very few studies of implicit memory in clinical populations had appeared in the literature. Although the results from Denny and Hunt indicated that priming of positive and negative information was equivalent across depressed and nondepressed subjects, it was conceivable that this null finding was due entirely to lack of sufficient power. Hence, prior to conducting a power analysis, it was necessary to posit a meaningful effect size for an interaction between group and word valence in the word fragment completion. Because effect sizes are typically large when utilizing free recall, a medium effect size was deemed meaningful in word fragment completion. The estimate of variance utilized was based on data from Denny and Hunt. Because the variance was slightly less in word fragment completion than in free recall, a subsequent power analysis indicated that 8 per group was adequate to detect an interaction. Again, to be conservative, this estimate was revised upward. Thus, 10 depressed and 12 nondepressed subjects were utlilized in the word fragment completion condition.

[2] Because only one subject in the entire sample qualified for a diagnosis of dysthymia, the results of this experiment apply mainly to Major Depressive Disorder.

[3] Although intended to be compatible with DSM-III-R, the SCID-P does not evaluate symptoms of Post Traumatic Stress Disorder. Therefore, subjects in this experiment were not assessed for the presence of this disorder. Additionally, a priori, it was determined that potential subjects would not be excluded based on a diagnosis of Simple Phobia as it was believed that this disorder was irrelevant in terms of the experimental hypotheses.

Appendix D

Analysis Summary Tables

Table 1

Correlation Analysis: BDI and MMPI Anxiety Scores

Variable	Group	N	Mean	r
BDI	Nondepressed	24	3.9 (2.4)	
Anxiety	Nondepressed	24	9.2 (6.2)	
				.12
BDI	Depressed	20	19.6 (6.0)	
Anxiety	Depresesed	20	18.6 (8.2)	
				.34

(Numbers in parentheses are standard deviations)

Table 2

Means and Two-Tailed t-Test Significance Levels for Demographic and Mood Variables as a Function of Group and Test Condition

	Group		
Test Condition	Depressed	Nondepressed	*p*
Cued Recall			
Age	26.0(9.2)	23.1(4.7)	<.34
Education	14.3(1.6)	14.0(1.5)	<.67
MMPI Anxiety Score	19.1(7.3)	9.9(6.8)	<.01
BDI Score*	20.0(5.5)	4.8(2.5)	<.01
Word Fragment Completion			
Age	29.4(12.4)	22.9(3.9)	<.10
Education	13.8(2.0)	13.9(1.0)	<.86
MMPI Anxiety Score	18.1(9.4)	8.4(5.5)	<.01
BDI Score*	19.1(6.7)	3.0(0.5)	

(Numbers in parentheses are standard deviations)

* Criterion variable, no test performed

Table 3

Mean Proportion Recalled as a Function of Group and Word Valence

	Group	
Word Valence	Depressed	Nondepressed
Positive	.55 (.20)	.65 (.17)
Negative	.62 (.19)	.56 (.11)

(Numbers in parentheses are standard deviations)

Table 4

Analysis of Variance: Proportion Recalled

Source	df	Mean Square	*F* value
Between-subjects			
Group	1	0.00442	0.13
Error	20	0.03469	
Within-subjects			
Valence	1	0.00064	0.04
Valence x Group	1	0.07450	5.00 **
Error (Valence)	20	0.01489	

** $p<.05$

Table 5

Mean Proportion Fragments Completed as a Function of Group, Word Type, and Word Valence

Word Valence	Word Type		
	Old	New	Priming score
Depressed group			
Positive	.52 (.20)	.33 (.17)	.19 (.21)
Negative	.51 (.16)	.34 (.13)	.17 (.11)
Nondepressed group			
Positive	.56 (.17)	.32 (.14)	.24 (.13)
Negative	.51 (.18)	.32 (.18)	.19 (.19)

(Numbers in parentheses are standard deviations)

Table 6

Analysis of Variance: Proportion New Fragments Completed

Source	df	Mean Square	*F* value
Between-subjects			
Group	1	0.00134	0.03
Error	20	0.04107	
Within-subjects			
Valence	1	0.00019	0.02
Valence x Group	1	0.00019	0.02
Error (Valence)	20	0.00789	

Table 7

Analysis of Variance: Proportional Priming Scores

Source	df	Mean Square	F value
Between-subjects			
Group	1	0.00884	0.44
Error	20	0.02002	
Within-subjects			
Valence	1	0.01162	0.34
Valence x Group	1	0.00278	0.08
Error (Valence)	20	0.03446	

Table 8

Mean Conditionalized Recognition and False Alarms as a Function of Group and Word Valence

	Judgment Type	
Word Valence	Correct Recognition	False Alarm
Depressed group		
Positive	.80 (.16)	.25 (.26)
Negative	.79 (.23)	.48 (.36)
Nondepressed group		
Positive	.90 (.11)	.65 (.30)
Negative	.89 (.15)	.64 (.29)

(Numbers in parentheses are standard deviations)

Table 9

Analysis of variance: Conditionalized Recognition and False Alarms

Source	df	Mean Square	F value
Between-subjects			
Group	1	0.78465	8.62 ***
Error	20	0.09105	
Within-subjects			
Valence	1	0.04703	2.04
Valence x Group	1	0.07110	3.08 *
Error (Valence)	20	0.02309	
Judgment	1	2.55860	29.53 ***
Judgment X Group	1	0.18761	2.17
Error (Judgment)	20	0.86658	
Valence X Judgment	1	0.08749	2.00
Valence X Judgment X Group	1	0.07935	1.81
Error (Valence X Judgment)	20	0.04373	

*** $p<.01$

** $p<.05$

* $p<.10$

Appendix E

Solicitation notice

Feeling Sad or Blue?

Paid participants are needed for an on-going study at the Psychology Dept. at UNCG. The questionnaire-type study is concerned with the effects of mood on tasks involving words. If you have been feeling sad or blue recently, are female, and are at least 18, you may qualify. If you qualify, you will be paid $15 for one hour and a half session. Of course, all material will be kept confidential.

Please call 334-5662 and leave your name and phone number for Libby Denny.

Appendix F

Words used in the study, with their frequencies of occurrence per 1,000,000 words[a]

Positive Content	Frequency	Negative Content	Frequency
achieving	14	anguish	8
advancement	11	bitterness	18
affection	22	criticized	8
amiable	2	defeated	10
beauty	68	depressed	10
capable	66	despair	20
cheerful	10	destroyed	31
curious	46	dismal	8
delighted	15	downcast	2
energetic	11	empty	64
exciting	27	failure	93
friendly	61	forlorn	3
glorious	16	gloomy	3
gracious	9	guilty	29
happiness	22	hopeless	14
helpful	29	inadequate	32

(Appendix continues)

jovial	1	inferior	7
kindness	6	jealous	4
loyal	18	lonely	25
orderly	19	melancholy	4
passion	40	oppressed	4
peaceful	26	troubled	23
playful	3	unlucky	2
sociable	1	withdrawn	4

[a] according to Francis and Kucera (1982)

Appendix G

Word lists

List 1	bitterness	achieving
	defeated	affectionate
	downcast	beauty
	failure	curiosity
	forlorn	exciting
	gloomy	gracious
	guilty	happiness
	hopeless	loyalty
	inadequate	orderly
	jealous	passion
	oppressed	playful
	troubled	sociable
List 2	anguish	advancement
	criticized	amiable
	depressed	capable
	despair	cheerful
	destroyed	delighted
	dismal	energetic
	empty	friendly
	inferior	glorious

(Appendix continues)

lonely	helpful
melancholy	jovial
unlucky	kindness
withdrawn	peaceful

Appendix H

Word fragments, with their solutions

__ l __ o m __

(gloomy)

i __ f e __ __ o r

(inferior)

d __ __ i g __ t __ d

(delighted)

l __ n __ __ y

(lonely)

__ e a __ e f __ __

(peaceful)

h __ p __ l __ s __

(hopeless)

d __ __ n c a __ __

(downcast)

j __ __ l o __ s

(jealous)

__ n a __ e __ u a t e

(inadequate)

j __ v __ __ l

(jovial)

__ a s __ i __ n

(passion)

__ n e __ g e __ __ c

(energetic)

__ m __ t y

(empty)

__ __ a u __ y

(beauty)

c __ e __ r f __ __

(cheerful)

c u __ i __ __ i t __

(curiosity)

a c __ __ e v __ n __

(achieving)

__ r o __ b __ __ d

(troubled)

__ p __ r __ s __ e __

(oppressed)

__ __ c i t __ n __

(exciting)

__ n __ u i __ h

(anguish)

__ m i __ b __ e

(amiable)

(Appendix continues)

p __ __ y __ u l

(playful)

g __ __ r i __ __ s

(glorious)

u __ l __ c __ __

(unlucky)

__ e s __ a __ r

(despair)

g __ __ l t __

(guilty)

__ a p __ i __ e s __

(happiness)

__ i t __ d __ a __ n

(withdrawn)

c __ p a __ __ e

(capable)

__ r __ e r l __

(orderly)

b __ __ __ e __ n e __ __

(bitterness)

__ __ r l __ r n

(forlorn)

__ r __ e n __ l __

(friendly)

__ o c __ __ b __ e

(sociable)

d e __ __ __ s __ e d

(depressed)

__ r a __ i o __ __

(gracious)

c __ __ t __ c __ __ e d

(criticized)

__ e l __ __ u l

(helpful)

__ i __ __ a l

(dismal)

f __ __ l u __ e

(failure)

d e __ t __ o __ e __

(destroyed)

__ f __ e __ t __ o __ a t __

(affectionate)

k __ n __ n e __ __

(kindness)

(Appendix continues)

__ d __ a n __ e m __ n __	__ e __ a n __ __ o l y
(advancement)	(melancholy)
l __ __ a l t __	__ __ f e a __ e __
(loyalty)	(defeated)

Appendix I

Sample of Likert form used in the rating task

friendly

1----------2----------3----------4----------5----------6

Does not describe me at all | Describes me very well

capable

1----------2----------3----------4----------5-----------6

Does not describe me at all | Describes me very well

peaceful

1----------2----------3----------4----------5-----------6

Does not describe me at all | Describes me very well

destroyed

1----------2----------3----------4----------5-----------6

Does not describe me at all | Describes me very well

unlucky

1----------2----------3----------4----------5-----------6

Does not describe me at all | Describes me very well

(Appendix continues)

amiable

```
1----------2----------3----------4----------5-----------6

Does not                                     Describes me
describe me                                  very well
at all
```

Appendix J

Consent form

I agree to participate in the present study being conducted under the supervision of Drs. Reed Hunt and Rosemery Nelson-Grey, faculty members of the Psychology Department of the University of North Carolina at Greensboro. I have been informed, either orally or in writing or both, about the procedures to be followed and about any discomforts or risks which may be involved. The investigator has offered to answer further questions that I may have regarding the procedures of this study. I understand that I am free to terminate my participation at any time without penalty or prejudice. I am aware that further information about the conduct and review of human research at the University of North Carolina can be obtained by calling 334-5878, the Office for Sponsored Programs.

Appendix K

Text used in the distractor task

Once on the long covered piers, you have come into a ghostly country that is no longer Here and yet not There. Especially at night. There is a hazy yellow vault full of shouting, echoing voices. There is the rumble of trucks and the clump of trunks, the strident chatter of a crane and the first salt smell of the sea. You hurry through, even though there's time. The past, the continent, is behind you; the future is that glowing mouth in the side of the ship; this dim turbulent alley is too confusedly the present.

Appendix L

Debriefing statement

All subjects:

I'd like to thank you for your participation and mention again that all information you've given me today is confidential. I'd also like to tell you a bit about what I'm studying in this experiment. What I'm really interested in is the relationship between mood and memory for positive and negative information. Since I am in interested in mood, I asked you to fill out two questionnaires that measure mood. I also asked you a list of questions concerned with how you've been feeling.

Previous research has shown that when people feel sad or blue, they often remember bad or negative things. Have you noticed that in yourself? I know I have. Research in this area generally has used memory tasks like free recall. Participants study a list of words and then are explicitly asked to recall the list.

Cued recall condition:

That's what I asked you to do and gave you word fragments to help you remember the words you saw on the rating list.

(Appendix continues)

All subjects:

When recall tests are used, people who feel sad or blue usually remember more negatively toned words while people who are feeling happier tend to remember more positively toned words. Half the folks in this experiment were given a recall test and given word fragments to use as cues to help remember the rating words. The other folks were given an implicit or indirect test. Those folks were given word fragments, but were not told to try to remember the list. Instead, they were told to complete the fragments with the first words that came to mind.

Fragment completion condition:

That's what you were asked to do today.

All subjects:

What I think will happen is that mood state won't have an effect on that type of test. I also asked people to circle the words they remembered from the rating task after they completed the fragments. I wanted to see how well people could remember the words. This research could be important in helping us understand states like depression, as well as normal mood fluctuations. Do you have any questions?

(Appendix continues)

Introductory psychology subjects:

I'd also like to ask that you not discuss the details of the experiment with your friends. Other people will be participating and I'm sure that you can see that if people knew what to expect, their reactions wouldn't be natural. (Credit slips were then given out.) Thanks again.

Community volunteers:

Thanks again for your help. (All subjects were then paid fifteen dollars. Subjects who were not currently receiving treatment were referred to the UNCG Psychology Clinic, UNCG Counseling Center, and Guilford County Mental Health Services.)