Implicit vs Explicit Mood Congruent Memory Bias in Depression.

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Implicit vs explicit mood congruent memory bias in depression

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IMPLICIT VS EXPLICIT MOOD CONGRUENT MEMORY BIAS
IN DEPRESSION

A DISSERTATION

Submitted to the Graduate Faculty of the
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degree of Doctor of Philosophy

in
The Department of Psychology

Submitted by Philip C. Watkins
B. S., University of Oregon, 1980
M. A., Louisiana State University, 1987
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>List of Tables</td>
<td>v</td>
</tr>
<tr>
<td>List of Figures</td>
<td>vi</td>
</tr>
<tr>
<td>Abstract</td>
<td>vii</td>
</tr>
<tr>
<td>Introduction and Literature Review</td>
<td>1</td>
</tr>
<tr>
<td>Method</td>
<td>36</td>
</tr>
<tr>
<td>Results</td>
<td>53</td>
</tr>
<tr>
<td>Discussion</td>
<td>84</td>
</tr>
<tr>
<td>References</td>
<td>107</td>
</tr>
<tr>
<td>Appendixes</td>
<td>129</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1 ..........................................44
Table 2 ..........................................54
Table 3 ..........................................58
Table 4 ..........................................61
Table 5 ..........................................66
Table 6 ..........................................67
Table 7 ..........................................68
Table 8 ..........................................69
Table 9 ..........................................71
Table 10 .........................................72
Table 11 .........................................73
Table 12 .........................................74
LIST OF FIGURES

Figure 1 .........................................19
Figure 2 .........................................35
Figure 3 .........................................51
Figure 4 .........................................52
Figure 5 .........................................58
Figure 6 .........................................59
Figure 7 .........................................62
Figure 8 .........................................79
Figure 9 .........................................81
Figure 10 ........................................83
ABSTRACT

Mood congruent memory (MCM) in depressed individuals, tends to be biased toward memories consistent with their mood, i.e. negative or unpleasant memories. Although MCM is a robust finding (cf. Blaney, 1986), the large majority of studies have used free-recall paradigms, and that methodology does little to delineate the cognitive mechanisms determining MCM. This study was designed to investigate whether MCM bias is a function of implicit or explicit memory. Implicit memory is taken as a measure of the organization or strength of association of the aspects of a memory representation, whereas explicit memory also taps elaboration that may involve control procedures such as retrieval strategies. Thus a comparison of implicit and explicit MCM bias may provide important information about the involvement of the structure of the memory representation, or the involvement of elaboration processes in MCM.

Two groups, a group of clinical depressives and a comparison group, were studied. Each group engaged in an encoding task involving words of varying affective valence. Following this encoding task, all subjects engaged in an explicit memory task (cued recall), and an implicit memory test (word completion). As expected, a
MCM bias was found in explicit memory, however, contrary to predictions, no MCM bias was found in implicit memory. This finding was interpreted as supporting the involvement of elaborative mechanisms in MCM. A second finding showed that MCM was found with depression items but not with physical threat words. Thus, the MCM bias in explicit memory is somewhat specific to information that is congruent with depression rather than to all negativistic information.
Clinical depression is a pervasive and serious affective disorder (Amenson & Lewinsohn, 1979; Lehman, 1971; Miles, 1977; National Institute of Mental Health, 1970). Some have observed cognitive distortions or negativistic automatic thinking to be frequent correlates of depression. Aaron Beck (1963; 1964; 1967) has proposed that this style of thinking is the crucial facet of depression. He submits that emotion and thought are intimately connected and that if one has a maladaptive thought about an event, this thought will result in a maladaptive emotional reaction.

While it is true that negativistic thinking and irrational beliefs have been found to be associated with depression (e.g. Beck, 1967; Buchwald, 1977; Cook & Peterson, 1986; Gotlib, 1981; 1983; Lewinsohn, Larson & Munoz, 1978; Munoz, 1977), it has not been shown that this style of thinking is necessarily a precursor to depression. This aspect of Beck’s theory has been criticized in the literature (e.g. Coyne & Gotlib, 1983). Lewinsohn, Steinmetz, Larson, and Franklin (1981), conducted a large scale longitudinal study to test whether a negative cognitive style may predict clinical depression. Their results showed that
depression-related cognitions occurred concomitantly with depression, rather than before the depressive episode. Other studies supported these results in that cognitive distortions have been found to be the result of depression rather than the cause (Hamilton & Abramson, 1983; Persons & Rao, 1985; Silverman, Silverman, & Eardley, 1984).

Though there is not strong support for negative cognitive distortions as the critical etiological factor in depression, this does not necessarily imply that depression-related cognitions are only symptoms of the disorder. It is possible that while the negative affective state tends to cause these cognitions, these negative thoughts may in turn serve to maintain this emotional state. Research has shown that sad affect can be induced by encouraging a subject to engage negative thoughts such as "I have too many bad things in my life" (Teasdale & Bancroft, 1977; Velten, 1968). Also, the Lewinsohn et al. (1981) prospective study of depression found that the extent of negativistic thinking predicted duration of the depressive episode. Beck has suggested that depression should be treated by teaching the patient to monitor and rebut their negativistic thinking (Beck, Rush, Shaw, & Emery, 1979). This treatment approach has been shown to be very effective (e.g. Rush,
Mood Congruent Memory

Khatami, & Beck, 1975; Kovacs & Rush, 1976) and has fared well compared to antidepressant treatments (Blackburn, Bishop, Glen, Whally, & Christie, 1981; McLean & Hakistian, 1979; Rush, Beck, Kovacs, & Hollon, 1977). While it is true that the effectiveness of cognitive therapy does not necessarily imply that Beck’s notions about the etiology of depression are accurate, it is possible that cognitive therapy may be effective by redirecting the depressed person away from negative thoughts which maintain or exacerbate the depression. Thus, it may be that these thoughts are important depression maintenance factors and this explanation may account for the success of Beck’s treatment with depression.

Information Processing And Depression

While the cognitive therapy approach has claimed alliance with information processing psychology (e.g. Murray & Jacobson, 1978; Mahoney & Arnkoff, 1978), until recently their research bore little resemblance to that of cognitive science. Lately however, the information processing paradigm has been applied to various emotional disorders including depression. Much of this research has been organized around the approach of
Gordon Bower and his associative network theory of memory.

Bower's model (Bower, 1981), which is also known as the "spreading activation model" of memory, contains several basic postulates. First Bower proposes that memory is composed of cognitive networks of associated concepts and descriptive propositions. Thus, various memories are associated with each other, and with descriptive statements about these memories. Secondly, each memory unit (i.e. memory) is composed of a cluster of components entitled "nodes". Bower goes on to submit that "Each distinct emotion...has a specific node or unit in memory" (Bower, 1981, p. 135). These are called "primitive emotion nodes". Each of these emotion nodes is linked with propositions that describe events from an individual's life during which that particular emotion is aroused. These emotion nodes may be activated by many stimuli, either physiological or symbolic-verbal. Further, Bower states that when an emotion node is activated above a threshold level, this node transmits excitation to those nodes where that emotion's specific autonomic arousal and expressive behavior are controlled. Finally, the activation of an emotion node spreads excitement throughout the memory structures to which it is connected, according to Bower.
emotion node will maintain activation of this emotion. When an emotion node is activated this influences which memories will later be retrieved.

**Memory Research in Depression**

One of the predictions of Bower's theory is that recall of information may be dependent on mood. This prediction is an extension of state dependent-learning. Information that is encoded while the subject is in a particular mood (or when this emotion node is activated above a threshold level) will be better remembered when the subject is once again experiencing this mood than a mood not experienced during encoding. This proposed phenomena is called mood dependent recall (MDR). The hedonic valence (pleasant, unpleasant) of the information is irrelevant. All that is required is that the same emotion be present at encoding and recall, and the information received while first experiencing this emotion will be more likely to be recalled than information acquired while experiencing a discordant emotion, regardless of the affective valence of the information.

Generally speaking, research has not supported Bower's prediction of mood dependent recall (MDR). In his 1981 article in the *American Psychologist*, Bower
reported some weak evidence supporting MDR which used a laboratory mood induction procedure involving hypnosis. Many studies investigating MDR have followed Bower in using the laboratory induction of mood, frequently with the Velten (1968) mood induction procedure. In this procedure, a particular mood (e.g. sadness) is apparently induced and the subject is given verbal stimuli to learn. A contrary mood state (e.g. happy) is then induced and new information is given to the subject to learn. Finally, the original mood state is restored and the subject is tested for recall.

A few studies have supported MDR since that time (Bartlett, Burleson & Santrock, 1982; Schare, Lisman & Spear, 1984; Mecklenbrauker & Hager, 1984), but numerous studies have found no MDR (Bower, Gilligan, & Montiero, 1981; Bower & Mayer, 1985; Bower & Mayer, in press; Brown & Taylor, 1985; Gilligan & Bower, 1984; Isen, Shalker, Clark, & Karp, 1978; Johnson & Klinger, 1988; Leight & Ellis, 1981; Schare, Lisman, & Spear, 1984; Wetzler, 1985;). In fact, in Bower's research which originally reported MDR (Bower, Montiero, & Gilligan, 1978), the first two experiments found no MDR. Mood dependent recall (MDR) was found only in experiment three, which involved an interference methodology.
These findings have led Bower (1987, p.453) to conclude that "mood-dependent retrieval using laboratory-induced moods is an evanescent and unreliable phenomenon." Thus, Bower's prediction regarding MDR has not been supported, and there may be other cognitive processes responsible for the few positive findings in this literature.

While the affective valence of the information is irrelevant with MDR, it is of great significance to mood congruent memory (MCM). A second prediction from Bower's theory concerns this latter phenomena. Activation of an emotion node, according to Bower, results also in the activation of semantically congruent memory units associated with this node. Thus, information that is consistent with the activated emotion node is elaborately processed and easily encoded, which results in better learning and recall.

Generally, it can be said that the phenomena of MCM in depression is fairly well established in the literature. Two basic research techniques have been used to investigate this hypothesis both with overall confirmatory conclusions. The first research paradigm involves the laboratory manipulation of mood. In these mood induction studies, several different induction procedures have been used, the most common being
Mood Congruent Memory

Velten's (1968) mood induction procedure. Typically, these experiments induce a particular mood state (usually either happy, sad, or control), the subjects are then presented with some verbal stimuli, and then recall of these stimuli is tested.

Many mood induction studies have been conducted which supported MCM (Bower, et al., 1981; Bower & Mayer, 1985; Bower et al., 1978; Brown & Taylor, 1985; Coleman, 1975; Forgas, Bower, & Krantz, 1984; Mathews & Bradley, 1983; Riskind, 1983; Teasdale & Fogarty, 1979; Teasdale & Russell, 1983; Teasdale & Spencer, 1984; Teasdale, Taylor, & Fogarty, 1980). Only one study using the induction methodology has produced supporting mood incongruence (i.e. information recalled tended to be opposite or inconsistent with mood; Clark, Teasdale, Broadbent, & Martin, 1983), and three studies (Gotlib & McCann, 1984; study 2; Mecklenbrauker & Hager, 1984; Seigal, Johnson, & Sarason, 1979) found no significant MCM effect. In the Clark et al. (1983) study, an unusually long period of time elapsed between the mood induction and the recall task, and it has been suggested (Blaney, 1986; Ingram, 1984) that in nondepressed subjects sadness may decay rapidly and that these subjects may even try to counteract the negative induced mood, hence showing a bias toward positive mood.
incongruent material with longer delays. Also, in two of the three studies where no significant MCM effect was reported (Gotlib & McCann, 1984; Seigal et al., 1979), the trend in these studies was consistent with MCM.

While the volume of mood induction studies supporting MCM seems convincing, there are several notable problems to this experimental paradigm. A number of problems arise out of demand characteristics of the mood induction methodology (Buchwald, Strack, & Coyne, 1981; Perrig & Perrig, 1987; Polivy & Doyle, 1980). First, it is possible that subjects report that the mood induction procedure is effective even when not experiencing negative emotion. A second problem arises out of the potential for cognitive priming. In procedures such as the Velten technique where the subject makes increasingly depressing or positive self-statements, this would seem to prime the subject to encode that information which is consistent with the experimenter's previous instructions. Also, many of these induction procedures not only ask the subject to attempt to experience the desired mood, they also ask the subject to maintain this mood. Thus, in an attempt to maintain the "induced" emotion, the subject may attend to that information which is likely to continue this mood, hence resulting in the mood congruent
Mood Congruent Memory

Finally, in the study of depression, it is hard to imagine that these induced moods are as extensive as those observed in the affective disorders of clinical proportions, or in the occurrence of negative emotions in the everyday life of nondepressed individuals.

A second technique used in the investigation of MCM involves an individual-differences approach in which subjects are divided into groups according to their current depressive level. For example, a group of diagnosed depressed individuals may be compared with nondepressed subjects with regard to recall of information of varying hedonic valence. Once again, the literature is largely supportive of MCM using the individual differences methodology (e.g. Bradley & Mathews, 1983; Dobson & Shaw, 1987; Dunbar & Lishman, 1984; Finkel, Glass, & Merluzzi, 1982; Ingram, Smith, & Brehm, 1983; Kuiper & Derry, 1982; McDowell, 1984). This conclusion should be qualified with several observations. First, most of these studies found that instead of a bias toward remembering negative stimuli, depressives more often showed lower recall of positive stimuli. Thus, it may be that depressives show a lack of the positive bias that is typically found with nondepressed individuals, rather than a tendency for depressives to actually recall more depressive
information than controls. Whatever the case, it still remains that depressives tend to recall proportionally more depressive material than do nondepressed subjects.

Secondly, it is not clear what the exact nature of the MCM bias is. Do depressed subjects tend to recall more depressive information than controls, or is their memory biased toward all negativistic subject matter? Conversely, do nondepressed subjects have a memory bias toward all nondepressed information (including neutral items), or is the bias only with positive material? Thus, a study is needed which includes positive, neutral, depressive, and negativistic nondepressive verbal stimuli.

Finally, MCM is more easily observed when the information is encoded in a self-referent task than other encoding procedures. The self-referent encoding task (SRET) involves asking the subject to rate various adjectives as to whether or how well these words describe themselves (Rogers, Kuiper, & Kirker, 1977). Variations of this methodology either ask the subjects to answer "yes" or "no" to whether the adjective applies to them, or to rate the extent to which the word applies to them on a Likert scale. Some studies (e.g. Clifford & Hemsley, 1987), have found that when a subject rates various adjectives in an task that asks them to apply
the adjective to another individual, no MCM is evident. Thus, a significant problem with this methodology presents itself. The apparent MCM effect may not be due to mood per se, but rather to the bias that depressives say "yes" more often when unpleasant adjectives apply to them, and hence these stimuli are more easily recalled. Thus, more research is needed which uses other encoding tasks in investigating mood biases in memory.

The individual differences experimental methodology presents several additional problems. First, because exposure and recall occur in the same affective state, it is not known whether the MCM bias occurs at encoding, recall, or both. Second, there are many more symptoms of clinical depression in addition to sad affect. It may be argued that the MCM finding is due to other aspects of depression such as neuroticism. However, for the importance of investigating MCM process in depression, this individual differences approach seems to be the preferred procedure as it largely avoids the problems of demand characteristics and cognitive priming discussed earlier.

Perceptual and Attentional Processes

Evidence has been presented supporting the notion that depressives process self-related mood congruent
information faster than controls. The SRET has been used to investigate mood congruent processing by recording the time elapsed between presentation of the query ("applies to you?"), and the subject's response. Not suprisingly, depressives endorse more mood congruent items in the SRET (MacDonald & Kuiper, 1984), and mood congruent adjectives are endorsed more readily than other stimuli (Bargh & Tota, 1988; Kuiper & MacDonald, 1982; MacDonald & Kuiper, 1984; MacDonald & Kuiper, 1985).

The findings on the perceptual effects of sadness are somewhat confusing. Bower (1987, p. 445) states that his theory predicts that "A pleasant mood would prime and lower the threshold for pleasant words - or at least, increase the response bias in their favor - and unpleasant moods should facilitate the identification of unpleasant words."

This prediction is made because when an emotion node is activated, words and concepts associated with this node are easily perceived. Bower (1987) cites several unpublished failures to support this prediction, and other research (Clark, et al., 1983; MacLeod, Tata, & Mathews, 1987), has also failed to support this prediction. Several studies (Gotlib & Cane, 1987; Gotlib & McCann, 1984; Powell & Hemsley, 1984; Small,
1985) have found evidence of mood congruent perceptual bias or at least a mood congruent interference effect, however.

One may begin to sort out these apparently conflicting results by studying the different methodologies used in these investigations. Lexical decision tasks appear to evince no perceptual mood congruent bias (Clark, et al., 1983; MacLeod, et al., 1987), while word recognition (Powell & Hemsley, 1984; Small, 1984) and Stroop interference tasks (Gotlib & McCann, 1984; Gotlib & Cane, 1987) do result in a significant mood congruent effect. Lexical decision tasks ask the subject to decide quickly whether a presented stimulus is an actual English word or not. Thus, words and nonwords are presented for which reaction times (RTs) are recorded. The prediction from network theory is that RTs of mood congruent stimuli should be shorter than those of other verbal stimuli. This prediction however, has not been supported.

Word recognition studies present a word stimulus that is below the threshold of conscious recognition of the subject, and the subject is asked to identify these subthreshold stimuli. The interpretation of the word recognition studies is confounded however, because it is not known whether these studies are indeed testing a
perceptual process, or merely a mood congruent response bias. For example, it is possible that a subject in this paradigm may glimpse a portion of the letters of the presented word (e.g. "inf_r_or" of "inferior") and guess correctly because of a mood congruent response bias. While the mood congruent response bias is of interest and is also predicted by Bower's theory, it does not relate to the effect of mood on perceptual/attentional processes.

The only reliable finding related to the effects of sad affect on mood appear to be from the Stroop interference task (Gotlib & McCann, 1984; Gotlib & Cane, 1987). In this methodology, a number of words are printed in several different colors. In this variation of the Stroop task, the words used are of varying affective valence. The task of the subject is to name the colors of the words as quickly as possible, and response latency is measured. These studies have found that color naming of words printed in various colors was slower for mood congruent stimuli (Gotlib & McCann, 1984; Gotlib & Cane, 1987). This finding is consistent with the predictions of Bower's network theory.

Only a few studies have investigated mood congruent attentional processes in depression. One such study (MacLeod, Mathews, & Tata, 1986) used a new method for
investigating attentional bias. In this procedure, a
dot probe occasionally appeared following the
presentation of a pair of verbal stimuli. These words
differed in hedonic valence. This probe was located in
the space vacated by one the two words, and the subject
was asked to respond to this probe as quickly as
possible. Reaction time (RT) measures were recorded,
and these responses were compared with clinical group
(depression, anxiety, and control) and affective valence
(social threat, physical threat, and neutral) of the
stimuli. The assumption from this design was that if a
subject is allocating most of their attention to a
particular type of stimuli (e.g. social threat), then
reaction times to the dot probe should be faster when
the probe follows this word type. This design has the
advantage of requiring a neutral response from the
subject (pressing a button), therefore, any observed
effect cannot be attributed to a mood congruent response
bias. In this paradigm, network theory would predict
that reactions to probes appearing behind mood congruent
stimuli would be speeded. While this prediction was
supported with clinical anxiety subjects, no attentional
bias was observed with depressed subjects. While this
study used "threat" stimuli, and "threats to personal
self-esteem" would seem to be mood congruent for
depressives, it could be argued that the use of purely depressive stimuli may have produced an attention bias. Also, this study compared threat stimuli to neutral words. Given the apparent asymmetry of MCM cited above, it may be useful to look at positive stimuli as well.

It is possible that depressed subjects may not bias their attention toward depressive stimuli, but rather may direct their attention away from positive items.

Gotlib, McLachlan, and Katz (1988) conducted a study which addressed these issues, and found results similar to that of MacLeod et al. (1986). Mildly depressed college students (scores greater than ten on the BDI) were compared with nondepressed counterparts (less than five on the BDI) on an attention allocation task similar to the MacLeod et al. (1986) design. This study reported similar findings in that depressives did not allocate their attention toward any particular stimuli, while the controls actually allocated their attention to the "manic" or positive stimuli. Thus, it may be concluded that anxious individuals tend to bias their attention toward threat stimuli, nonanxious, nondepressed individuals tend to bias their attention away from threat words and toward positive stimuli, and depressed individuals appear to show no biased attention allocation regarding either threat or depressed words.
Clinical Implications

Several theorists have argued that MCM may be an important maintenance variable in depression. John Teasdale (1983) has written perhaps the most precise version of this theory. He argues that a depressed mood makes negative memories (mood congruent) more accessible for memory retrieval than other information. More probable recall of these memories causes the depressed individual to remain sad which again makes predominantly negative memories more accessible for recall, resulting in a vicious cycle, depression and negativistic thinking. In addition, the tendency for a depressed individual to remember negative events leads to lowered expectations regarding adaptive coping behaviors and to increasingly negative interpretations of their experience, which tends to exacerbate the mood as well. For example, because of MCM, memories of social failures recur, leading to lowered social expectations for this individual, making less likely participation in social reinforcers, and may lead to negative interpretations of their social experiences. This situation is diagramed in Figure 1. If MCM is indeed a critical variable in the maintenance of depression, learning more about this phenomena could lead to improved treatment methods, and perhaps help prevent relapse.
Mood Congruent Memory

Figure 1

Hypothesized relationship between depression, MCM, and avoidance of adaptive behaviors

LOWERED EXPECTATIONS RE: OUTCOME OF COPING BEHAVIORS

INCREASED RECALL OF NEGATIVE EVENTS

DEPRESSION

AVOIDANCE OF EFFECTIVE COPING BEHAVIORS (e.g. social reinforcers)
The Process of Mood Congruent Memory

Earlier it was shown that in the case of sadness/depression, MCM as investigated by free recall methodologies, is a reliable and robust finding. However, very little is known about the variables which determine this phenomena. While Bower's associative network approach and self-schema theory have been used as an explanation, empirical data relating to the underlying process of the MCM effect are currently lacking. It is apparent that many processes operate in free recall, and therefore other procedures may be needed to investigate what is responsible for MCM. Mood congruent memory may be explained by several processes. It is possible that MCM is due to perceptual or attentional biases on the part of the depressed individual. Secondly, encoding processes may be involved in MCM. Retrieval strategies may also account for depressed individuals recalling more negative material. Of course, it is also possible that combinations of these processes contribute to MCM. In the following paragraphs, each of these possibilities will be explored.

It is possible that the depressed patient biases his or her attention toward mood congruent stimuli. It may be that the depressed person allocates attention to
mood congruent stimuli, therefore rendering them likely to be encoded in memory. However, as discussed above, it does not appear that depressives evince an attentional bias. In addition, MacLeod et al. (1986) could find no relationship between RT to the various word stimuli (including socially threatening words), and later recognition performance with these same stimuli. Therefore, evidence to date does not appear to support attentional bias as an explanation for MCM.

A second, perhaps more likely, possibility involving attentional bias in depression is that mood congruent stimuli distract the depressive from learning other mood incongruent information. This suggestion is consistent with the findings reviewed above that depressives named the colors of mood congruent words slower in a Stroop task. It is possible that these mood congruent stimuli distract the depressive, thus rendering the encoding of other information less likely.

Cognitive processes related to encoding processes may also relate to MCM. Mandler (1980) has suggested that encoding may involve two processes, integration and subsequent elaboration. This suggestion has arisen out of research findings with amnesic patients. Various researchers have found that the behavior of amnesics may be influenced by performing a previous task, even if
they cannot remember that they performed the task, let alone the details of the event. This phenomenon has been observed with several different tasks, for example, writing the mirror image of a word. A typical experiment of this sort may involve having amnesics practice writing the mirror image of various words. In subsequent mirror writing tasks, these subjects will write words faster if they are words to which they have been exposed previously in this task. Amnesics show this advantage, even though they report that they cannot remember practicing writing these mirror images earlier (cf. Squire, 1987).

Parallel results have also been demonstrated with normals (cf. Jacoby & Witherspoon, 1982). The ability for a task involving the study of some stimuli to affect subsequent behavior, even though the subject may not explicitly recall the task, has been called implicit memory. Memory that is directly accessible to conscious recollection has been called explicit memory. Henceforth in this paper I will refer to these two forms of memory in this manner. They have also been labelled procedural and declarative memory (Cohen, 1984; Squire, 1983), reference and working memory (Olton, 1983), expectancy and data based memory systems (Kesner, 1980), and this distinction has also been related to Tulving’s
(1972) division between semantic and episodic memory. Generally speaking, these theories differ as to how independent the theorists view these two memory systems (cf. Jacoby & Witherspoon, 1982).

This effect of memory without awareness led Mandler (1980) to propose two distinct encoding processes, integration and elaboration. Integration is assumed to be an automatic process, which involves the activation of a schema or memory structure. This process is assumed to be modality specific (e.g. auditory or visual), and tied to the physical features of the perceived information. Because of the schema's internal organization, mutual activation occurs among the schema's components. This activation produces further strengthening (or integration) of the internal organization of the schema. Thus, according to Mandler, integration relates to the actual structure of the memory representation. Activation, and subsequent integration make a schema "more accessible in the sense that it will come to mind more readily when only some of its features or components are presented" (Graf & Mandler, 1984, p. 554). Thus, a well integrated schema will be more likely to be activated if some of its components are presented to a subject. For example, if "loser" is a well integrated word schema for a subject,
the presentation of "lo" will likely activate the entire word, "loser".

While integration is assumed to be an automatic process, elaboration is presumed by Mandler to occur subsequent to integration and is subject to control processes. In cognitive psychology, control processes involve what information the subject decides to process, and how the subject decides to process this information. Generally, cognitive elaboration is seen as the extent and degree of cognitive analysis that information receives (Craik & Tulving, 1975). According to Mandler, elaboration, which involves relating the occurrence of a word schema to its context, provides associations to related words and concepts. Elaboration is not modality specific or tied to the physical features of the stimulus as is integration. While activation and integration increase only the accessibility of a schema, elaborative processing increases both accessibility and retrievability. Hence the relation of integration to implicit memory, and elaboration to explicit memory.

Free recall data tell us little about the internal structure of the emotional information. It is possible that mood congruent information in depression is structured like other memory representations but is much
more elaborated. According to Mandler’s framework, the MCM bias with free recall in depression provides us with no information regarding the integration or internal strength of mood congruent memory representations. Thus, a test of implicit memory bias in depression would provide valuable information as to the internal structure of depressed congruent memory representations.

As stated above, Mandler has suggested that integration is an automatic process, whereas elaboration is affected by control processes. Theories explaining MCM such as Bower’s (1981), strongly imply automatic processes. However, it is possible that strategic elaborative processes may be involved in MCM. It is possible that depressives may use some controlled strategy in encoding stimuli that leads to a recall advantage for mood congruent information. It has been found that free recall (as well as cued recall and word recognition) are enhanced in semantic encoding conditions, whereas semantic versus nonsemantic encoding conditions has no differential effect with implicit memory (Graf & Mandler, 1984; Mandler, Graf, & Kraft, 1986). In addition to depth of processing, retention interval, and modality of study-presentation also show a different pattern of results in explicit versus implicit memory (Graf & Schacter, 1987; Greene, 1986). These
findings lend credence to Mandler's proposal that activation and integration are relatively automatic, while explicit memory is subject to strategic elaborative processes. Thus, it is possible that MCM is due primarily to strategic elaborative processes and has little to do with the internal structure of the emotional memories.

Evidence exists to indirectly support this suggestion. As noted above, if the subject is encouraged to relate the stimuli to him or herself, the MCM effect was more likely to be found. If MCM is operative in maintaining clinical depression and self-related encoding is required, then it must be posited that depressives tend to excessively relate stimuli to themselves. This process is similar to Beck's suggested cognitive distortion of personalization (Beck, et al., 1979), and internal attributions suggested by Seligman's reformulated learned helplessness theory of depression (Seligman, (Abramson, Seligman, & Teasdale, 1978). In Lewinsohn's recent integrative theory of depression, self-focused attention is also afforded an important role (Lewinsohn, Hoberman, Teri, & Hautzinger, 1985). Limited research (Ingram, Lumry, Cruet, & Sieber, 1987), has supported the notion that depressives are more given to self-focused attention. Thus, it may be that both
depressed individuals and subjects who have been induced to feel sad are likely to encode items in a self-referent manner. This proposal implies that depressives often elaborate mood congruent information, but does not necessarily imply any differences in the integration process itself.

If Bower's proposals are correct, then one would expect that the individual in whom mood has activated congruent memory structures, many associations would be produced with mood congruent stimuli. If the depressed individual does produce these mood congruent associations due to spreading activation, then these associations should benefit not only encoding but recall as well. Thus, it is possible that the MCM effect is due primarily to a retrieval bias and may have little to do with encoding.

Ingram (1988) has argued that studies which use incidental recall paradigms (such as the SRET) test automatic processes in memory. He argues that MCM found in incidental recall studies indicates an automatic encoding process because the subject is not told at encoding that they will later be asked to recall the information. However, Ingram ignores the possibility of retrieval biases that may be unrelated to encoding biases. In fact, evidence presented by Anderson and
Pichert (1978), indicates that retrieval processes may be independent from encoding processes. In this study, subjects were asked to read a story that involved the description of a home from either the perspective of a home buyer, or a burglar. After asking the subjects to recall the story once, they were asked to recall the story a second time from the perspective other than the one in which they had read it originally (home buyer or burglar). Results showed that upon second recall, subjects reported information not previously recalled, and this was information important to the second perspective. In addition, they also recalled less information that was important to their original perspective.

This finding suggests that it may be inappropriate to conclude that results from incidental recall paradigms are reflective of automatic processes. Evidence suggests that implicit memory is not affected by a shift of perspectives at recall as explicit memory appears to be. Thus, a comparison of implicit and explicit memory bias in depression would also lend information important to the issue of retrieval strategies in depression.
Some have suggested that MCM is due to mood congruent stimuli being unusually frequent stimuli for depressives. For example, words like "depressed", "sad", and "loser", are stimuli both heard and used frequently by these subjects. However, if MCM were due to individual differences in word frequencies, one would not expect to find MCM in normals with induced sadness. As reviewed earlier, MCM has been established with nondepressed individuals who have been induced to feel sad. Also, if individual differences due to word frequency accounted for MCM, one would not expect to find MCM with diurnal variations of mood, and one would expect to find MCM in remitted depressives. Clark and Teasdale (1982) found that depressives tended to recall more unpleasant memories when they were more depressed, and Dobson and Shaw (1987) found that the pattern of MCM memory changed upon remission of depression. Thus, the available evidence does not support a word frequency hypothesis for MCM.

Problem

As argued above, data regarding the mechanisms which account for MCM in depression is lacking. The purpose of this study was to investigate implicit versus explicit memory bias in depression, and in this way
investigate both the structure of emotional information in depression (via integration), and the role of control processes in MCM such as encoding or retrieval strategies. This study provides needed information as to the processes involved in MCM associated with depression.

This study compared two groups of individuals, a group of depressed individuals, and a non-depressed control group. All subjects were exposed to a set of words of varying affective valence (positive, neutral, depressed, and physical threat). As suggested earlier, inclusion of positive, neutral, depressed, and negative-nondepressed verbal stimuli would aid in determining the exact nature of MCM in depression. Physical threat subject material (e.g. ambulance, coronary, stab, pain), was considered to be negative-nondepressed information. Subjects engaged in a modified SRET with these stimuli that followed the design of Mathews, Mogg, May, and Eysenck (1989). In this SRET variation, all subjects were instructed to imagine themselves in a scene which involved each word. Following this encoding task, subjects participated in a choice RT task. This purpose of this task was to separate the experimental tasks of interest. Then all subjects engaged in either a cued recall (CR) task, designed to test explicit memory, or a
word completion task. The order of CR or word completion was counterbalanced. In the word completion task the subject was asked to complete a three letter word stem with the first word that came to mind. This procedure has been used as a test of implicit memory (e.g. Greene, 1986; Graf & Mandler, 1984; Mandler Graf, & Kraft, 1986). This is a test of implicit memory because there are no explicit instructions to recall study items, but subjects typically complete the letter stems more frequently with studied items than with non-studied (unprimed) words. Thus, in Mandler's (1980) conceptualization, words that are completed in this task are the most accessible, and hence better integrated, at the time of testing. Half of the letter stems in this task were from words to which they had been exposed in the SRET (primed condition), and half were the first letters from words to which they were not exposed (unprimed condition). The unprimed condition was included to control for response bias.

Following another filler task, all subjects engaged in the alternate memory task, either word completion or cued recall. Thus, the design of this study was a 2 (subject groups) x 4 (affective valence of verbal stimuli) x 3 (type of memory test) mixed design. This
The predictions of this study are listed below.

**Hypothesis 1:** It is predicted that depressives will recall proportionally more negative words than a control group in the cued recall task. This finding is predicted because of previous findings of explicit memory bias in depression. Because explicit memory involves both integration and elaboration, the results of the explicit task alone cannot determine the extent of involvement of these two processes in MCM.

**Hypothesis 2:** It is predicted that depressives will complete proportionally more mood congruent word stems from a list to which they had been previously exposed in an encoding task than will control subjects. However, it is predicted that depressed individuals will not differ from controls in their completion of mood congruent letter stems from a list of words to which they had not been exposed. This finding would indicate that the structure of mood congruent memory representations is more organized and more easily activated than non-mood congruent schemata. Also, this finding would rule out a retrieval strategy or bias as the sole variable accounting for MCM.
Because the there were two different types of memory involved, separate ANOVAs were calculated for explicit and implicit memory. For explicit memory, an interaction between group and valence is predicted. For implicit memory a three way interaction between group, test, and affective valence is predicted. A three way interaction would indicate that the memory tasks had a differential effect with group and affective valence of the verbal stimuli. If, it is found that the depressed group remember more negative words in the cued recall (explicit) condition, but not in the word completion (implicit) condition, this pattern of data would imply that the mood congruent stimuli are the better elaborated, but not necessarily better integrated than are other words. Thus, this finding would suggest elaboration as the important mechanism in MCM. If however, it is found that depressives recall proportionally more negative words in the word completion but not in the cued recall condition, this pattern of data would indicate that mood congruent stimuli are better integrated but not necessarily better elaborated for depressives. This result would suggest that the structure of the mood congruent information may be primarily responsible for the MCM effect. Although this is the result found in the Mathews et al. (1989)
study with anxiety subjects, this would be an unlikely finding. Because explicit memory is a reflection of both integration and elaboration, integration should enhance explicit and implicit memory. Thus, one would not expect to find an enhancement of implicit memory without an enhancement of explicit memory as well. If an implicit memory bias is found with depressed subjects but not with controls, then an additional cognitive mechanism must be posited (e.g. cognitive avoidance), to account for the lack of an explicit memory bias.

Hypothesis 3: Finally, it is predicted that the depressives will respond proportionally faster to mood congruent stimuli in the encoding task. According to Bower, mood congruent concepts (in this case depressive related events and concepts) have subthreshold activation, and thus imagining scenes related to these congruent stimuli should be proportionally faster. It should be noted, that this hypothesis is not crucial to the basic purpose of this study.
FIGURE 2

GROUP

Depression  Comparison

Cued recall

Primed word completion
Unprimed word completion

MEMORY TASK

Positive

Neutral

Depressed

Physical Threat

DV: number of correct recall
METHOD

Subjects

Two experimental groups were used in this study. The experimental group consisted of individuals with a primary diagnosis of unipolar depression, i.e. subjects as major depression or dysthymia. This group was composed of 17 subjects. The diagnosis of depression was confirmed through clinical interview (Schedule for Affective Disorders and Schizophrenia; SADS), and administration of the Beck Depression Inventory (BDI). Individuals in this group met the criteria of a BDI score above 19. Also, these individuals met the diagnostic criteria for either dysthymia or major depression as defined by the Diagnostic and Statistical Manual of Mental Disorders, the third revised version (DSM-III-R; American Psychiatric Association, 1987). All diagnoses were confirmed by a licensed psychologist. In addition, if subjects were not interested in treatment, they were excluded from the study. Four subjects who met the diagnostic criteria for unipolar depression were not interested in treatment and therefore excluded.

The comparison group was recruited from the campus at Louisiana State University. This group also consisted of 17 individuals. No subjects in this group
were experiencing any axis I DSM-III-R psychiatric disorder. Thus, the clinical interview served to exclude any other psychiatric diagnoses. Also, any individual with a BDI score greater than seven was excluded from this group. Finally, this group was formally matched to the experimental group for gender, age (± three years), and verbal intelligence (± .5 s.d. via the Shipley Institutes of Living scale).

The two groups were compared by analyzing verbal intelligence and age separately with ANOVA to delineate any group differences. As seen in Table 2, no differences were found between the two groups in verbal I.Q., F(1,32)=1.79, p=.19, or age, F(1,32)=0.00, p=.97. Of course, significant group differences were found in the BDI, F(1,32)=148.47, p<.0001, and other state and trait measures used in this study (see Table 2 for a listing of means and significant differences).

Materials and apparatus

**Clinical Measures**

*Beck Depression Inventory (BDI; Beck, 1978).* This instrument has extensive normative data and therefore is a valuable instrument to assist in diagnosing depressive disorders. Psychometric data on this instrument are good. Item-total correlations range from .31 to .68,
and Spearman-Brown corrected split-half reliability has been reported at .93 (Beck, 1972). Test-retest reliability for nonclinical populations is also satisfactory (.75; Miller & Seligman, 1973), and as expected are somewhat lower for patient populations (.49 after three weeks; May, Urquhart, & Tarran, 1969). Correlations with other depression scales are generally good, and the BDI has been found to be sensitive to clinical change as well. This instrument is found in Appendix A.

Schedule for Affective Disorders and Schizophrenia (SADS; (Endicott & Spitzer, 1978). This interview scale was based on the Research Diagnostic Criteria (RDC; Spitzer, Endicott, & Robins, 1975; 1978), which is quite similar to the criteria presented in DSM-III. This scale is valuable in that it covers the symptom content of depression comprehensively, and has been used extensively in depression research studies. Psychometric data are available on eight summary scales derived from the SADS (Endicott and Spitzer, 1978). These subscales have been titled: 1) depressive mood and ideation; 2) endogenous features; 3) depressive-associated features; 4) suicidal ideation and behavior; 5) anxiety; 6) manic syndrome; 7) delusions-hallucinations; and 8) formal thought disorder.
Cronbach alphas for the eight subscales range from .47-.97. With the exclusion of the formal thought disorder scale and the anxiety scale all alphas were above .79. Thus, internal consistency is adequate for the scales important for diagnosis of depression. Inter-rater reliabilities had interclass correlations of .82 to .99. Test-retest reliabilities at one week ranged from .49 to .93. Once again, all scales but the formal thought disorder and the anxiety scales had test-retest reliabilities above .78. One may refer to this instrument in Appendix B.

Visual Analogue Scale (VAS; Aitken, 1969). This scale is a relatively brief scale, yet has psychometric properties comparable to longer scales (e.g. Davies, Burrows, & Pyton, 1975; Zeally & Aitken, 1969). It consists of a 100 mm. line with "normal mood" at one pole and "extreme depression" at the opposite end of the line. The subject simply marks where he or she is feeling at the moment on this line. An example of this measure is found in Appendix C.

Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971). This measure provided additional mood state information. It consists of 65 adjectives which are rated on a 5-point likert type scale. Factor analysis of responses to these adjectives has yielded
six scales: 1) tension-anxiety, 2) depression-dejection, 
3) anger-hostility, 4) vigor, 5) fatigue, and 6) 
confusion. The two scales of interest in this study are 
the tension-anxiety (T) and the depression-dejection (D) 
subscales. This measure has also been found to have 
adequate psychometric properties. Internal consistency 
scores (via the Kuder-Richardson-20) are above .90 for 
both the anxiety and the depression subscales (.92 and 
.95 respectively). Test-retest reliability ranges from 
.70 (T) and .74 (D) for 20 days, to .51 (T) and .47 (D) 
for six weeks. The POMS has been shown to be sensitive 
to clinical change (e.g. Lorr, McNair, Weinstein, 
Michaux, & Raskin, 1961). Also, this measure has been 
shown to change in various mood induction studies (e.g. 
Pillard & Fisher, 1967). Further, the various subscales 
of the POMS have been shown to correlate with other 
related measures. This scale is shown in Appendix D.

Eysenck Personality Questionnaire (EPQ; Eysenck & 
Eysenck, 1963). This measure served as the trait 
measure in this study. The factor of Neuroticism is a 
trait related to anxiety and depression. Although this 
measure contains three clinical scales, only the 
neuroticism scale (N) was used in this study. Internal 
consistency of the subscales of the EPQ is adequate, 
ranging from .74-.85 (N=.84). At an interval of one
month, test-retest reliabilities range from .51 to .90, with most groups scoring in the .80 to .90 range. Further, the authors of this test have shown that N is related to variables that are similar to the construct of neuroticism. The reader may refer to this inventory in Appendix E.

Shipley Institutes of Living Scale (Pollack, 1942)
This scale has been used extensively for screening verbal intelligence and has been found to be an adequate measure for this purpose (Prado & Taub, 1966). Validity data for this measure are also presented in Pollack (1942). It is a pencil and paper instrument which yields a vocabulary score and an abstraction score. The vocabulary score was used as a measure of verbal intelligence. A copy of this instrument is presented in Appendix F.

Verbal Stimuli
These stimuli were gathered from various sources in the literature (e.g. Derry & Kuiper, 1982; Gotlib, McCann, & Katz, 1988; Mathews et al., 1989) and were intended to represent depressive/sad congruent, physical threat, neutral, and positive affective valences. These stimuli were then normed with 50 undergraduate students at Louisiana State University. These students made
qualitative judgments on each word as to whether they were depressed, neutral, or positive. Depressed words were defined as words the subjects associated with unpleasantness, and they were instructed that words which involved threats to self-esteem or emotional well being should be rated as depressed as well. Positive stimuli were defined as being words of a pleasant nature, and neutral words were words that were neither pleasant or unpleasant. Subjects were instructed that if a word had mixed qualities for them (i.e. both pleasant and unpleasant features), that they should rate these words in a "not sure" category, thus preventing the inclusion of neutral words with mixed affective valence. Only those words with 70% agreement of rated category were used in this experiment. Physical threat stimuli were derived from past research (Mathews et al. 1989). Words from each affective valence category were balanced according to length and frequency using the norms provided by Kucera and Francis (1967). ANOVA analyses indicated these words did not differ according to length or frequency (see Table 1). See Appendix G for the final list of stimuli.

All of the words had a unique three or four letter word stem. In addition, none of the three letter stems were common to the first three letters of any four
letter stems. For example, asse__ and ass__ could not both be included. For each of these words, there was at least one word (not presented to the subjects), which shared their three or four letter word stem yet was higher in word frequency. Also, there was at least one word of greater frequency for every form of the stimulus list words with essentially the same meaning (e.g. for the stimulus "fail", it was determined that there was at least one word beginning with the letters "fai" of greater use frequency than "failure" as well as "fail").

These words were then divided into three sets (A, B, or C) consisting of an equal number of words from each affective valence category. Each subject was exposed to two of the three sets. This was done in order that for each subject one set could serve as the explicit recall set, one set as the implicit memory set, and one set as an unprimed set. The stimuli in each of these three sets were also balanced according to length and frequency as above. Appendix H lists the stimuli in their respective sets (A, B, or C). Once again, ANOVA analyses indicated that these sets did not differ according to length or frequency (see Table 1).
Table 1

F tables and means for frequency and length data for word stimuli.

<table>
<thead>
<tr>
<th>Source</th>
<th>F</th>
<th>p</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective valence</td>
<td>.07</td>
<td>.98</td>
<td>.51</td>
<td>.68</td>
</tr>
<tr>
<td>Set</td>
<td>.17</td>
<td>.85</td>
<td>.06</td>
<td>.94</td>
</tr>
<tr>
<td>Set x Valence</td>
<td>.63</td>
<td>.71</td>
<td>.11</td>
<td>.99</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency Mean</th>
<th>Length Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>21.08</td>
<td>6.92</td>
</tr>
<tr>
<td>Neutral</td>
<td>23.86</td>
<td>6.38</td>
</tr>
<tr>
<td>Depressed</td>
<td>21.46</td>
<td>6.92</td>
</tr>
<tr>
<td>Physical Threat</td>
<td>19.50</td>
<td>6.83</td>
</tr>
</tbody>
</table>

Set A | 24.03 | 6.84 |
Set B | 21.31 | 6.75 |
Set C | 19.09 | 6.69 |
Response sheets were created for each memory task. The cued recall task consisted of 32 three and four letter word stems from one of the three sets of stimuli (A, B, or C) to which they were exposed in the encoding task. The word completion response sheet consisted of 64 three and four letter word stems that related to two of the three sets of verbal stimuli (AB, BC, or AC), one of those sets being the one to which the subjects were not exposed to during the encoding task. The order of the words for both tests was pseudo-randomized, in that there were no more than two word stems of the same affective valence presented in order.

Apparatus

The Micro Experimental Laboratory (MEL; Schneider, 1988; Butler, 1988), was used to present the verbal stimuli and the presentation of the filler tasks. This software program was used in conjunction with an IBM PC or compatible. This software system has received good reviews (e.g. Butler, 1988), and has accurate timing for RT experiments.
Procedure

Preceding the experiments, all subjects were interviewed using the SADS and were administered the BDI. From these instruments a determination was made as to the appropriateness of the subject for the experimental or comparison groups. All interview data were reviewed with a licensed psychologist. If the subject was deemed appropriate, he or she was scheduled for the participation in the actual experiments.

Encoding Task

Each subject was presented with verbal stimuli from two of the three sets of words as described above (AB, BC, or AC). Subjects were informed that this was an imagination task and that they will be presented with a number of words on the video monitor. Each word was presented for ten seconds duration, and the subjects were asked to imagine themselves in a scene that involved themselves and the word. Subjects were informed that they could think of a past scene, a future scene, or an imaginary scene. Subjects were asked to press a button when they thought of a scene that involved themselves and the presented word. After this response, an instruction appeared on the monitor with
the word encouraging the subject to continue to think about this scene. After the presentation of each word, each subject was asked to rate how pleasant or unpleasant the scene was, where 0=very unpleasant, and 9=very pleasant.

Seven practice words were presented, followed by the 64 experimental words. The first example word "journey" was presented and the experimenter gave examples of how the subjects might imagine themselves involved with this word. For example, subjects may be encouraged to imagine themselves on a trip to Florida, or a backpack in the Rocky Mountains etc. Following this example word, six more trial stimuli were presented so that the subjects were comfortable with this encoding task.

Filler Task

Following the encoding task each subject was involved in a filler task lasting approximately three minutes. In this task, subjects responded to various number or letter (nonword) groups and determined whether these groups were numbers or letters as quickly as possible. Filler tasks were used in this experiment to temporally and phenomenologically separate the experimental tasks of interest (i.e. the encoding task and the two memory tasks).
The two memory tasks were counter balanced for order. Thus, following the first filler task, half of the subjects engaged in the cued recall test, and half engaged in the word completion task. After they completed one memory task, they participated in a similar choice reaction time filler task as before, and then were administered the alternate memory task.

Cued Recall Test: Subjects were presented with a list of three or four-letter stems (see Appendix H). They were asked to attempt to remember words from the imagination task that began with these letters. Subjects were encouraged to guess if they were not sure of a response. The amount of time a subject took to fill this sheet out was recorded, but no subject was given longer than five minutes to complete this memory test.

Word Completion Test: In the word completion test, subjects were given a response sheet similar to the one used for cued recall, and were asked to write down the first word that came into their mind that began with the three letters printed on the sheet. Subjects were encouraged to complete this task as quickly as possible. This response sheet contained three and four letter word stems from the primed condition (words to
which they had been exposed in the encoding task), and the unprimed condition (the group of words to which they had NOT been exposed). Once again, subjects were timed as to how long they took to complete this task.

Following the memory tests, all subjects were administered a debriefing interview which is included in appendix .

Scoring of Cued Recall and Word Completion

In most cases, the shortest form of the word was used for the verbal stimuli. Words subjects produce in the memory tasks which were of a different form than the stimulus originally presented but were of essentially the same meaning (e.g. "failure" for the original presentation of "fail"), were scored as correct responses. A list of the acceptable responses is found in Appendix I.

Statistics

Combining explicit and implicit memory tests in one ANOVA is probably inappropriate because one is not comparing similar measures. Thus, the explicit memory test and the implicit memory test were analyzed separately. In this case, a two-way interaction between group and valance was predicted for explicit memory, and a three way interaction between group, valance, and test
Mood Congruent Memory

(primed and unprimed) was predicted for implicit memory. If ANOVA resulted in significant main or interaction effects, then planned orthogonal comparisons were performed as described by Kirk (1982, p. 92-98).

Hypothesis three was analyzed with a 2 (group) by 4 (affective valence) ANOVA for RT. A significant interaction was predicted. If an interaction was found, planned orthogonal comparisons were performed as described above.
Figure 3

Predicted results for cued recall and for word completion tasks.

<table>
<thead>
<tr>
<th></th>
<th>Higher # words recalled</th>
<th>Lower # words recalled</th>
</tr>
</thead>
<tbody>
<tr>
<td># correct words recalled</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Group:
- Depressed: ●●●●
- Comparison: o-----o
Figure 4

Prediction for word completion of unprimed stimuli.

higher #
words recalled

# correct words
recalled

lower # words
recalled

Negative          Affective Valence          Nondepressed

Group:

Depressed: • •

Comparison: o-------o
RESULTS

Group Differences:

The two groups were compared on the BDI, VAS, EPQ-N, and the Depression, Vigor, and Fatigue factors of the POMS using ANOVA. The purpose of these analyses was to delineate group differences that may be important to the interpretation of the memory recall data which were the primary focus of the study. As reported in the methods section, no group differences were found for age and verbal I.Q., thus matching on these variables was successful. Significant group differences were found with other variables that one might expect to differentiate depressed and nondepressed individuals. Table 2 summarizes the results of these analyses and group means for each variable. As expected, the depressed group scored significantly higher than controls on the BDI, VAS, EPQ-R, and the Depression and Fatigue subscales of the POMS. Comparison subjects had significantly higher scores than depressives on the Vigor factor of the POMS.

ANOVA for Order Effects.

As noted in the Methods section, memory tests (implicit and explicit) were counterbalanced for order. However, it may be argued that the findings may be an
Table 2

Means of Various Variables by Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Variable</th>
<th>F</th>
<th>p</th>
<th>Depressed</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age</td>
<td>0.00</td>
<td>.97</td>
<td>26.94</td>
<td>26.82</td>
</tr>
<tr>
<td></td>
<td>Verbal I.Q.</td>
<td>1.79</td>
<td>.19</td>
<td>16.44</td>
<td>16.69</td>
</tr>
<tr>
<td></td>
<td>BDI*</td>
<td>148.5</td>
<td>.0001</td>
<td>27.53</td>
<td>3.71</td>
</tr>
<tr>
<td></td>
<td>VAS*</td>
<td>20.08</td>
<td>.0001</td>
<td>46.24</td>
<td>11.53</td>
</tr>
<tr>
<td></td>
<td>Neuroticism*</td>
<td>39.36</td>
<td>.0001</td>
<td>18.35</td>
<td>9.06</td>
</tr>
<tr>
<td></td>
<td>POMS Depression*</td>
<td>102.9</td>
<td>.0001</td>
<td>32.53</td>
<td>4.88</td>
</tr>
<tr>
<td></td>
<td>Vigor*</td>
<td>17.36</td>
<td>.0002</td>
<td>10.35</td>
<td>18.65</td>
</tr>
<tr>
<td></td>
<td>Fatigue*</td>
<td>26.06</td>
<td>.0001</td>
<td>16.88</td>
<td>6.18</td>
</tr>
</tbody>
</table>

Note: * indicates that the two groups differed significantly on this variable (p<.05). For all above analyses df=1,32.
artifact of order of memory tests. Therefore, ANOVAs were calculated to determine the extent of the effect of order, if any. No main effect was found for order, $F(1,30)=.94$, $p=.34$. Also, no significant interaction effects involving order were found. Therefore, it is unlikely that the primary findings of the study were an artifact of the order of presentation of memory tests.

Hypothesis 1: Mood Congruent Memory in Explicit memory.

As argued earlier, it is probably inappropriate to combine two different measures of memory in one ANOVA. Therefore, explicit and implicit memory conditions were analyzed separately. A test of sphericity was calculated to determine if the probability of the ordinary $F$ test was correct. This statistic tests the hypothesis that the orthogonal components are uncorrelated and have equal variance. If this hypothesis is not rejected, then the probabilities provided by the ordinary $F$ tests are appropriate (cf. Freund, Littell, & Spector, 1986, p. 183). The test of sphericity indicated that ordinary $F$ tests were appropriate for analysis of explicit memory data ($\text{Chisquare approximation (5)}=8.64$, $p=.12$). As predicted, a significant valence by group interaction was found in the explicit (CR) memory condition,
Mood Congruent Memory

$F(3,90) = 3.92$, $p<.01$. Table 3 summarizes means and group differences pertaining to this analysis. (See Figures 5, 6 and 7 for a graphic presentation of these results. Figure 5 illustrates the interaction between group and valence for recall of only the positive and depressed words only. Figure 6 illustrates the results including recall of words of all four affective valences.

Orthogonal contrasts showed that the comparison group recalled more positive words than the depressed group. Thus, the expected MCM bias was found in the explicit memory condition. However, a group difference was also found in explicit recall of physical threat words. Here the comparison group recalled more physical threat words than did the depressed group.

Planned orthogonal contrasts indicated that within the depressed group, subjects recalled significantly more depressed words than either positive words or physical threat words (see Table 3). In the comparison group, subjects recalled more positive words than depressed words.

Because previous research has shown that depressives generally recall less information than normal controls, it could be argued that direct
Table 3
Means of Various Recall Measures by Group and Test

<table>
<thead>
<tr>
<th>Group</th>
<th>Test</th>
<th>Positive</th>
<th>Neutral</th>
<th>Depressed</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>a</td>
<td>ab</td>
<td>bc</td>
<td>a</td>
</tr>
<tr>
<td>D</td>
<td>CR</td>
<td>2.94</td>
<td>3.18</td>
<td>3.94</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>c</td>
<td>bc</td>
<td>ab</td>
<td>bc</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>4.47</td>
<td>3.88</td>
<td>3.29</td>
<td>4.06</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>1.59</td>
<td>1.88</td>
<td>2.47</td>
<td>1.82</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>2.11</td>
<td>2.00</td>
<td>1.94</td>
<td>1.71</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>0.88</td>
<td>0.94</td>
<td>1.41</td>
<td>0.65</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>1.06</td>
<td>0.94</td>
<td>1.35</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Note: D=depressed group, C=comparison group, CR=cued recall test. Explicit test is represented by test of cued recall (CR), Implicit test is represented by primed and unprimed word completion. In CR condition, means that share a letter are not significantly different.
Interaction between Group and Valence for Positive and Depressed Words.

Note: "Hits" is the number of correct completions on any given test. The solid lines connected by 'D' represents the results for the depressed group. The dotted line connected by 'C' represents the comparison group.
Figure 6

Interaction between group and valence for words of all affective valences

Note: "Hits" is the number of correct completions on any given test. The solid lines connected by 'D' represents the results for the depressed group. The dotted line connected by 'C' represents the comparison group.
comparison of means between depressives and controls by valence may be misleading. Therefore an additional ANOVA was performed to attempt to control for this general recall inhibition in depressives. Difference scores were formed such that for each subject their explicit recall of neutral words was subtracted from the number of words recalled for each valence. Thus, three different difference scores were formed for positive, depressed, and physical threat. For example, the formula for calculating the difference score for positive recall was as follows:

\[
\text{Positive CR} - \text{Neutral CR} = \text{Positive Difference Score}
\]

As expected, a significant group by valence interaction was found, \(F(2,60)=5.9\ p<.005\).

Orthogonal contrasts of difference means showed that depressives had significantly higher depressed recall difference scores than did controls (see Table 4). No significant difference was found between the two groups in physical threat or positive recall difference scores. Within the comparison group, the positive difference mean was significantly higher than the depressed difference score. Contrasts within the depressed group showed the opposite pattern. In this group the depressed difference score was significantly
Table 4
Means of Difference Scores for Explicit Recall by Group and Valence

<table>
<thead>
<tr>
<th>Group</th>
<th>Positive</th>
<th>Depressed</th>
<th>Physical</th>
<th>Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>ac</td>
<td>b</td>
<td>c</td>
<td></td>
</tr>
<tr>
<td>Comparison</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table:

<table>
<thead>
<tr>
<th>Group</th>
<th>Positive</th>
<th>Depressed</th>
<th>Physical</th>
<th>Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-.24</td>
<td>.77</td>
<td>-.18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ab</td>
<td>c</td>
<td>abc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>.59</td>
<td>-.59</td>
<td>.18</td>
<td></td>
</tr>
</tbody>
</table>

Note: Means that share a letter are not significantly different.
Figure 7

Means of Explicit Recall by Group and Valence

The means illustrated below represent the difference between valenced and neutral scores.

Note: "Controlled recall" is the mean number of items subjects recalled in CR for a particular valence minus the number of neutral items recalled.
higher than both positive and physical threat difference score means (see Table 4). Figure 7 was formed to illustrate this interaction. This figure shows a more symmetrical pattern of MCM bias than that suggested by the uncontrolled recall means illustrated in Figures 5 and 6. Some caution should be expressed regarding this finding however. Some have suggested that it may not be appropriate to use difference scores with measures that may be correlated (Cronbach & Furby, 1970). Some moderate correlations were found between explicit recall of neutral items and recall of other affective valences (correlation coefficients ranging between .33 and .55).

Hypothesis 2: Implicit Memory Bias.

Contrary to the prediction, no interaction between group, test, and valence was found for implicit memory, $F(3,90)=0.46, p=.71$. A significant main effect was found for test ($F(1,30)=53.47, p<.0001$), thus demonstrating priming. A significant main effect was found for valence $F(3,90)=3.49, p<.01$. Here both groups tended to complete more of the depressed word completions, across both primed and unprimed conditions. No interaction was found between valence and group ($F(3,90)=1.01, p=.39$).
Correlations between Implicit and Explicit Memory

To further investigate the relationship between explicit memory bias and implicit memory bias, correlations between explicit memory measures and implicit memory measures were calculated. Two different types of memory variables were compared. First, primed implicit memory was correlated with cued recall for each valence. For example, positive CR was correlated with positive primed word completion, neutral CR was compared with neutral primed word completion, etc. The relationship of these variables is shown in Table 5.

Secondly, two types of memory bias scores were calculated and compared. For the explicit condition recall scores for neutral words were used as a control condition and this number was subtracted from the recall hits for each of the other three affective valences. Thus, a bias score was formed for positive, depressed, and physical threat words for each subject. For example, the formula used for positive cued recall (CR) bias was as follows:

\[
\text{Positive Bias} = \text{Positive CR} - \text{Neutral CR}
\]

Bias scores for the implicit condition were formed in a similar manner. However, in addition to using neutral scores as a control condition, the unprimed word completion score was also subtracted from each primed
valence score to control for response bias. For example, the formula for the implicit bias score for depressed words was as follows:

\[
\text{Depressed Implicit Bias} = (\text{DP} - \text{DUP}) - (\text{NP} - \text{NUP})
\]

where DP is the number of depressed word completions in the primed condition, DUP is the number of depressed word completions in the unprimed condition, NP is the number of neutral word completions in the primed condition, and NUP is the number of neutral word completions in the unprimed condition.

A second type of bias score was formed by subtracting the number of positive hits from the number of depressed hits. Thus, for CR the formula was as follows:

\[
\text{Positive/Negative CR Bias} = \text{Positive CR} - \text{Depressed CR}
\]

The formula for the implicit positive/negative bias also used the unprimed scores to control for response bias. Thus, the formula for implicit positive/negative bias was as follows:

\[
\text{Implicit Positive/Negative Bias} = (\text{PP}-\text{PUP}) - (\text{DP}-\text{DUP})
\]

where PP is the number of positive primed word completions, PUP is the number of positive unprimed word completions, DP is the number of depressed primed word completions and DUP is the number of depressed unprimed word completions. The correlations of the bias measures
Table 5

Correlations between Cued Recall (CR) and Primed Word Completion Scores for all Subjects.

**Explicit Memory**

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Neutral</th>
<th>Depressed</th>
<th>Physical Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>.03</td>
<td>-.03</td>
<td>-.11</td>
<td>.04</td>
</tr>
<tr>
<td>Neutral</td>
<td>.13</td>
<td>-.01</td>
<td>.13</td>
<td>.18</td>
</tr>
<tr>
<td>Depressed</td>
<td>-.29</td>
<td>-.19</td>
<td>-.04</td>
<td>-.17</td>
</tr>
</tbody>
</table>

**Implicit Memory**

<table>
<thead>
<tr>
<th></th>
<th>P-UP</th>
<th>N-UP</th>
<th>D-UP</th>
<th>PT-UP</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-UP</td>
<td>.02</td>
<td>.02</td>
<td>.03</td>
<td>.32</td>
</tr>
<tr>
<td>N-UP</td>
<td>.30</td>
<td>-.07</td>
<td>.08</td>
<td>.25</td>
</tr>
<tr>
<td>D-UP</td>
<td>-.10</td>
<td>-.21</td>
<td>.11</td>
<td>.06</td>
</tr>
<tr>
<td>PT-UP</td>
<td>.31</td>
<td>-.25</td>
<td>.31</td>
<td>-.22</td>
</tr>
</tbody>
</table>

Note: No correlations were statistically significant (P<.05). Correlations of interest are printed in **bold type**. UP=unprimed, P=positive, N=neutral, D=depressed, PT=physical threat.
Table 6
Correlations between CR and primed word completion scores by group.

### Comparison Group
#### Explicit Memory

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Neutral</th>
<th>Depressed</th>
<th>Physical Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>-0.03</td>
<td>0.03</td>
<td>0.15</td>
<td>0.25</td>
</tr>
<tr>
<td>Neutral</td>
<td>0.31</td>
<td>-0.03</td>
<td>-0.04</td>
<td>0.40</td>
</tr>
<tr>
<td>Depressed</td>
<td>-0.10</td>
<td>-0.21</td>
<td>0.05</td>
<td>0.17</td>
</tr>
<tr>
<td>Physical Threat</td>
<td>0.01</td>
<td>-0.16</td>
<td>-0.07</td>
<td>0.01</td>
</tr>
</tbody>
</table>

### Depressed Group
#### Explicit Memory

<table>
<thead>
<tr>
<th></th>
<th>Positive</th>
<th>Neutral</th>
<th>Depressed</th>
<th>Physical Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>-0.21</td>
<td>-0.21</td>
<td>-0.08</td>
<td>-0.16</td>
</tr>
<tr>
<td>Neutral</td>
<td>0.07</td>
<td>-0.01</td>
<td>0.22</td>
<td>0.05</td>
</tr>
<tr>
<td>Depressed</td>
<td>-0.32</td>
<td>-0.17</td>
<td>-0.21</td>
<td>-0.49*</td>
</tr>
<tr>
<td>Physical Threat</td>
<td>-0.19</td>
<td>-0.25</td>
<td>-0.06</td>
<td>0.21</td>
</tr>
</tbody>
</table>

Note: * indicates statistical significance (p<0.05).

Correlations of interest are printed in **bold type**.
### Table 7

Correlations between Explicit and Implicit Bias Scores for all Subjects

<table>
<thead>
<tr>
<th>Explicit Memory</th>
<th>Bias</th>
<th>Positive</th>
<th>Depressed</th>
<th>Physical</th>
<th>Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bias</td>
<td>.15</td>
<td>.20</td>
<td>.04</td>
<td>.30</td>
<td></td>
</tr>
<tr>
<td>Implicit</td>
<td>Positive</td>
<td>.04</td>
<td>.04</td>
<td>-.12</td>
<td>.13</td>
</tr>
<tr>
<td>Memory</td>
<td>Depressed</td>
<td>-.21</td>
<td>-.27</td>
<td>-.05</td>
<td>-.19</td>
</tr>
<tr>
<td>Physical</td>
<td>-.08</td>
<td>-.12</td>
<td>-.04</td>
<td>.09</td>
<td></td>
</tr>
</tbody>
</table>

Note: "Bias" is the number of positive hits minus negative hits, all other variables are bias scores computed with the number of neutral hits. No correlations were statistically significant (p<.05). Correlations of interest are printed in **bold** type.
Table 8
Correlations between Explicit and Implicit Bias scores by group.

Comparison Group

<table>
<thead>
<tr>
<th>Bias</th>
<th>Positive</th>
<th>Depressed</th>
<th>Physical Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implicit Positive</td>
<td>-.21</td>
<td>-.22</td>
<td>-.09</td>
</tr>
<tr>
<td>Depressed</td>
<td>-.17</td>
<td>-.17</td>
<td>.10</td>
</tr>
<tr>
<td>Physical Threat</td>
<td>-.05</td>
<td>.16</td>
<td>.05</td>
</tr>
</tbody>
</table>

Depressed Group

<table>
<thead>
<tr>
<th>Bias</th>
<th>Positive</th>
<th>Depressed</th>
<th>Physical Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implicit Positive</td>
<td>.03</td>
<td>-.15</td>
<td>-.20</td>
</tr>
<tr>
<td>Depressed</td>
<td>.05</td>
<td>-.31</td>
<td>-.39</td>
</tr>
<tr>
<td>Physical Threat</td>
<td>-.08</td>
<td>-.24</td>
<td>-.23</td>
</tr>
</tbody>
</table>

Note: "Bias" is the number of positive hits minus negative hits, all other variables are bias scores computed with the number of neutral hits. No correlations were statistically significant (p<.05). Correlations of interest are printed in bold type.
for all subjects and by group are found in Tables 7 and 8.

As observation of Tables 5 through 8 attests, measures of implicit and explicit memory by valence were not related in this experiment. The only correlation that approached statistical significance was in the depressed group between the depressed bias scores which were computed with the neutral words as a baseline. This relationship was a negative one, the opposite of what one would predict if implicit memory bias was contributing to explicit memory bias in depressives. Thus, in this study, if a depressed subject tended to exhibit an explicit memory bias, she was not likely to exhibit an implicit memory bias and vice versa.

Correlations Between Memory and State and Trait Measures

Correlations were also calculated between various state and trait measures and the memory scores that are discussed above. These correlations are summarized in Tables 9 through 12. Because of the large number of correlations calculated, a decision was made to set alpha level at a more conservative level (p<.01). In addition, because two distinct but internally homogenous groups were used in this study, most attention will be devoted to significant correlations that show the same
Table 9
Correlations of Recall Variables with State and Trait Measures

<table>
<thead>
<tr>
<th>Memory Variable</th>
<th>Correlations of state and trait measures</th>
<th>POMS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>BDI, EPQ-N, VAS, Dep, Vigor, Fat</td>
</tr>
<tr>
<td>Positive variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive CR</td>
<td>-0.50* -0.60* -0.29 -0.42* 0.41* -0.46*</td>
<td></td>
</tr>
<tr>
<td>Positive WC</td>
<td>-0.01 -0.27 -0.17 -0.30 0.16 0.31</td>
<td></td>
</tr>
<tr>
<td>Positive-Neutral CR</td>
<td>-0.15 -0.24 -0.21 -0.30 0.22 -0.18</td>
<td></td>
</tr>
<tr>
<td>Positive-Neutral WC</td>
<td>0.07 0.00 0.20 0.03 -0.06 0.12</td>
<td></td>
</tr>
<tr>
<td>Positive CR Bias</td>
<td>-0.52* -0.67* -0.41* -0.46* 0.61* -0.31</td>
<td></td>
</tr>
<tr>
<td>Positive WC Bias</td>
<td>-0.19 -0.27 0.03 -0.25 0.12 -0.35</td>
<td></td>
</tr>
<tr>
<td>Depressed variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressed CR</td>
<td>-0.06 0.13 0.15 0.07 -0.26 0.15</td>
<td></td>
</tr>
<tr>
<td>Depressed WC</td>
<td>0.34 0.28 0.05 0.24 -0.27 0.25</td>
<td></td>
</tr>
<tr>
<td>Depressed-Neutral CR</td>
<td>0.34 0.39 0.16 0.12 -0.35 0.10</td>
<td></td>
</tr>
<tr>
<td>Depressed-Neutral WC</td>
<td>0.26 0.26 0.18 0.27 -0.18 0.46*</td>
<td></td>
</tr>
<tr>
<td>Physical Threat (PT) Variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Threat CR</td>
<td>-0.30 -0.44* -0.08 -0.33 0.19 -0.50*</td>
<td></td>
</tr>
<tr>
<td>Physical Threat WC</td>
<td>0.09 -0.01 0.04 -0.08 -0.21 -0.12</td>
<td></td>
</tr>
<tr>
<td>PT-Neutral CR</td>
<td>0.04 -0.12 -0.03 -0.26 0.03 -0.24</td>
<td></td>
</tr>
<tr>
<td>PT-Neutral WC</td>
<td>0.11 0.19 0.34 0.09 -0.18 0.19</td>
<td></td>
</tr>
</tbody>
</table>

Note: "Positive bias" scores = positive - depressed recall. CR=Cued Recall, WC=Word Completion, and PT=Physical Threat. Dep=POMS Depression factor, Vigor=POMS Vigor factor, Fat=POMS Fatigue factor. * indicates statistical significance at the p<.01 level.
Table 10

Correlations of Positive Memory Variables
with State and Trait Measures by Group

<table>
<thead>
<tr>
<th>Memory Variable</th>
<th>G</th>
<th>R</th>
<th>P</th>
<th>BDI</th>
<th>EPQ-N</th>
<th>VAS</th>
<th>Dep</th>
<th>Vigor</th>
<th>Fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>POSITIVE CR</td>
<td></td>
<td></td>
<td></td>
<td>-0.42</td>
<td>-0.23</td>
<td>-0.05</td>
<td>0.07</td>
<td>0.37</td>
<td>-0.39</td>
</tr>
<tr>
<td>POSITIVE WC</td>
<td></td>
<td></td>
<td></td>
<td>0.09</td>
<td>0.27</td>
<td>-0.03</td>
<td>-0.42</td>
<td>0.29</td>
<td>-0.30</td>
</tr>
<tr>
<td>POSITIVE-NEUTRAL CR</td>
<td></td>
<td></td>
<td></td>
<td>0.14</td>
<td>-0.12</td>
<td>-0.3</td>
<td>-0.27</td>
<td>0.23</td>
<td>-0.06</td>
</tr>
<tr>
<td>POSITIVE-NEUTRAL WC</td>
<td></td>
<td></td>
<td></td>
<td>0.52</td>
<td>0.37</td>
<td>0.51</td>
<td>0.24</td>
<td>-0.08</td>
<td>0.52</td>
</tr>
<tr>
<td>POSITIVE CR BIAS</td>
<td></td>
<td></td>
<td></td>
<td>0.03</td>
<td>-0.27</td>
<td>-0.01</td>
<td>0.33</td>
<td>0.43</td>
<td>0.33</td>
</tr>
<tr>
<td>POSITIVE WC BIAS</td>
<td></td>
<td></td>
<td></td>
<td>-0.10</td>
<td>0.42</td>
<td>0.33</td>
<td>-0.38</td>
<td>0.11</td>
<td>-0.33</td>
</tr>
</tbody>
</table>

Note: "Positive bias" scores = positive - depressed
Recall. CR=Cued Recall, WC=Word Completion, Dep=POMS
Depression factor, Vigor=POMS Vigor factor, Fat=POMS
Fatigue factor. D=Depressed group, C=Comparison
group. No correlations were statistically significant
at the p<.01 level.
Table 11

Correlations of Depressed Memory Variables with State and Trait Variables by Group

<table>
<thead>
<tr>
<th>Memory Variable</th>
<th>Depressed CR</th>
<th>Depressed WC</th>
<th>Depressed-Neutral CR</th>
<th>Depressed-Neutral WC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D</td>
<td>C</td>
<td>D</td>
<td>C</td>
</tr>
<tr>
<td>Correlations of state and trait measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G: BDI; EPQ-N; VAS; Dep; Vigor; Fat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressed CR</td>
<td>.39</td>
<td>.06</td>
<td>.04</td>
<td>.25</td>
</tr>
<tr>
<td>Depressed WC</td>
<td>.56*</td>
<td>.20</td>
<td>.04</td>
<td>.36</td>
</tr>
<tr>
<td>Depressed-Neutral CR</td>
<td>.13</td>
<td>.12</td>
<td>-.29</td>
<td>-.60*</td>
</tr>
<tr>
<td>Depressed-Neutral WC</td>
<td>.55</td>
<td>.04</td>
<td>.23</td>
<td>.49</td>
</tr>
</tbody>
</table>

Note: CR=Cued Recall, WC=Word Completion, Dep=POMS Depression factor, Vigor=POMS Vigor factor, Fat=POMS Fatigue factor. D=Depressed group, C=Comparison group. * indicates significance at the p<.01 level.
Table 12
Correlations between Physical Threat Memory Variables and State and Trait Measures by Group

<table>
<thead>
<tr>
<th>Memory Variable</th>
<th>( \text{G}_1 )</th>
<th>( \text{R}_1 )</th>
<th>( \text{U}_1 )</th>
<th>( \text{P}_1 )</th>
<th>( \text{BDI} )</th>
<th>( \text{EPQ-N} )</th>
<th>( \text{VAS} )</th>
<th>( \text{Dep} )</th>
<th>( \text{Vigor} )</th>
<th>( \text{Fat} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Threat CR</td>
<td>( D_1 ) -.14</td>
<td>.06</td>
<td>.39</td>
<td>.03</td>
<td>-.26</td>
<td>-.26</td>
<td>( C_1 ) .09</td>
<td>-.58*</td>
<td>-.26</td>
<td>-.57*</td>
</tr>
<tr>
<td>Physical Threat WC</td>
<td>( D_1 ) -.14</td>
<td>-.11</td>
<td>.12</td>
<td>-.23</td>
<td>-.22</td>
<td>( C_1 ) .36</td>
<td>-.16</td>
<td>-.30</td>
<td>.04</td>
<td>-.23</td>
</tr>
<tr>
<td>PT-Neutral CR</td>
<td>( D_1 ) .40</td>
<td>.12</td>
<td>-.33</td>
<td>-.11</td>
<td>.03</td>
<td>( C_1 ) .50</td>
<td>-.07</td>
<td>.07</td>
<td>-.20</td>
<td>.09</td>
</tr>
<tr>
<td>PT-Neutral WC</td>
<td>( D_1 ) .28</td>
<td>.27</td>
<td>.58*</td>
<td>.10</td>
<td>-.18</td>
<td>( C_1 ) .25</td>
<td>.09</td>
<td>.05</td>
<td>.13</td>
<td>-.25</td>
</tr>
</tbody>
</table>

Note: CR=Cued Recall, WC=Word Completion, PT=Physical Threat, Dep=POMS Depression factor, Vigor=POMS Vigor factor, Fat=POMS Fatigue factor. D=Depressed group, C=Comparison group. * indicates significance at the \( p < .01 \) level.
correlation pattern within each separate group. Other correlations that show significance across all subjects, but differing correlation patterns within each group, will be interpreted cautiously. The most consistent finding was the negative relationship between the EPQ Neuroticism scale (EPQ-N) and explicit recall of positive items (see Table 9). Cued recall (CR) of positive words and the positive CR bias were both negatively correlated with the EPQ-N. This negative relationship was also evident in the within group correlations (see Table 10). The BDI was also found to be negatively related to CR of positive items, as expected. Although this relationship did not hold in the comparison group, within group correlations showed this negative association in the depressed group. It seems that in this case the critical within group correlation was with the depressed group, because of the low variance in depression scores in the comparison group. The homogeneity of variance in the comparison group would lower any correlations. The POMS Vigor subscale was positively related to CR of positive words and CR positive bias, however this result is somewhat equivocal because within group correlations showed this to be a stronger relationship in the depressed group than in the comparison group. Positive CR was
negatively associated with most depression related variables, as might be expected. However, within group correlations showed that in the comparison group positive CR negatively correlated with the Depression factor of the POMS, while there was no relationship in the depression group between these variables (see Table 10). Contrasting with this result, although a significant negative relationship was found between the Fatigue factor of the POMS and positive CR across groups, within group correlations found this relationship to be consistent in the depressed group, but not in the comparison group.

Correlational analyses with all subjects revealed few significant correlations with memory of depressed items. The one correlation that did prove to be significant was between the depressed minus neutral word completion score, and the Fatigue factor of the POMS. Within group correlations showed this was still a strong relationship within the depressed group ($r = .75$), while no relationship was demonstrated in the comparison group. Thus, as depressed subjects report more fatigue, they tend to remember more depressed items relative to neutral items in an implicit memory task.

Explicit memory of physical threat information was negatively associated with the EPQ-N and the Fatigue
factor of the POMS. The relationship of physical threat CR with the EPQ-N appeared to be largely due to a negative association in the comparison group. However, the negative correlation between physical threat CR and the Fatigue factor of the POMS was found in separate correlations involving both groups.

ANOVA for Intrusions

In order to further investigate variables that might be related to the explicit memory bias, an analysis was undertaken to investigate the possibility of response bias. Incorrect responses on the cued recall task were recorded, and two advanced clinical psychology Ph.D. students and one Ph.D. rated the words as to whether they were positive, neutral, depressed, or physical threat. Instructions for rating were done in the same manner as rating for the original verbal stimuli as described in the methods section. These raters were kept blind to the diagnosis of the subjects. Only words with unanimous agreement among the three raters were used for analysis. In addition, neutral words were not analyzed since these words would not contribute to an understanding of response bias and mood congruent memory bias.
Because of the high frequency of zeros in the data, it was determined that a nonparametric statistic should be used. Thus, Kruskal-Wallis tests were used to analyze this data. No group difference was found for positive intrusions (Chisquare approximation = 0.00, p = .98). Similarly, no group difference was found for physical threat intrusions (Chisquare approximation = .24, p = .63). However, a significant group difference was found for depressed intrusions (Chisquare approximation = 5.80, p < .01). Here, the comparison group actually had more depressed intrusions than the depressed group. These data are illustrated in Figure 8. From this diagram, it is apparent that the data are opposite to what one would expect if a response bias were contributing to the explicit memory bias.

Hypothesis 3: Reaction Times:

Prior to the analysis of RT, trial times with very high or very low values (mean ± 3 s.d.) were eliminated. Thus, if the subject did not respond, i.e. they could not imagine a scene in 10 seconds, this score was eliminated from the analysis. If for any subject, more than 6 of the 16 RTs for each valence were eliminated, this subject was eliminated from the analysis. No subjects met this criterion for elimination. No main
Figure 8
Interaction Between Group and Valence for Intrusions in Cued Recall
effects for group ($F(1,32)=.02$, $p>.10$), or valence ($F(3,96)=1.3$, $p>.10$). A nonsignificant trend was noted for the interaction between valence and group ($F(3,96)=2.14$, $p=.10$). As seen in Figure 9, subjects in the depressed group tended to respond slower in imagining positive, neutral, and physical threat scenes, but tended to respond faster in imagining depressed scenes. All of these differences are small and were not significant, so it cannot be argued that differences in imagination RTs contributed to recall differences.

**Pleasantness Ratings**

As described in the procedure section, following the imagination task with each word, the subjects rated the pleasantness of the scene they imagined. These ratings were analyzed by group and by valence. Significant main effects for group, $F(1,32)=4.9$, $p<.03$, and valence, $F(3,96)=384.28$, $p<.0001$, were found. As expected, scenes imagined with positive words were rated most pleasant, followed by neutral words. Both physical threat and depressed scenes were rated as more unpleasant than positive and neutral words, and imagined physical threat scenes were generally rated as more unpleasant than scenes with depressed words.
Figure 9

Reaction Times by Valence and Group

Depressed Group = D
Comparison Group = C

Note: RTs are latencies of time for a subject to imagine a scene involving themselves and the stimulus word.
finding was due to differential rating of pleasantness.
The main effect of valence was modified by a significant group by valence interaction ($F(3,96)=3.82, p<.01$). As illustrated in Figure 10, comparisons of means indicated that the depressed group generally rated the positive, neutral, and depressed scenes as less pleasant. Because the pattern of pleasantness ratings for the positive, neutral, and depressed scenes was the same for both groups, it cannot be argued that the MCM interaction was found because no group differences were found in pleasantness ratings of the physical threat scenes, contrasting with the differences found with the other valences as described above.
Figure 10

Pleasantness Ratings by Valence and Group

Depressed Group = D
Comparison Group = C

Note: Pleasantness ratings are ratings of the pleasantness of each imagined scene in the imagination task where 10 = most pleasant and 1 = most unpleasant.
This study investigated the contribution of implicit memory processes to explicit mood congruent memory (MCM) bias in depression. Consistent with previous research (cf. Blaney, 1986), MCM was found in explicit memory. However, contrary to predictions, no MCM bias was found in implicit memory. In addition, correlation analyses between explicit memory measures and implicit measures indicated no relationship between the two. Thus, it may be concluded that the explicit MCM bias found in this study was not due to an implicit MCM bias.

Using Mandler's (1980) framework of implicit and explicit memory, the current findings suggest that MCM bias in depression is primarily due to elaborative processes. Reviewing Mandler's formulation of implicit and explicit memory, implicit memory is primarily a reflection of integration or priming. Priming is the extent the components of a schema (or words in this study) have been mutually activated in the past. Thus a more integrated word will be more easily activated when some of its components are presented. Explicit memory, in this case CR, reflects elaboration because elaboration involves the association of the schema or
word with other information in memory. Thus, a more elaborated word is more easily retrieved because of more associations to other items in memory which results in more 'memory handles' or cues to assist retrieval. As reviewed in the introduction, this formulation of implicit and explicit memory is supported by depth of processing research. If encoding encourages elaboration (deeper encoding), explicit memory is enhanced, but implicit memory is left unchanged.

Thus, the finding in this study of MCM in explicit memory but not implicit memory, suggests the involvement of elaborative processes in MCM in depression. In other words, for depressed subjects, depressive words were better elaborated, and tended to have more associations with other items in memory, than words of other affective valence. This pattern of data implies that depressed words received relatively more cognitive analysis than words of other emotional content, and thus were more easily retrieved. Conversely, positive words were better elaborated for nondepressed individuals, hence leading to recall advantage for words of positive hedonic valence.

One may argue that the observed MCM bias was due to a response bias. It may have been that depressives just guessed more frequently with depressed words, or
Mood Congruent Memory

controls guessed more frequently with positive words leading to more negative and positive hits, respectively. There are two reasons to doubt this explanation. First, research in cognitive psychology has shown that manipulation of response bias does little to change most recall measures unless there is a high degree of probability of guessing the correct response (e.g. recognition; Erdelyi, Finks, & Feigin-Pfau, 1989; Roediger & Payne, 1985; Roediger, Srinivas, & Waddill, 1989). Secondly, the analysis of intrusions in the cued recall (CR) task contradicts the response bias hypothesis. This analysis showed that control subjects had significantly more depressed word intrusions than did depressed subjects. Thus, these data argue against the explanation that the MCM bias in explicit memory was due to a response bias.

The pattern of memory bias in explicit and implicit memory found here contrasts with that found with anxiety subjects. Mathews et al. (1989), found that while anxious subjects showed a clear implicit MCM bias, they found only a nonsignificant MCM trend in explicit memory. This study found no MCM in implicit memory, and a strong explicit MCM bias. Correlational analyses in both studies indicated that MCM biases in explicit and implicit memory were not related. Thus, it appears that
depressives tend to process mood congruent information extensively, while anxious subjects do not. Conversely, mood congruent memories are easily activated for anxious subjects, while mood congruent memories for depressives are no more easily primed than they are for controls.

This interpretation has some intuitive appeal. While anxious thoughts are activated easily for anxious individuals, they attempt to avoid dwelling on them because of their anxiety provoking nature. On the other hand, depressed words are not activated any easier for depressives than for nondepressed individuals, but when they are activated, these individuals tend to dwell on these memories and process them extensively which leads to better recall of depressive information and may influence the depressives outlook on their environment.

This interpretation is also consistent with the attentional bias data discussed in the introduction. Anxious individuals tend to allocate their attention toward mood congruent stimuli, but depressives show no immediate attentional bias (MacLeod, Mathews, & Tata, 1986). There exists some data that suggests that attended words are more readily primed than nonattended words in implicit memory tasks (Eich, 1984; Jacoby and Brooks, 1984). Thus, one might speculate that the increased priming of mood congruent information in
anxious subjects may relate to an attentional bias, and the lack of any differential priming in depressives may relate to the lack of an attentional bias. Clearly, this speculation extends beyond known data, and the relationship of attention bias to implicit and explicit memory bias needs to be tested directly.

At this point one may note the similarity of elaboration in Mandler’s framework, and the clinical phenomena of rumination. It seems to follow, that if an individual dwells on or ruminates about particular information, then this information would be better elaborated and thus be more retrievable. Recently Nolen-Hoeksema (1987) has proposed a response styles theory of depression. She suggested that individuals who tend to ruminate in response to depressed mood will tend to maintain the depressed mood longer and perhaps even exacerbate the negative mood state. These researchers have presented some evidence in support of this formulation (Morrow & Nolan-Hoeksema, 1990). Thus, it is possible that individuals who become depressed tend to ruminate, and this rumination tends to be focused on mood congruent information which results in the MCM bias and the maintenance of depressed mood. Future research could investigate this notion further by manipulating rumination similar to the methodology of Morrow and
Mood Congruent Memory

Nolen-Hoeksema (1990), and then testing for MCM bias.

The reader might note the similarity of Nolan-Hoeksema's (1987) response styles theory of depression and Eysenck's (Eysenck & Eysenck, 1963) theory of neuroticism. In this regard it should be recalled that the most consistent relationships observed with recall were negative associations between recall of positive variables, and the Neuroticism scale of the EPQ. Thus, it is possible that depressed mood may interact with neuroticism or a tendency to ruminate, to produce the observed explicit MCM bias.

Explicit Memory Findings

Several aspects of the observed MCM bias in explicit memory should be discussed. First, the effect appeared to be more of a positive bias for comparison subjects, than a negative bias for depressives. As noted in the introduction, this result is consistent with the bulk of past research on MCM (cf. Blaney, 1986). This interpretation of the data would suggest that depression may decrease the retrievability of positive information more so than it increases retrieval of negative information. However, this apparent asymmetry in the MCM effect may be due to the fact that depressives generally recall less information regardless
of affective valence. As shown in the ANOVA of difference scores and illustrated in Figure 7, when this general recall difference is controlled, a more symmetrical pattern of memory bias results. In other words, the depressed subject's MCM bias was a similar pattern to the control's MCM bias, but in the opposite direction. Thus, this study demonstrated the importance of including a neutral word category in future studies of MCM to control for the general recall inhibition usually found to be associated with depression.

Second, in this study MCM was demonstrated with cued recall (CR). As stated earlier, most studies of MCM used free recall (FR) as the dependent measure. The finding of MCM with CR suggests that adding some memory cues does not significantly change the MCM pattern.

The third finding of importance was the specificity of the observed MCM effect. Comparisons of means within the depressed group showed that they recalled more depressed words than physical threat words. Conversely, there was no difference in the recall of depressed and physical threat words for controls. Thus, it does not appear that the MCM effect relates to all negative information. Rather, it appears to be related to words more specific to depression. This result supports Beck's (1967; 1972) theory regarding the cognitive content specificity of depressive schemata, and Bower's
Beck has suggested that depressogenic schema are activated in depression and these cognitive structures contain information related to the negative cognitive triad (negative thoughts about the self, the world, and the future). Thus, the words found in the depressed hedonic valence category in this study would correspond to information Beck argues would be contained in depressogenic schemata. On the other hand, information that is contained in schemata that are activated in anxiety states include thoughts related to threat and vulnerability (Beck & Emory, 1985). The words found in the physical threat category would correspond to this schema. Thus, the finding of a memory bias with depressed words, but not with words of physical threat corresponds with Beck theory regarding the content specificity of cognitive schemata.

If mood is the primary variable responsible for negative memory bias, then one would expect state or mood variables to be related to MCM bias. Thus, the more severe the depression, the greater the negative memory bias. One would expect that BDI scores would be most clearly related to a negative memory bias. Correlation analyses across groups supported this notion.
only with positive recall variables, and within group
correlations supported this result in the depression
group.

This result appears to be inconsistent with other
studies investigating MCM in depression. Several
studies have failed to find a relationship between MCM
and mood state variables (Mathews & Bradley, 1983;
Riskind, 1983; Riskind, Rholes, & Eggers, 1982). In
addition, Gilligan and Bower (1984) reviewed a number of
unpublished experiments conducted in their laboratory
and also reported no relationship between the extent of
sadness and MCM bias. However, all of these studies
used mood induction methodologies to vary mood, and as
argued earlier, these induction procedures may not vary
mood to the extent as that found in clinical
depression. Corroborating this suggestion, no MCM
association with extent of depression was found in the
comparison group, where extent of depressed mood is
assumed to have little variation. In one of the early
studies of MCM (Lloyd & Lishman, 1975), depressives were
asked to recall positive and negative events from their
lives and latencies were recorded. In this study, the
expected MCM correlation with recall latencies was found
which is consistent with the findings of this study.
Thus, one may expect to find a relationship between MCM
bias and depressed mood with depressed subjects, but will not be likely to find this association in groups where depressed mood is not as extensive.

While the expected relationships were demonstrated in correlations of state and trait variables with recall of positive information, expected associations were not found with explicit recall of depressed words. Thus, the relationship between depressed mood and increased retrievability of congruent information is not completely clear. It is possible that MCM is related to some other aspect of depression other than depressed mood. As discussed earlier, in the current study the variable that seemed to be most clearly related to lack of recall of positive items was the Neuroticism scale of the EPQ. Thus, the current results replicate the findings of Martin, Ward, and Clark (1983), who found subjects with high Neuroticism score recalled more negative information than those with low Neuroticism score. This memory recall bias was found to be independent of mood. The Neuroticism scale is assumed to be a trait variable different from the state variable of mood assumed by most theorists to be important in MCM. It is possible that mood might interact with neuroticism to produce the MCM bias. Thus, future research should attempt to tease out the impact of
neuroticism versus depressed mood on MCM bias. One way of investigating this issue would be to choose two groups of subjects based on high and low neuroticism scores. Then one could randomly assign half of the subjects in both groups to a depressed mood induction, and the other half to a positive mood induction. Following mood induction all subjects would encode words of various affective valences followed by a recall test.

Implicit Memory Findings

A significant differential priming effect was not found between groups in the implicit memory condition. Results from the correlational analyses in the depressed group suggested that word completion of depressed primed words was associated with state measures that one would normally associate with depression (the BDI and the Depression and Fatigue factors of the POMS). However, these relationships were not evident in the comparison group, only a few of the expected correlations with implicit memory measures were found, and it is clear no MCM bias was found in implicit memory.

There are several possible explanations for the failure to find an implicit MCM bias. First, it is possible that the implicit memory measure was insensitive for detecting differential priming of
Mood Congruent Memory 95

information of differing hedonic valence. However, Mathews et al. (1989) found an implicit MCM memory bias with anxiety subjects using a similar methodology. Therefore, unless the implicit MCM bias in depression is weaker than that found in anxiety subjects, it would be difficult to argue that this methodology was insensitive to finding an implicit MCM bias.

A second and related possibility is that it may be more difficult for priming to be demonstrated for depressed words because of the high completion rate of unprimed depressed words. Both groups correctly completed depressed unprimed words more frequently than words of the other affective valences. Thus, it is possible that this high rate of unprimed completions made it more difficult for differential priming to be demonstrated for depressed information. However, for this argument to be valid, one must also argue that the rate of completed primed depressed words was insensitive because of a ceiling effect. The argument here would be that since the unprimed rate for depressed words was generally higher, this did not allow for further improvement in the primed condition. As seen in Table 3, mean priming rates for depressed words varied between two and two and a half words out of a possible eight. Thus, a ceiling effect seems unlikely. All of the
alternative hypotheses for the lack of finding an implicit MCM bias seem unlikely.

Virtually no other studies have investigated implicit MCM bias in depression. Only one other study has used an implicit memory measure to evaluate the processing of emotional information in depression (Segal, Hood, Shaw, & Higgins, 1988). Although these researchers found a significant priming effect for self-schema relevant words, affective valence of the words was not manipulated so this study does not directly relate to the current study.

Theoretical Implications

Currently, theorizing of implicit and explicit memory in cognitive psychology is in a state of flux. Several recent reviews (McKoon, Ratliff, & Dell, 1986; Richardson-Klavehn & Bjork, 1988) have questioned the activation/elaboration view of implicit/explicit memory. Most theorists who follow the implicit/explicit distinction assert that implicit memory tasks activate an abstract schema devoid of contextual information. According to these theorists, explicit memory involves elaboration which includes associations of the schema to information of environmental context. For example, when a student is asked in a test to recall information from
a lecture, she may use memory cues from the lecture in addition to the information asked for (like anecdotes) to assist her in recalling the needed information. These memory cues would be an example of contextual information that is used in explicit memory, but not in implicit memory.

One of the most cited alternative views is the data driven versus conceptually driven distinction made by Roediger and associates (Roediger, 1984; Blaxton, 1985; Roediger & Blaxton, 1987). Data driven tests are those tests where subjects are asked to primarily operate on the perceptual information that they are given. Thus, most implicit memory tests may be seen as data driven. Conceptually driven tests are those in which subjects are asked to mentally reconstruct the study episode (the episode in which the material to be remembered is originally presented). Most explicit tests are seen as conceptually driven. However, some explicit tests may be seen to be as a combination of data driven and conceptually driven tests. For example, in the CR task used in this study, subjects were given perceptual information on which to operate, but they were also asked to reconstruct a previous episode with this perceptual information. The data regarding implicit and explicit tests investigating linguistic and perceptual
contexts appears to follow the data driven/conceptually driven dichotomy more than the implicit/explicit distinction. For example, when bilingual subjects are exposed to a word in one language, implicit priming will not be observed in another language, whereas explicit memory is not affected by linguistic context (for a review see Richardson-Klavehn & Bjork, 1988). Further, if the type of letters are changed from study to test then implicit priming is attenuated whereas explicit memory is not. For example, if words are studied in small case letters, priming is greater if letter stems are given at testing in small case rather than in block letters. However, this change in letter type has little effect on explicit memory. These two findings clearly follow the data driven/conceptually driven account and would not be predicted by most implicit/explicit memory theorists who assert that an abstract concept devoid of contextual detail is activated in priming.

However, some studies (Cermak, Talbot, Chandler, & Wolbarst, 1985; Diamond & Rozin, 1984; Graf & Schacter, 1985; Osgood & Hoosain, 1974; Schacter, 1985; Schacter & Graf, 1986; Schacter & Whitfield, 1986) have found results inconsistent with the data driven/conceptually driven distinction. For example, this approach does not account well for the finding that some types of priming
(e.g. free association) depend on whether the phrase is one in which the words regularly occur together. In such experiments a subject is more likely to complete the primed association GREEN-_______ as "GREEN-PASTURES" than the primed phrase "green-book". Additionally, the data driven/conceptually driven distinction does not explain why amnesics fail to show priming with nonwords. These and several other findings (cf. Richardson-Klavehn & Bjork, 1988) are not consistent with the position taken by Roediger.

Richardson-Klavehn and Bjork (1988) concluded their review with the assertion that an adequate theory of implicit and explicit memory must integrate components of both the abstractionist and the data driven/conceptually driven viewpoints. In this regard, Mandler's approach seems to be a useful integration of the data driven/conceptually driven and abstract activation/elaboration accounts. Although Mandler's approach basically agrees with the activation/elaboration account of implicit and explicit memory, Mandler does not argue that activation is necessarily that of a abstract concept devoid of context. As was discussed in the introduction, Mandler (1980) states that activation/integration is tied to the phonological/perceptual characteristics of the stimuli. In this
regard, Mandler's approach appears to account well for the linguistic/perceptual context effects described above.

If however one were to accept the data driven/conceptually driven account of implicit and explicit memory, it would not necessarily change the practical implications of the findings presented here. It appears that when depressives are asked to mentally construct a previous episode (conceptually driven task), they have more difficulty constructing a positive episode than nondepressed individuals. However, when partial data are presented to a depressed individual (data driven task), they are not as likely to produce mood congruent information as in the conceptually driven situation. Thus, it is the conceptually driven situation that tends to more readily show the MCM effect. This approach would still appear to support the interpretation that MCM in depression appears to rely less on automatic processes, and more on cognitive operations such as elaboration. Conceptually driven tests by definition involve more elaborative processes because elaboration refers to the extent a memory is associated with other items in memory and conceptually driven tests ask the subject to reconstruct a previous episode which must involve associations to other memories. Thus, it
appears that if one opts for the data driven/conceptually driven account of implicit/explicit memory, it does not significantly endanger the elaboration interpretation.

The findings of this study also relate to Beck's cognitive theory of depression and anxiety (Beck, 1967; Beck & Emery, 1985; Beck et al., 1979). As stated earlier, the finding that depressives showed an explicit MCM bias with depressed related words, but not with those related to physical threat supports his notion of cognitive content specificity. However, Beck's theory suggests that the main differences between depression and anxiety relate to cognitive content. Data are now converging to suggest important cognitive process differences in addition to differences in cognitive content. As reviewed earlier, mood congruent attention allocation biases have been found with anxiety subjects but not with depressives (McCloud et al., 1986; Gotlib et al., 1988). In addition, implicit memory bias has been demonstrated with anxiety patients, but generally researchers have failed to find an explicit MCM bias in anxiety subjects (e.g. Mathews et al., 1989). As demonstrated in this study, depressives show the opposite pattern in that they have an explicit MCM bias, but no implicit MCM bias. Beck's cognitive theory of
emotional disorders does not account well for these findings. In addition, it does not appear to follow from Beck’s account of depression that MCM biases would be found with one type of memory, but would not be found in another type of memory. Thus, it appears that Beck’s theory is at least incomplete.

Williams, Watts, MacLoed, and Mathews (1988) have offered a cognitive theory of anxiety and depression that appears to predict the findings of the current study well. Following the framework of Mandler, they proposed that because of the functional properties of anxiety, cognitive resources are allocated more at the preattentive stage which includes attention allocation and perceptual memory or priming. On the other hand, they suggest that in depression cognitive resources are allocated more toward mood congruency in the elaboration stage which is presumed to follow the preattentive stage. Thus, the finding here that depressives show a mood congruent bias in explicit memory but not in implicit memory, directly supports this cognitive model of depression.

As one may recall, Mandler argues that implicit memory is more reflective of automatic processes, while more control procedures are involved in explicit memory. Thus, these findings imply that MCM bias is not
a completely automatic phenomena and controlled processes may be involved. This raises questions as to the appropriateness of Beck's use of the term "automatic thought". In brief, Beck argues that depressed mood is the result of automatic thoughts which result from the activation of the depressogenic schemata which is reflected in dysfunctional attitudes. Beck's use of "automatic" is not clearly specified, although he seems to imply that the thought is not voluntary, or the patient does not 'try to think' these thoughts. It does not appear that Beck's use of the term "automatic thought" directly corresponds to the construct of automatic as it is used in cognitive psychology. The results here suggest that controlled procedures may be involved in the negative thinking or memory of depressives. Thus, the concept of "automatic thought" appears to need further operationalization, and this may help to determine the exact nature of the negative thinking bias in depression. This theory development would direct future research into cognitive processes in depression, and may have important treatment implications as well.
Conclusions

This study found a MCM bias in explicit memory, but no such memory bias in implicit memory for depression. Thus, although depression makes mood congruent memories more retrievable, they are not necessarily more accessible. Seen in a different framework, when asked to mentally reconstruct a previous episode (conceptually driven task), depressives tend to recall mood congruent memories. However, when asked to produce responses to perceptual stimuli, depressives do not respond frequently with recently learned mood congruent information. The results of this study suggest that the primary mechanism for the explicit MCM bias found is elaboration. The pattern of results did not support ease of activation, or response bias accounts of MCM. In addition, the lack of association between explicit MCM and implicit MCM implies that these two forms of memory bias do not share the same cognitive processes. If MCM proves to be an important maintenance mechanism in depression, the results here imply that cognitive elaboration may best explain why depressives bias their memory toward negative material. It is possible that cognitive and other treatments for depression are effective in that they interfere with, or modify this elaborative process, which lends depressed information
less retrievable thus resulting in the relief of depressed emotion. If future research corroborates cognitive elaboration as a critical mechanism underlying MCM, then treatment approaches to depression may be enhanced by investigating more effective ways to modify this elaborative process.

Several suggestions may be made for future research. Further investigation of encoding processes and their effect on implicit and explicit memory may also shed light on the mechanisms underlying MCM. The results here would predict that encouraging elaboration in encoding would enhance the mood congruent effect.

The encoding task used here encouraged elaboration. Manipulation of encoding (e.g. semantic versus structural) may help us better understand the importance of elaboration in MCM. The manipulation of retrieval strategies may also shed light on the process of MCM (e.g. Anderson & Pichert, 1978). Secondly, future research should attempt to disentangle the participation of mood in MCM, and other variables such as neuroticism. Related to this, the results here may suggest the importance of rumination in depressed MCM. Thus, further operationalization of rumination and elaboration is needed so that future research can
identify these cognitive mechanisms and further investigate their importance in MCM.

This study showed that MCM is found in explicit memory but not in implicit memory. This finding supports the suggestion that elaborative mechanisms may be an important variable underlying explicit MCM bias. Thus, future research should use other methodologies to investigate the participation of elaboration in MCM. If further progress is made in identifying this cognitive mechanism, and this mechanism proves to be important in MCM, cognitive treatments of depression may be improved by determining treatment strategies that may more effectively intervene in this process.
REFERENCES


Mood Congruent Memory


Mood Congruent Memory


Appendix A

The Beck Depression Inventory (BDI)
Appendix B
Schedule for Affective Disorders and Schizophrenia (SADS)
Depression Section
Appendix C

Visual Analogue Scale (VAS)
NAME ______________________________________________________

On the line below please indicate how sad or depressed you are feeling right now. As you can see, the left hash mark represents "normal mood" and the right hash mark represents "extreme depression". Please place a vertical slash on the line at the point which you feel best represents your mood right now.

normal                      extreme
mood                          depression
Appendix D

Profile of Mood States (POMS)
PLEASE NOTE

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145, Profile of Mood States (POMS)
147-149, Eysenck Personality Questionnaire (EPQ)
151, Shipley Institutes of Living Scale (verbal section)

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Appendix E

Eysenck Personality Questionnaire (EPQ)
Appendix F

Shipley Institutes of Living Scale

(verbatim section)
Appendix G

Verbal Stimuli
The above lists the stimuli used in the described experiment. Word frequencies are given in parentheses, and the three or four letter word stem used in the cued recall and word completion tasks are shown by underline.
Appendix H

Scoring Guide for Correct Responses
Acceptable responses for presented word stems.

cal_________ calm, calmed, calming, calmly
pol_________ poise, poised
liv_________ lively, livliest
com_________ comfort, comforted, comforting, comfortable
tal_________ talented, talent
cre_________ creative, creativity
tran________ tranquil, tranquility
viv_________ vivacious, vivaciously
pos_________ post
pea_________ pear
pow_________ powder, powdered, powdering
bou_________ boulder, bouldered, bouldering
nut_________ nutmeg
pur_________ purchase, purchased, purchasing
lat_________ latitude
tele________ telescope, telescoped, telescoping
pan_________ panic, paniced, panicing
alo_________ alone
stu_________ stupid, stupidity
defe_________ defeat, defeated, defeating
reg_________ regret, regretful, regretting, regretted
infe________ inferior, inferiority
cri_________ criticize, criticized, criticizing, critical
disa_________ disapprove, disapproved, disapproving, disapproval
sta_________ stab, stabbed, stabbing
vic_________ victim, victimized
can_________ cancer
fun_________ funeral
ass_________ assault, assaulted, assaulting, assultive
coll_________ collapse, collapsed
mut_________ mutilate, mutilated, mutilating
incu________ incurable
truu_________ trust, trusted, trusting, trustworthy
bli_________ bliss, blissful
ela_________ elated, elate
prosu_________ prosper, prospered, prospering, prosperity
deci_________ decisive, decisiveness
car_________ carefree
reassure, reassuring
ref_________ refreshed, refresh, refreshing
sto_________ story, storied
fri_________ fringe, fringed, fringing
cru_________ cruise, cruised, cruising, cruiser
sha_________ shampoo, shampooing, shampooed
cir_________ circuit, circuiting, circuited
sandwich, sandwiches
forehead, foreheads
chronicle, chronicled
weak, weaken, weakened, weakening
dread, dreaded, dreading, dreadful
remorse, remorseful
hopeless, hopelessness
guilty, guilt
deprived, deprive, depriving
listless, listlessness
persecute, persecuting, persecuted
harm, harmed, harming
fatal, fatality, fatally
hearse, hearst (?)
attack, attacked, attacking
fracture, fractured, fracturing
coronal
ambulance
suffocate, suffocating, suffocated
relax, relaxed, relaxing
secure, secured, securing
respect, respected, respecting, respectful,
respectfully
serene, serenity
rej_________ rejoice, rejoiced, rejoicing
deli_________ delight, delighted, delightful, delighting
dil__________ diligent, diligently
c conf_________ confident, confidently
bat__________ bath, bathing, bathed
trai_________ trail, trailed, trailing
aut__________ author, authored, authoring
sho__________ shower, showered, showering
mole________ molecule
cos__________ costume, costuming, costumed
pub__________ publisher, publishing, published, publishings, publishers
inte________ interpret, interpreting, interpreted, interprets
emp__________ empty, emptied, emptying
sco__________ scorn, scorned, scorning
bea__________ beaten, beat, beating
insu________ insult, insulted, insulting
hos__________ hostile, hostility
desp________ despised, despise, despising, despicable
impo________ impotent
wor________ worthless, worthlessness
pai__________ pain, pained
wou________ wound, wounded, wounding
coff________ coffin
let________ lethal, lethality
stra________strangle, strangled, strangling
acc________ accident, accidentally
cas________ casualty
para________paralysis, paralyzed, paralyzing
VITA

PERSONAL DATA

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EDUCATION

1990    Ph.D. Louisiana State University
        Baton Rouge, Louisiana
        Major: Clinical Psychology
        Minor: Behavioral Neurology

1987    M.A. Louisiana State University
        Baton Rouge, Louisiana
        Major: Psychology

1983    M.A. Western Baptist Seminary
        Portland, Oregon
        Major: Psychology

1980    B.S. University of Oregon
        Eugene, Oregon
        Major: Psychology

PROFESSIONAL EXPERIENCE

Research Experience
   Responsibilities included literature search, organization of data, computer
   analysis of data using SAS, collection of data, organization of research
   projects. Supervisor: Dr. Donald A. Williamson, Ph.D.
1982-1984
Research Assistant, Portland, OR.
Organization, administration, and data
collection of 60 subject treatment
outcome study concerning the cognitive
treatment of depression. Supervisor:
Dr. Rebecca Propst, Ph.D.

Teaching Experience
1990-present
Assistant Professor, Psychology
Department, Eastern Washington
University, Cheney, WA. Supervisor: Dr.
William Williams, Ph.D.

1988-1989
Instructor, Louisiana State University.
Taught adolescent psychology for three
semesters as half time instructor.
Supervisor: Dr. James Geer, Ph.D.

1985-1986
Teaching Assistant, Abnormal Psychology,
Louisiana State University, Baton Rouge,
Louisiana. Responsibilities included
lecturing, formation, administration,
and scoring of exams. Supervisor: Dr.
Yvonne Osborne, Ph.D.

1989-1990
Psychology Intern, University of
Southern California-L.A. County Medical
Center. Responsibilities include both
clinical and research activities.
Supervisor: Dr. Norm Tiber, Ph.D.

1984-1985
Teaching Assistant, Experimental
Psychology, Louisiana State University,
Baton Rouge, La. Responsibilities
included scoring tests, directing lab.
Instructor: Dr. Robert Mathews, Ph.D.

Clinical Experience
1988-Sept. 1988
Therapist, Parkland Hospital, Baton
Rouge, LA. Served as therapist on
eating disorders team. Responsibilities
included eating disorder assessments,
individual and group eating disorder
therapy. Supervisor, Dr. Donald A.
Williamson, Ph.D.
1987-May, 1988  
Mental Health Technician, Parkland Hospital, Baton Rouge, La. Worked with various eating disordered patients (primarily Bulimia Nervosa). Supervisor: Dr. Donald A. Williamson, Ph.D.

1987-1988  
Practicum, Psychological Services Center, Louisiana State University, Baton Rouge, La. Assessment and treatment of various eating disordered patients. Primary therapist: Binge-eat obesity group. Assessment and treatment of affective disorders. Primary therapist: Unipolar Depression group. Supervisor: Dr. Donald A. Williamson, Ph.D.

1986-1987  
Practicum, Psychological Services Center, Louisiana State University, Baton Rouge, Louisiana. Assessment of various eating disordered patients, student co-therapist with family group, and obesity group. Supervisor: Dr. Donald A. Williamson, Ph.D.

1985-1986  
Practicum, Psychological Services Center, Louisiana State University, Baton Rouge, La. Assessment and treatment of children and adolescents. Supervisor: Dr. Johnny Matson, Ph.D.

1984-1985  
Practicum, Psychological Services Center, Louisiana State University, Baton Rouge, La. Assessment and treatment of adult patients. Supervisor: Dr. William F. Waters, Ph.D.

1982-1983  
Practicum, George Fox College, Newberg, Oregon. Assessment and treatment of students at this liberal arts college. Supervisor: Dr. Emory Nester, Ed.D.
OTHER POSITIONS HELD
1985-1986 Served as student representative to the to the Clinical Training Committee, Louisiana State University, Baton Rouge, Louisiana.

PUBLICATIONS


MANUSCRIPTS UNDER REVIEW:

MANUSCRIPTS IN PREPARATION


Watkins, P. C. A measure for assessing the acceptability of psychological explanations for problem behavior.

Watkins, P. C., Mathews, A., Williamson, D. A., & Fuller, R. Mood congruent information is more retrievable but not more accessible in depression.

UNPUBLISHED MANUSCRIPTS


RESEARCH IN PROGRESS

Watkins, P. C. The development of the "Food Automatic Thoughts Questionnaire" (FAT).


PRESENTATIONS


RESEARCH INTERESTS
Information processing approach to unipolar depression:
- attentional processes in depression
- memory processes in depression
Cognitive and behavioral treatments of depression
Information processing approach to bulimia
Information processing approach to body image.

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