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An investigation of memory deficits in long-term and short-term memory in dysphoric college students

Chul Woo Lee

University of Wollongong

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AN INVESTIGATION OF MEMORY DEFICITS IN LONG-TERM AND SHORT-TERM MEMORY IN DYSPHORIC COLLEGE STUDENTS

A thesis submitted in fulfilment of the requirements for the award of the degree

Doctor of Philosophy

from

UNIVERSITY OF WOLLONGONG

By

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I certify that the thesis entitled *An investigation of memory deficits in long-term and short-term memory in dysphoric college students*, and submitted for the degree of Doctor of Philosophy, is the result of my own research, except where otherwise acknowledged, and that this thesis (or any part of the same) has not been submitted for a higher degree to any other university or institution.

signed: ..................................................

Date: ..................................................
Abstract

Previous studies on depression have suggested that depression is accompanied by memory disturbances such as memory deficits (Hasher & Zacks, 1979; Ellis & Ashbrook, 1988; Hartlage, Alloy, Vazquez, & Dykman, 1993). The thesis aims to explore depressive memory deficits in terms of long-term and short-term memory, employing precision of elaboration and memory span tasks respectively.

The long-term memory deficits focused on elaboration deficits using a subject-generated elaboration method (Stein, & Bransford, 1979). Regarding elaboration deficits in depression, several studies suggested that memory deficits in recall occur in tasks requiring elaborative processing such as in semantic processing within the depth of processing paradigm, and processing of elaborated sentences (Weingartner, Cohen, Murphy, Martello, & Gerdt, 1981, study 1; Ellis, Thomas, & Rodriguez, 1984, study 1). Recall deficits due to these elaboration deficits were attributed to inadequate allocation of cognitive effort expended on the current task. In addition Hasher and Zacks (1988) and Abramson, Alloy, and Rosoff (1981) suggested that depression interferes with elaborative processing. These elaborative processing deficits were inferred from reduced performance in overall recall. However, the purpose of the first three experiments was to examine directly this elaborative processing deficit through precision of elaboration, as well as recall, using a subject-generated elaboration method. The results showed that both recall and the extent of precise elaboration depends upon the task instructions. Consistent with this hypothesis, dysphoric students generated less precise elaboration in a more controlled task instruction, and greater depression is associated with less precise elaboration (experiment 1C), while in a less controlled task instruction (experiment 1A), such a difference in the precision of elaboration disappears. Reduced recall performance was found in experiment 1A, but not in experiment 1C. These results were discussed in terms of a cognitive effort account of depressive
memory deficits and the reduced initiative hypothesis. It seems that these results put a constraint on a general elaborative processing deficit.

The following chapter shifted the focus to the mood induction procedure from naturally occurring depression with aiming to develop a better mood induction procedure in terms of duration and intensity. The most popularly used mood induction procedure, the Velten Mood Induction Procedure is flawed by its short-lived induced mood, particularly when cognitive and behavioural measurement proceeds (Clark, 1983). To overcome this problem, this study examined the effects of three mood induction procedures (the Velten procedure, music mood induction, and the combined Velten-plus-music procedure) on the strength and duration of induced depression while undertaking a sentence completion task. Mood state was measured prior to, immediately after, and at 3 six-minute intervals after mood induction. The results showed that the Velten-plus-music and Velten procedures induced a large immediate increase in depression scores as measured by the Depression Adjective Check List (DACL) and a Visual Analogue Scale (VAS). Mood induced by the Velten-plus-music and music procedure was relatively stable through the post-induction period, but mood induced by the Velten procedure dissipated quickly over time. Anxiety level was increased by all three induction procedures, relative to a neutral music control condition. The results show that the transient mood change induced by the Velten procedure can be prolonged by playing depressing music.

The subsequent four experiments examined verbal short-term memory. The effect of dysphoric mood states on immediate serial recall was investigated from a working memory perspective. Experiments 3A and 3B found no differences between dysphorics and nondysphoric controls with respect to either serial recall of 6 or 7 digits, or speech rate measures. Self-report questionnaires indicated that the dysphorics had a higher incidence of negative automatic thoughts and task-irrelevant thoughts while performing the memory
tasks. However, this did not influence serial recall performance. Experiment 3C investigated serial recall for long and short words, and found similar levels of recall performance, word length effects and speech rates in natural dysphorics and three groups of nondysphorics who were subjected to either neutral, elated or dysphoric mood induction. The natural dysphorics reported more negative automatic thoughts than any of the mood-induced groups, but no differences in report rates for task-irrelevant thoughts were found. In experiment 3D, a running memory span task was used, in which subjects were required to recall the final six items of a list in which list length was 6, 8, 10, or 12 items. In this task, dysphorics showed memory deficits only when list length exceeded 6 items, and updating of the rehearsal set was required. The results of Experiments 3A - 3C show that the articulatory loop is functioning normally in dysphorics, but experiment 3D suggests that dysphorics have difficulty in adapting their rehearsal strategies, suggesting a deficit in central executive function. The results are discussed in terms of the distinction between automatic vs. effortful processing, and in terms of the distinction of maintenance vs. elaborative rehearsal.

The next two experiment address similar issues to verbal short-term memory in the visual recognition memory of matrix patterns with varying retention intervals (1, 8, 15 seconds). Experiment 4A using a 4 x 4 matrix pattern showed that recognition performance of dysphorics did not deteriorate more rapidly over retention intervals, compared to nondysphorics, nor did overall performance vary between both groups. The subsequent experiment, 4B, used a 5 x 5 matrix pattern with longer retention intervals (1, 15, 30 seconds). There was a significant interaction between group and retention intervals. However, this interaction effect was due to poor performance of dysphoric subjects in the immediate recognition test rather than in a longer retention interval, compared to nondysphorics. These results suggest encoding difficulties rather than difficulties in the maintenance rehearsal of stimuli. In terms of the working memory model, these results are
similar to those in verbal short-term memory, suggesting that dysphoric students have some
difficulties with central executive functioning rather than with the visuo-spatial scratch pad
responsible for the maintenance rehearsal of visual stimuli.

In sum, the results reported appear to fit better with the initiative deficit hypothesis
rather than the reduced attentional capacity or cognitive effort accounts of depressive
memory deficits because performance of depressives was sensitive to task instruction and
cognitive strategy rather than task difficulty.
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CHAPTER 1

Theoretical Frameworks of Memory Disturbances in Depression

1.1 Phenomenology of Depression

Depression has been used to describe a brief negative mood which ordinary people experience in their daily life and whose duration lasts a few minutes or a day, having little disruptive effect on their life; for example, interest in their usual pleasant activities, cognitive functioning, and interpersonal relationships. Most people from time to time experience depressed affect as a transitory reaction to life events, such as minor failures and disappointment. In general, they make an effort to exit from such distress and most find that depressed periods pass quickly. However, some people experience a more lasting negative affect, developing more severe depressed affect with accompanying symptoms; eg., negative thoughts and feelings about themselves. They become more self-occupied, recalling unpleasant experiences more frequently, find fault with themselves, which consequently leads to a negative self-concept, pessimism about the future and the current situation (Beck, 1967).

To identify general features of depression is important because any theoretical framework should take account of these features. Major symptoms of depression can be categorized into cognitive, somatic, and motivational aspects. According to the DSM-III-R (1987) and Akiskal and McKinney (1975), besides dysphoric mood, various symptoms accompany depression; negative cognitions of the self (eg., self-devaluation and low self-concept), thoughts disturbances (eg., poor concentration, mixed-up thoughts, and slow thinking), intrusive thoughts of death or suicide, motivational deficits (eg., lethargic responding and decreased interest in usual activities), and somatic changes (weight loss or gain, sleep disturbances, and appetite disturbance). Each of these symptoms has received attention from many researchers by examining the difference between depressed and nondepressed persons. For example, in relation to negative
cognitions of the self, Beck, Steer, Epstein, & Brown (1990) using the Beck Self-Concept Test, showed that depressed patients (unipolar and bipolar depressives) have low and negative self-concept relative to anxiety patients and psychiatric controls. Regarding decreased interests in activities, Isen, Shalker, Clark, and Karp (1978) found that people whose depressed mood was induced by having them lose at a computer war game are less likely to attend to another activity, compared with people in an elated mood through winning. These results suggest that depression reduces interest in activities.

As an example of poor concentration, Watts and Sharrock (1985) found that depressed patients experience concentration problems in reading and watching the television. In relation to psychomotor retardation, clinically depressed people slowed down their speech rate as measured by the total time taken to count from 1 to 10 in their own time (e.g., Szabadi, Bradshaw, & Besson, 1976; Teasdale & Fogarty, 1979). Concerning weight fluctuation, Frost, Goolkasian, Ely, and Blanchard (1982) studied current eating behaviour among high- and low-restraint people while they were undergoing the Velten mood induction procedure (VMIP, 1968; elation, depression, and neutral). Depressed high-restraint people took in significantly more food than neutral or elated high-restraint people and depressed low-restraint people. These results suggest that depression can have effects on an actual eating behaviour as a function of one’s level of eating history (high vs. low restraint). Two studies on suicidal intent (Hill, Gallagher, Thompson, & Ishida, 1988; Ranieri, Steer, Lavrence, Rissmiller, Piper, & Beck, 1987) reported that depression is positively correlated with suicidal intent.

Despite such diverse differences between nondepressed and depressed people, there are some controversial issues. Firstly, whether such depression-related symptoms are unique to depressed people or are part of a non-specific negative symptomatology of general psychopathology (cf. Gotlib, 1984; Burt, Zembar, & Niederehe, 1995). Secondly, depression co-occurs commonly with anxiety disorders, eating disorder,
alcohol, and drug abuse (Gotlib, & Hammen, 1992). Particularly, to select a purely depressed sample from a student population seems difficult (Ingram, Kendall, Smith, Donnell, & Ronan, 1987). Finally, another issue is whether mild/moderate depression classified by dint of psychometric measures (e.g., BDI), not by clinical diagnosis, is qualitatively the same as clinical depression (Depue & Monroe, 1978). In other words, this is the issue of whether depression can be placed on the continuum ranging from mild to severe depression. The last issue is particularly relevant here because the following experiments in this thesis rely on dysphoric students except for two experiments. The following section will address this issue in detail.

1.2 Generalisability of Findings from Analogue Studies to Clinical Depression

Depression-related studies have relied on different depressed subject populations; e.g., mildly/moderately depressed students, elderly depressed people, clinically depressed patients (e.g., Hasher, Rose, Zacks, Sanft, & Doren, 1985; Gibson, 1981; Weingartner et al., 1981). In addition, researchers have used a mood induction procedure to induce depression (e.g., Ellis et al., 1984). One controversial issue is whether findings from the analogue studies using either mood induction procedures or a mildly/moderately depressed student population can be generalised to the clinical population.

Many of the studies have relied on the student population. Depressed students were screened out from the student population by using various psychometric measurements (e.g., BDI: Beck Depression Inventory, Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The typical procedure in the selection of depressed students is to administer the BDI and to classify them into depressed and nondepressed group according to their scores on the BDI. However, the concerns of generality and validity of analogue studies using the student population to clinical depression were addressed due to following reasons (Depue & Monroe, 1978; Coyne & Gotlib, 1983). One of the central concerns is with the severity of depression; depressed patients are more severely
depressed than college students. In addition, in other demographic factors such as age, marital status, IQ, and education, college students and clinical patients may be different. Secondly, depression in college students is confounded with other general psychological distress such as anxiety, hostility, and maladaptive beliefs (Coyne & Gotlib, 1983). Relative to college students, depressed patients show more dramatic impairment in behavioural, anxiety, and other somatic components. Finally, depression experienced by college students is ephemeral and unstable, relative to clinical depression. However, in their recent review on analogue studies using college students, Vredenburg, Flett, and Krames (1993) concluded that these claims are not well founded, and that the existing empirical findings suggested that the general findings from analogue studies using dysphoric student populations are similar to those from clinical depression. Another type of analogue studies employing a mood induction procedure will be discussed in another chapter.

1.3 Theoretical Frameworks of “Depression and Memory”

Many researchers on depression are interested in what factors make people depression-prone, contribute to the maintenance of depression, and what kinds of qualitative and quantitative changes in cognitive and interpersonal areas depressed people experience. Particularly in the area of “depression and memory”, diverse theoretical frameworks have been proposed to explain negative memory bias and memory deficits in depressed people (e.g., Hasher & Zacks, 1979, 1988; Teasdale & Barnard, 1993; Ellis & Ashbrook, 1988, Williams, Watts, MacLeod, & Mathews, 1988). Memory function in depressed people has been investigated quite extensively using the application of the information processing approach to “depression and memory”. A number of depression-related studies employing experimental paradigms at all levels of cognition have been conducted; for example, verbal and visual short-term memory (e.g., Colby & Gotlib, 1988; Cornblatt, Lenzenweger, & Erlenmeyer-Kimling, 1989), depth of processing (eg.,
Deny & Kuiper, 1981; Davis, 1979a; Kuiper & Derry, 1982), cognitive effort (e.g., Ellis et al., 1984), implicit vs explicit memory (Roediger & McDermont, 1992; Elliott & Greene, 1992; Denny & Hunt, 1992; Watkins, Mathews, Williamson, & Fuller, 1992), and attentional bias (e.g., MaCabe & Gotlib, 1993; Ingram, Bernet, & McLaughlin, 1994). The advantage of employing these experimental paradigms is that more specified cognitive processes can be investigated; which memorial processes are impaired and which remain intact in depression.

Three main frameworks of effects of depression on memory will be considered: the first predicts a negative memory bias of depressives towards negative information (e.g., Beck, 1967, 1979; Bower, 1981), the second is related to depressive memory deficits (e.g., Hasher & Zacks, 1979; Ellis & Ashbrook, 1988), and the third is associated with depressive self-focused attention as a mediating variable of depressive memory deficits and memory bias (e.g., Pyszczynski & Greenberg, 1987). Each framework is different in their emphases on different aspects of altered cognitive functioning. The negative memory bias is predicated on schematic/network processing, depressive memory deficits are based on the assumption of limited attentional capacity, and the explanation of negative memory bias and performance deficits relies on the self-regulatory process and self-focused attention.

Secondly, in regard to emotional contents of stimuli used, the three major frameworks are different. The schema/network and self-focused attentional models mainly have been interested in the interaction between emotional contents and depression, whereas the attentional capacity model is more concerned with neutral ones in that the content of stimuli is neither positively nor negatively valenced. Even though depressive memory deficits are of a primary interest to the current study, the three approaches are discussed because of their complementary function in understanding depressive memory deficits.
1.3.1 Attentional Capacity-related Frameworks and Depression

Several reviews on cognitive functioning in depression demonstrated that depression impairs cognitive functioning including memory (McAllister, 1981; Williams et al., 1988; Miller, 1975; Hartlage, Alloy, Vazquez, & Dykman, 1993; Ellis & Ashbrook, 1989; Burt et al., 1995). The following frameworks in this category dealt with such questions as the nature and extent of the memory impairment and the etiology of such deficits in depression. The common assumption among frameworks is that depressive memory deficits arise from a limited attentional capacity which can be allocated to various mental activities including depressive thoughts (cf. Kahneman, 1973). According to the general capacity theory (cf. Kahneman, 1973), different mental activities impose different demands on the limited capacity and these activities requiring attention compete for the limited amount of resources. In general the allocation of attentional resources is affected by four factors; i) a dispositional tendency reflecting involuntary attention (e.g., allocate attention to a novel smell; to one’s name in the unattended ear; ii) momentary intentions, iii) the evaluation of demands, and iv) the levels of arousal (Norman, 1976). From this general notion of the capacity theory, several variants have developed, which will be described in the following sections.

1.3.1.1 Reduced Attentional Capacity Model

With the assumption of the limited attentional capacity, Hasher and Zacks (1979) proposed a theory to account for the effects of aging, arousal, stress, and depression on memory. The theory comprises two basic assumptions. The first one is that cognitive operation on most tasks requires some attentional resources; at the one end of the continuum are automatic processes, at the other end, effortful processes. Automatic processes are considered as requiring minimal attentional resources from the limited-capacity attentional mechanism. They can occur without intention, and without interfering with other processing and they do not benefit from practice. In contrast,
effortful processes require considerable attentional capacity, and so tend to interfere with other cognitive activities also requiring capacity (cf. Hartlage et al., 1993). In regard to attributes of automatic vs. effortful processes, they claimed that automatic processes encode the fundamental aspects of the flow of information, i.e., spatial, temporal information, and frequency of occurrence (e.g., Hasher & Zacks, 1984; cf. Ellis, 1990, 1991). On the other hand, effortful processes are involved in learning and memory including imagery, rehearsal, organization, and mnemonic techniques. The second assumption is that attentional capacity varies both within and between individuals. The available attentional capacity at any moment is affected by such variables as depression, age, and stress.

With these two assumptions, they contended that reduced available capacity could occur because of a reduction in total attentional capacity in depression. As a result, the reduced attentional capacity impairs those cognitive processes particularly requiring attentional capacity (i.e., effortful processes) but has no effect on those processes not requiring attentional capacity (i.e., automatic processes). In regard to the relationship between the severity of depression and available capacity, their subsequent studies suggested that the degree of reduction in attentional capacity is proportional to the severity of depression (Hasher et al., 1985; Hasher, Zacks, Rose, & Doren, 1985).

The impairing effects of depression on the effortful tasks were tested in a forced choice recognition test and recall of prose among mildly/moderately depressed people (Hasher & Zacks, 1979, study 4; Hasher et al., 1985). The findings of some earlier studies were not supportive of their prediction; overall performance deficits in depression were not found in either test. The null findings in the prose recall were interpreted as that the prose task might not be so demanding as to disrupt performance and/or the level of depression was not severe. However, a recent review on depressive memory deficits in terms of the continuum of automatic vs. effortful processing supported the assumption that depression interferes with effortful processing but not with automatic processing.
More apparent memory deficits were found in clinical depression than mild/moderate depression such as in a student population. On the other hand, as they claimed, the processing of frequency was not disrupted by depression (Hasher & Zacks, 1979, study 3). However, there is some controversy over whether processing of spatial information by nondepressed people is automatic (cf. Naveh-Benjamin, 1987, 1988; Ellis, 1990, 1991). Furthermore whether the spatial processing of information in depression remains intact is not clear.

One of the drawbacks with this framework (Hasher & Zacks, 1979) is that the model is not clear about the mechanism of how depression reduces the available capacity. The revised capacity model (Hasher & Zacks, 1988) addressed this problem. In response to criticisms of the general capacity view, Hasher and Zacks (1988) proposed the revised capacity model which was originally designed to predict the relationship among age, memory, and discourse comprehension. However, Hasher and Zacks (1988) claimed that the model could be applied to the studies of depression (pp. 194). In contrast with the old reduced capacity model, the revised framework proposed an inhibition mechanism to explain cognitive deficits in depressive mood states. The normal function of the inhibition mechanism is to prevent task-irrelevant ideas (called off-goal-path thoughts) from entering into working memory, helping people concentrate on the current criteria of the task. In depressed mood states, the inhibition mechanism is malfunctioning or becomes inefficient, and as a result, more off-goal-path thoughts are allowed to enter working memory. Once they enter working memory space, it allows the irrelevant information to receive sustained activation. Three categories of off-goal-path thoughts were illustrated: irrelevant environmental details, personalistic memories or concerns, and off-goal-path interpretations. The hypothesis of a malfunctioning inhibition mechanism in depression suggests that depressive memory deficits can occur due to off-goal-path thoughts which could occupy or compete for the limited working memory capacity with goal-path thoughts. In addition, they put forward more specific
assumptions. More specifically, this malfunctioning inhibition mechanism can cause lowered self-initiated activity in elaborative processing, resulting in poor elaboration and attentional deficits by reducing the ability to switch their attention from one task to another. In sum, the possible cause of depressive memory deficits lies in the malfunction of an inhibition mechanism and the intrusion of off-goal-path thoughts into working memory capacity (thought contents).

The concept of off-goal-path thoughts appears parallel to such various terms as task-irrelevant and extra task-irrelevant thoughts (Ellis & Ashbrook, 1988), and negative automatic thoughts (Beck, 1967; Hollen & Kendall, 1980). In a similar vein, the concept of a degenerated cognitive structure (inefficient inhibition mechanism) was proposed by Kuhl and Helle (1986) to explain depressive memory deficits. According to the degenerated cognitive structure hypothesis, memory deficits occur because an inefficient inhibition mechanism allows degenerated intentions to intrude into working memory capacity. The concept of a degenerated intention can be compared to off-goal path thoughts (Hasher & Zacks, 1988). Kuhl and Helle (1986) defined intentional states as the most self-committing and motivational states and claimed that depression involves excessive perseveration of intentional states related to unfulfilled goals arising from events such as object loss or loss of control. The degenerated intention means that depressed people tend to encode unrealistic intentions into realistic ones. This hypothesis was examined in a study which compared depressed patients with nondepressed patient controls on short-term memory span by inducing degenerated-intention. As predicted, depressed patients found it difficult to discard unrealistic intentions. On the memory span task, depressed patients in the degenerated condition showed a poor performance, compared to nondepressed patient controls. They concluded that depressive STM deficits occur due to the interference of unfulfillable intentions within working memory. Compared to the revised reduced-capacity framework (Hasher & Zacks, 1988), the
degenerated intention hypothesis placed more emphasis on the motivational (intentional/volitional) aspect of depression to explain depressive memory deficits.

1.3.1.2 Resource Allocation Model

From a similar perspective to Hasher and Zacks (1979, 1988), Ellis and Ashbrook (1988, 1989) proposed a resource allocation model to explain the disruptive effects of emotional mood states on memory tasks. Their model makes three principal assumptions to explain the mainly disruptive effects of depressed mood states on cognitive performance. First, emotional states such as depression regulate the allocation of attentional resources, such that the total available capacity in depression is reduced. Second, in most cases, the encoding of information usually requires some allocation of capacity, which is the same as the assumption by Hasher and Zacks (1979). Third, memory performance is frequently correlated with the amount of capacity allocated to the cognitive task (e.g., Tyler, Hertel, McCallum, & Ellis, 1979). As additional elements, "irrelevant-task processing" and "extra-task processing" were proposed to explain memory deficits in depressed mood states.

Irrelevant-task processing means that attentional processing of subjects is directed to all those features of a task which are unnecessary for optimal performance of the criteria task, while extra-task processing means any allocation of their attentional capacity to a whole range of potential cognitive activities directed toward any events other than the criterion task (e.g., thinking about sad feeling). With these assumptions, they predict that depressive memory deficits occur on effortful tasks when some portion of total capacity is diverted to irrelevant-task and/or extra-task processing. In addition, their review illustrated some variables affecting depressive memory deficits; structural and organisational characteristics of the task, its personal relevance, task demands, and the degree of knowledge or expertise of subjects. Concerning these variables, it was claimed that the processing of highly organized, highly personally relevant, familiar
materials would require fewer cognitive resources (less effortful processing) and thus should be relatively impervious to any disruptive mood effects.

In sum, depression reduces the total available capacity but depressive memory deficits are determined by both the extent of cognitive effort required by a task and/or irrelevant/extra-task processing. That is, despite this reduced capacity, they can perform as well as nondepressives at relatively easy task.

In comparison to the reduced capacity model (Hasher & Zacks, 1979, 1988), the resource allocation model has many common features to explain memory deficits in depressed mood states. First of all, both frameworks assume a limited attentional resource and depressive mood states reduce the attentional capacity available to the current task. Secondly, these task-irrelevant thoughts (irrelevant-task processing and extra-task processing) and off-goal path thoughts respectively can compete for the reduced capacity with task-relevant thoughts. Thirdly, depressive memory deficits are most likely to occur in conditions when the task requires effortful processing. This account of depressive memory deficits was called the “cognitive effort account” by Hertel and Rude (1991a).

This argument was supported through depressive memory deficits found across three studies (Ellis et al., 1984). In three studies employing an incidental recall paradigm, experimentally depressed people showed an overall recall decrement in elaborative processing of sentences, in semantic processing of words, and in more difficult sentence frame to fit a target word in. These overall deficits were interpreted as being due to their poor allocation of attentional resources to the more effortful task condition. So processing of elaborated sentences, semantic processing of words, and sentences accompanying more difficult decision, are assumed to be more effortful than nonelaborated, structural processing, and sentences with a less difficult decision respectively. However, in effect, no measurements of either cognitive effort expended or
depressive thoughts (irrelevant/extra-task processing) as possible causes of deficits were undertaken.

There are some criticisms of the resource allocation model, which are applicable to the reduced capacity model (Hasher & Zacks, 1979). Kihlstrom (1989) noted that the resource allocation model is ambiguous about the effects of positive mood states on memory. Particularly he raised the question of whether positive as well as negative thoughts can induce task-irrelevant processing, thus impairing performance. Secondly, he pointed out that the model can not predict other memory phenomena such as mood-congruence and mood state-dependent learning and retrieval (e.g., Bower, 1981). Riskind (1989) noted that the motivational factor was ignored in the model. Motivational deficits were proposed as an explanatory framework for depressive memory deficits (Miller, 1975; McAllister, 1981). As an alternative view to the resource allocation model, he suggested that due to low motivation of depressives, depression may also diminish the person’s expectation that attending or allocating resources to tasks would produce any benefit. The hypothesis of motivational deficits is contrast with the reduced capacity model and the resource allocation model in that the motivational hypothesis does not necessarily assume a reduced attentional capacity. Also it can predict that the depressive memory deficits can be removed if attention or interest could be stimulated by suitable incentives or more specific instructions to encourage depressed people. Another problem with both models is that there is rarely any independent measure of attentional capacity allocation (Mitchell & Hunt, 1989). Furthermore it is not clear what makes the task more or less demanding.

1.3.1.3 Reduced Cognitive Initiative vs. Resource Allocation Models

Recently the reduced capacity and the resource allocation models have been challenged. In contrast with those capacity-based frameworks (Hasher & Zacks, 1979; Ellis & Ashbrook, 1988), Hertel and Hardin (1990) explained depressive memory deficits
in terms of reduced initiative (Hertel & Hardin, 1990) or reduced cognitive self-control (Hertel, 1994). They assumed that if depressed subjects can allocate resources and perform as well as nondepressed subjects on effortful tasks, the origin of the deficit lies in the stage of initiating such effortful processing rather than a lack of ability due to reduced capacity. According to this model, depression inhibits cognitive initiative, so that depressed people do not spontaneously use strategies or engage in the types of elaborative thinking that produces good performance, hence causing depressive memory deficits particularly in the uncontrolled task. However, they are able to do so when they are given a specific instruction to muster their attention to the current task. So an emphasis shifts away from reduced capacity to the initiation of cognitive strategy for memorial processes for optimal performance particularly in an uncontrolled task condition.

A similar argument to the reduced initiative model was mentioned in the previous studies (Hasher & Zacks, 1988; Abramson, Alloy, & Rosoff, 1981). According to Hasher and Zacks (1988), depression reduces self-initiated activities, whose role is to create distinctive memory traces through elaboration. As a result, depressives are likely to show their memory deficits when the task requires self-initiated activities from subjects. The difference to the reduced initiative model is that the reduction in self-initiated activities results from the reduced processing resources. Abramson et al. (1981) examined the hypothesis testing strategy of depressed students in the response-outcome paradigm of the learned-helplessness model. Depressed students show poor performance in the self-generated hypothesis condition, but not in the experimenter-provided hypothesis condition. They suggested that in general, depressives do not seem to actively engage in cognitive strategies; for example, attention focusing, memory search and rehearsal. Performance deficits in depressives are closely associated with failure of depressives to initiate helpful cognitive strategies for the solution of the problems. A similar conclusion can be drawn from a study examining problem solving strategy
In the "Levene task" (Levene, 1966) examining hypothesis-testing behaviour, depressed patients are to narrow down possible solutions until they reach the final solution. Depressed subjects show poor performance due to poor focusing (inability to narrow down a set of hypotheses) and perseveration on disconfirmed hypotheses. These results can be interpreted in terms of the reduced initiative hypothesis; as self-initiated activities for problem solving can be seen as a less controlled situation relative to an experimenter-provided condition, depressed subjects could show performance deficits.

Furthermore, several studies have tested the reduced initiative model (Hertel, 1994; Hertel & Hardin, 1990; Hertel & Rude, 1991a, 1991b; Channon, Baker, & Robertson, 1993a; Slife & Weaver, 1992). Hertel and Hardin (1990) tested these predictions using implicit and explicit memory tests (Jacoby & Witherspoon, 1982). It is generally accepted that an implicit memory test is not affected by cognitive strategies of subjects, but an explicit memory test is. So if depressed subjects do not elect any strategy spontaneously for their performance, which is not specified by the experimenter, in that situation the lack of initiative should be reflected on the explicit memory test. This assumption was confirmed in study 1 using biasing of homophone spelling and recognition of homophones as implicit and explicit memory tests respectively. Experimentally induced depressed subjects showed depressive memory deficits in the explicit memory test, recognition, but not in the implicit memory test. This dissociation between implicit and explicit tests suggest that nondepressed subjects could use any cognitive strategy which is not set up by the task characteristics. When the study 2 supplied subjects with a possible strategy, memory deficits found in the recognition test disappeared. These results imply that depressed subjects did not generate helpful strategies for the recognition test, while nondepressed subjects did. Depression reduces self-initiated cognitive strategy in the retrieval phase. In sum, the locus of the depressive
memory deficit lies in the initiation of strategy, not of effortful processing in the recognition task.

Other supportive results were obtained with experiments using the sentence completion task in which subjects were to fit a sensible word in the sentence frame (Hertel & Rude, 1991b). The variation of initiation by subjects can be induced by encoding instruction, in contrast with the study (Hertel & Hardin, 1990), in which an initiative strategy can be set up at retrieval stage. Two task instructions were employed. In the focused instruction condition, subjects were required to rehearse the target word, while in the nonfocused instruction condition, the choice of rehearsal of the target word was dependent upon the subjects. As predicted by the model, in the incidental recall of target words, depressive memory deficits occurred in the unfocused instruction condition.

Another recent study (Hertel, 1994) supported the reduced initiative model. This time, the variation of initiative takes place during the rating of words that is, during encoding. Two rating tasks for sets of positive, negative, and neutral words were employed; one was for emotional value and the other was for their physical curvature. In the rating process of the physical curvature, subjects are assumed to be able to integrate the level of letters into words even if the task instruction does not require this. So depressive memory deficits should be reflected on the subsequent word identification test in which subjects were asked to read aloud the word presented briefly. Consistent with the prediction from the reduced initiative model depressed subjects identified less words previously rated for their physical curvature, compared to nondepressed people, but this difference did not occur on the words rated for their emotional value. These depressive memory deficits found in the automatic task of word identification are contradictory to the prediction from the resource allocation.

Channon et al. (1993a) contrasted the reduced initiative view with the resource allocation theory (Ellis & Ashbrook, 1988) in the effects of the extent of structure of
word lists on recall among depressed patients. In line with the reduced initiative model, they predicted that depressive memory deficits should obtain in the condition which allowed for the most spontaneous use of cognitive operation when a varying level of structure of word lists (highly, mediumly, unstructured) exists. That is, depressive deficits are expected in the medium structure of materials in which there is the most opportunity to benefit from the use of a strategy to improve performance. In contrast, the resource allocation theory can predict that as unstructured materials require more attentional resources, depressive memory deficits should occur in the unstructured condition. Three types of word lists were used; randomly selected words among which no close relationship exist, and the other two comprised categorised words with two presentation methods (random and clustered). Depressive memory deficits were found only in the medium structure condition, i.e., when the categorised words were presented in a random order. These results support the reduced initiative model and suggest that a simply more demanding task (unstructured word lists) does not always accompany memory impairment with depressives.

However, the recent study by Baker and Channon (1995) failed to show any differential effects between depressed and nondepressed groups when a helpful strategy in the Levene reasoning task was provided to focus their attention on the task. Overall depressive deficits occurred regardless of provision of the helpful strategy. The helpful strategy was to ask subjects to report all possible alternative hypotheses to solution. In contrast, in a similar condition, Silbermann et al. (1983) found a facilitative effect of helpful strategies in depressed patients, but still their overall performance deficits remain. The results in both studies suggest an actual reduction in total available capacity with or without the reduced initiation of cognitive strategy. These results in the reasoning task area are contrasted with those in memory tasks employed by Hertel and her colleagues showing no overall deficits. The role of initiation in the reasoning task requires a more research in this area.
In sum, the cognitive effort account of depressive memory deficits did not consider the varying extent to which effortful processing is self-initiated vs. demanded by task characteristics (Hertel, 1994). Those studies aforementioned proved that memory deficits can be obtained according to the variation of the self-initiated activities independent of attributes of effortful operation. Furthermore such memory deficits can be reversed by reducing the role of self-initiative activities in task performance through more controlled task instruction or provision of a helpful strategy for performance. However, depressive memory deficits caused by this lowered self-initiative seem to be explained by irrelevant task and/or extra task-processing without necessarily assuming reduced initiative (Ellis, 1991; Ellis & Ashbrook, 1988). In other words, those task instructions used for reversal of memory deficits appear to increase subjects’ attention to the current task, thus facilitating task-relevant processing. Furthermore, from a theoretical perspective, the reduced initiative model is not clear about whether the reduced initiative arises from motivational or cognitive deficits (Hetel & Hardin, 1990).

Despite some drawbacks in the reduced initiative hypothesis, supporting evidence for this claim comes from the findings in self-focused attention studies that depressed people were found to have heightened self-focused attention to internal matters (e.g., Smith & Greenberg, 1981; Ingram & Smith, 1984; Smith, Ingram, & Roth, 1985) and that depressives suffer from concentration difficulties (Watts & Sharrock, 1985). A clear distinction between the reduced-capacity hypothesis and narrowing attention to task-irrelevant thoughts was made by Hartlage et al.’s (1993) review, which will be discussed in the following section.

1.3.1.4 Comparison of Capacity - Reduced vs. the Narrowing of Attentional Focus Models

Hartlage et al. (1993) distinguished between a reduced attentional capacity and narrowing of attentional focus on depression-relevant thoughts, in explaining depressive
memory deficits. A narrowing attentional focus is not incompatible with the reduced capacity model, but it does not assume a difference in total available capacity across depressed and nondepressed groups. According to this hypothesis, memory deficits in effortful processing operations are associated with a primary allocation of available capacity to the depression-related materials and/or thoughts, thus reducing capacity available to the current task performance. The source of depressive memory deficits lies in inadequate allocation of available capacity rather than the absolute reduction of total capacity. A third explanatory framework can be made by combining the reduced capacity model and narrowing attentional focus hypothesis. According to this combined version, during depression, both reduced capacity and inadequate allocation occur (Ellis & Ashbrook, 1988). The contrast of the reduced capacity with narrowing attentional focus was substantiated by investigating the previous literature employing a secondary task. Hasher and Zacks (1988) recommended the secondary task procedure as the best available method of measuring available capacity. The main assumption underlying this comparison is that if depressives direct their attention to depression-relevant thoughts without reducing the available attentional capacity (narrowing attentional focus), the total latencies across probe signals (neutral, positive, and negative) should be equal in depressives and nondepressives. This is because depressives are expected to respond faster to negative words than neutral or positive words, whereas nondepressives are reported to respond faster to positive words than neutral or depressive words. Otherwise, if a longer total response time is found for depressives relative to nondepressives, this supports the reduced capacity hypothesis. According to the reduced capacity model, this is because depression reduces total available capacity and hence the remaining available capacity for the probe task is smaller than that of nondepressives. The findings from relevant studies are in favour of narrowing attentional focus view (e.g., MaCabe & Gotlib, 1993; Bargh & Tota, 1988; Ingram, 1984).
MaCabe and Gotlib (1993) examined attentional bias in a dichotic listening task with a concurrent light-probe reaction time task. The distracting words varied from positive, neutral, to negative words and were presented through the unattended channel. Both groups (depressed patients and normal controls) did not differ in their total latencies to the probe signal even though depressed patients showed a longer response time to the probe when negative distractors were presented in the unattended channel than when positive or neutral materials were presented. In an experiment using the depth of processing paradigm with a concurrent digit task as a secondary task, Bargh and Tota (1988) showed that the total latencies as a function of memory load were not different between depressed and nondepressed subjects, even though depressed subjects were faster to respond in a self-referent judgement of negative content words than that of positive and neutral content words. If depression reduced the available capacity, the increase in memory load would have produced longer latencies in depressives. Ingram (1984) examined recall of unfavourable and favourable feedback with a tone-detection task as a concurrent task. The results are consistent with previous studies; total response latency to the probe signal was the same for failure-experienced subjects as for success- or neutral- experienced subjects. Negative mood subjects still were slower to respond to the tone and recall more unfavourable feedbacks than positive or neutral mood subjects when they were presented with unfavourable feedback. Furthermore there was no recall difference among the three mood-induced groups.

Another line of supportive findings for a narrowing of attentional focus comes from the initiative model. The previous review on the initiative model found that depressive memory deficits are more likely to occur in an uncontrolled experimental instruction condition. It can mean that depressives do not pay full attention to the current criterial task. Poor performance may be due to diversion of their attention to their own problems or other task-irrelevant thoughts. Furthermore, depressive memory deficits can be reversed by providing subjects with focused instruction, suggesting that their available
total capacity is equal. This line of reasoning seems to be consistent with the narrowing attentional focus hypothesis. The narrowing attentional focus hypothesis and the reduced initiative proposal have a common assumption of no difference in total available capacity, but differ in their emphasis; the former focuses on diverted attention, and the latter on reduced initiative/motivation.

Another line of studies (distracting effects) seems to be related with testing the reduced capacity vs. narrowing attention hypothesis. Here the distracting effects mean that distracting tasks enhance performance of depressives, and argue that such facilitating effects take place because self-preoccupied thoughts of depressives are removed temporarily by the task (e.g., Foulds, 1952). This interpretation is consistent with the narrowing attentional hypothesis. The distracting effects in depression will be discussed in a later section. In sum, the current available studies appear to offer more support to a narrowing attention view than to the reduced capacity hypothesis.

Theoretical frameworks aforementioned mainly addressed impairing effects of depression on task performance. However, phenomena accompanying depression are more diverse, including mood-dependent/mood-congruent learning and retrieval. Thus a more comprehensive framework is required to accommodate such phenomena as well as depressive memory deficits. Williams et al. (1988, chap. 10) address both areas in their model of “Affective decision and resource allocation”.

1.3.1.5 Affective Decision and Resource Allocation

In contrast with the attempt of the above frameworks to explain depressive memory deficits, Williams et al. (1988) proposed a more comprehensive framework with the aim of explaining both memory deficits and selective memory bias in depression, as well as an attentional bias towards threatening stimuli in anxiety. They noted that both network and schema theories did not consider in detail whether different emotional states may have different effects on different aspects of cognitive processing. Anxiety
mainly accompanies an attentional bias, while depression affects memory bias (Dalgleish & Watts, 1990). To take account of such a different tendency of emotional states, two assumptions were included into their theory. First, both encoding and retrieval stages involve a passive, automatic aspect (similar to automatic processing), and an active, strategic aspect (similar to effortful processing). Second, a bias in one aspect need not entail a bias in the other. The model claims that anxiety preferentially affects the passive, automatic aspects of encoding and retrieval, whereas depression preferentially affects the active, effortful aspects of encoding and retrieval. Another assumption is that all stimulus inputs go through an affective decision mechanism and depending upon both the extent of the affective valence (threat vs. nonthreat in the case of anxiety; depressed vs. nondepressed in depression) of stimulus and emotional states (anxiety and depression), more or less resources are allocated. In the case of mood-congruent-encoding and retrieval, depression may affect active, strategic elaboration rather than a pre-attentive (automatic) stage, and mood-congruent materials will be given greater elaboration, thus will be more retrievable. A final assumption is related to the severity of depression; the predisposition to allocate processing resources towards negative materials at elaborative stages becomes more evident as depression become more severe. According to this framework, depressive memory deficits in neutral materials can be explained as a result of poor elaboration, because neutral materials will not be given priority in the elaboration stage. This assumption of the differential effects of depression and anxiety on an attentional and memory bias was supported by the review by Dalgleish and Watts (1990). That is, attentional bias towards threatening stimuli in anxious states is more prominent than memory bias, whereas in depressed mood, memory bias is more apparent than attentional bias towards negative materials. Thus anxiety seems to affect an attentional process (automatic), while depression seems to affect a memorial process (strategic).
1.3.1.6 Towards a Unifying Framework

In regard to depressive memory deficits, various theoretical frameworks were discussed and compared with mainly their own supportive evidence. Models differ in their accounts of cognitive mechanism in explaining depressive memory deficits; reduced capacity, malfunctioned inhibition, reduced initiative, and narrowing attention. Secondly, they differ in the degree to which reduced cognitive resources are invariant or flexible and responsive to environmental cues (Ellis & Ashbrook, 1988; Hartlage et al., 1993; Hasher & Zacks, 1979, 1988; Hertel, 1994; Hertel & Hardin, 1990). Thirdly, each model is not good enough to accommodate all the currently available findings. These models make slightly different predictions, but each implies that depressed subjects will be impaired on tasks that require effortful rather than automatic processes, and on complex tasks requiring cognitive strategy.

The question of how to integrate models into a more testable theoretical framework remains. In terms of descriptive level, three approaches to memory deficits in depression are feasible (Hartlage et al., 1993). The first approach is that there is an actual reduction in total available capacity associated with depression. The second approach is that total capacity still remain intact, but due to narrowing of attention a proportion of cognitive resources is taken up by task-irrelevant and depressive thoughts. The third one is that both reduced capacity and narrowing attention occur at the same time. This summary appears to be nicely accommodated into two concepts of the working memory model; that is, the reduced storage capacity of working memory and malfunctioning resource allocation. Therefore, memory deficits in depression can be related to central executive functioning of working memory, which is thought to deal with the processing and manipulation of information as well as resource allocation. In effect, this assumption has been supported by the findings that depression is associated with impairment in the central executive component of working memory (e.g., Channon & Baker, 1994; Channon, Baker, & Robertson, 1993; Channon & Baker, 1993).
1.3.2 Schema/Network-related Model and Depression

In general, people's reports of their environment, events, and facts are frequently incomplete, or even highly distorted and inaccurately elaborated (cf. Bartlett, 1932). In relation to depression, clinical observation suggests that emotional content information is processed in an idiosyncratic or biased fashion (Beck, 1967, 1976). Compared to non-depressed controls, depressed subjects are negative in their recall of performance feedback, evaluate themselves more negatively, and blame themselves for failure (Coyne & Gotlib, 1983; Segal & Shaw, 1986; Blaney, 1986). Thus it may be said that depression is associated with selective attention, knowledge acquisition and better recall of mood-congruent information. Schematic/network models were proposed to explain such phenomena and address the existence of schema/network and its effects on selective memory bias in emotional mood states. The critical question is whether these characteristic biases in cognitive content and processes in depression result from the operation of schemata.

1.3.2.1 Beck' negative self-schemata model

Beck (1967, 1976) proposed the existence of negative schema and put an emphasis on negative cognitions for the initiation, maintenance, and intensification of depressed mood states. Beck postulated that a negative self-schema has been formulated since childhood and represents stable, underlying beliefs and assumptions about the nature of the world and self, which affects the selection, encoding, and interpretation of environmental stimuli. Depressive schemata contain the cognitive triad; a negative view of self, world, and future. Once the negative schema is activated by matching environmental events, it has two main effects. First, latent negative automatic thoughts (e.g., I am a failure) come into their mind either consciously or unconsciously. The second function of the depressive schema is to facilitate faulty information processing in
evaluating situations. The systematic thinking errors are as follows; they make arbitrary inferences on the basis of inadequate evidence, selectively abstract information consistent with their schema rather than considering the more plausible alternatives, and overgeneralize from fragmented or unrepresentative incidents. Among these hypotheses, a negative self-schema in depression in particular has been extensively studied by many researchers to explain the increased probability of recall for negative information about self.

More recently, regarding the activation of negative schemata, it was claimed that the activation of schemata is determined by the interaction of personality modes and types of stressors (Beck, 1983; Beck, Epstein, & Harrison, 1983). He assumed two types of personality mode; sociotropy and autonomy. Sociotropic people put more value on interpersonal relationships such as acceptance, intimacy, and support. Threat or loss in those areas make sociotropic people depressed and experience automatic thoughts (e.g., nobody likes me). On the other hand, autonomous people put more value on independence, achievement, and goal-setting. Stressors congruent with those schemata (e.g., thwart of goal-directed activity) are likely to cause automatic thoughts (e.g., I am a failure). This prediction was confirmed in the 6 month follow-up study of patients with unipolar depression (Hammen, Ellicott, Gitlin, & Jamison, 1985; Hammen, Marks, Mayol, & deMayo, 1985). Depressed patients who experienced more objective stress congruent with their personality type reported significantly greater levels of depressive symptoms.

A recent review by Haaga, Dyck, and Ernst (1991) of Beck's cognitive theory of depression enumerated some testable hypotheses derived from it and examined each hypothesis in relation to the previous literature. Firstly, in relation to the preponderance of negative automatic cognitions, the hypothesis that there is a higher proportion of negative cognitions in depressives, relative to nondepressives was substantiated by studies using questionnaires measuring the frequency of negative thoughts (Hollon,
Kendall, & Lumry, 1986; Dobson & Shaw, 1986; Crandell & Chambless, 1986).
Secondly, regarding positive automatic thoughts, they drove the exclusivity hypothesis; positive thoughts are totally excluded in a depressed episode. Contrarily, previous studies showed that positive thoughts are reported less frequently compared to negative thoughts (Kendall, Howard, & Hays, 1989; study 2; Ingram & Wisnicki, 1988). It seems that the accessibility of positive thoughts is reduced in a depressed mood (Ingram, Smith, & Brehm, 1983; Breslow, Kocsis, & Belkin, 1981). Thirdly, regarding the negative cognitive triad, Haaga et al. (1991) concluded that the negative view of depressives of the self, the world, and the future received enough empirical support from the previous literature. They claimed that as the three parts of the triad have a high correlation (Lewinsohn, Larson, & Munoz, 1982), the cognitive triad reduces to a single dimension, that is, a negative view of the self. Finally, the hypothesis of the automatic processing of negative thoughts was also supported (e.g., Bargh & Tota, 1988).

In summary, a negative self-schema is a stable, general, underlying structure developed from childhood experience (e.g., loss of important persons), and latent negative self-schemata become activated by matching environmental events e.g., loss of job. Once negative self-schemata are activated, negative automatic thoughts such as “I am a failure” and systematic logical errors lead to the negative cognitive triad, and in turn this helps foster the depressed mood. Thus, Beck’s cognitive theory of depression put an emphasis on negative cognition in the etiology and maintenance of depression. However, recently Teasdale and Barnard (1993) raised problems with Beck’s cognitive model of depression. One important problem is the possibility that negative cognitions as a mediating variable to depression can be a consequence of depression rather than an antecedent to the depressed feeling. This argument is based on the findings that regardless of types of treatment of depression (e.g., antidepressant drugs and behaviour therapy), negative thoughts recover towards normal levels when depressed episode is remitted.
1.3.2.2 Bower's Associative Network Model.

Bower (1981) has proposed that the effects of mood on cognitive processes can be incorporated within a general associative network theory of memory (e.g., Collins & Loftus, 1975). The general idea of an associative network model is that contextual or personal variables including emotional mood states can be represented as episodic memory traces, which subsequently can aid remembering the events as acting as contextual cues. According to the associative network model, distinct emotions such as joy, fear, and depression, have their own node in memory. Each emotion node is connected to nodes with many other aspects of the emotion such as autonomic patterns, expressive behaviours, verbal labels for the emotion, and typical situations likely to elicit the emotion. Those different instances of the concept are connected by associative connections of varying strength depending on the individual's personal experience. Emotion nodes can be activated by any of these related events or phenomena, and if the activation exceeds some threshold, they transmit excitation to units that produce the corresponding patterns of autonomic arousal, facial expression, etc.

With these assumptions, two distinct phenomena were predicted; state/context-dependent learning, and mood-congruent encoding and retrieval. State/dependent learning states that material would be retrieved best when the situation in encoding and retrieval stages matches. This has been demonstrated in drug-induced states such as alcohol intoxication (Eich, 1977), and environmental context (Godden, & Baddeley, 1975). Some experimentally induced mood states produced it successfully (Bower, Monteiro, & Gilligan, 1978, study 3; Schare, Lisman, & Spear, 1984, study 3). State dependent memory was also found in naturally occurring mood shift in manic-depressive patients, (Weingartner, Miller, & Murphy, 1977). However, several studies failed to replicate it (Bower & Mayer, 1985; Bower, Gilligan, & Monteiro, 1981 study 3; Schare
et al., 1984, study 1 and 2) and a review by Blaney (1986) showed that on the whole state-dependent learning effects have been hard to obtain.

On the other hand, mood-congruent encoding and retrieval depends upon a similarity between the mood and the affective valence of the material that is being learned or remembered and recall is superior when there is a match between the affective valence of the material and the mood in which the material is recalled. Blaney (1986) concluded that state-dependent memory effects have been weak and unreliable, while mood-congruent memory effects are relatively robust and consistent.

To explain the mixed findings in state-dependent memory, Isen (1984) suggested that mood works as a contextual cue aiding remembering, whose effects are most apparent when the meaning of cues are obscure such as in the interference learning paradigm. In the interference paradigm, subjects are exposed to two different mood states within a session and learned two different lists - one while happy and the other while sad. Subjects are asked to recall the lists either in concordant or in discordant mood (Bower et al., 1978). Kihlstrom (1989) claimed that the reason why mood states as contextual cues are weak is because the cues are fairly implicit. That is, mood states as context variables are not so expressively presented as the lists. Only if mood states are actively encoded, i.e. they are relevant to the task at hand, can they serve as effective retrieval cues. That is why state-dependent effects have been frequently observed in free recall but rarely in recognition and cued recall (Eich, 1980). More cues are available in cued recall and recognition tests so subjects do not necessarily draw their attention to the mood state cues.

In relation to the mood-congruent effect, several researchers found asymmetrical effects, which is contradictory to the prediction of the network model (Bower, 1981). The asymmetry of positive and negative mood states is related to the findings that parallel effects of affect on memory were not always obtained (Breslow et al., 1981; Clark & Waddell, 1983; Isen et al., 1978; Nasby & Yando, 1982, study 1, Williams and
Broadbent, 1986). The network model assumes that similar underlying processes are operative in happy and in sad mood states. However, there are suggestions in the experimental literature that this is not actually the case, and that subjects are more likely to perform in accord with the predictions of network theory when in happy moods than in sad moods. Happy moods typically facilitate the learning and the recall of affectively positive material while inhibiting the learning and recall of affectively negative material. Sad mood has often been found to reduce the learning and recall of affectively positive material without enhancing the learning and recall of negative materials (Natale & Hantus, 1982; Williams & Broadbent, 1986). For example, Williams and Broadbent (1986) investigated the autobiographical memories produced to cue words by people who had recently attempted suicide by overdose. The results showed that suicide attempters had more difficulty in retrieving memories to positive cue words, and took longer to do so, whereas there were no group differences in the retrieval of memories to negative cue words.

In comparison to Beck's cognitive model of depression, the associative network model put a reciprocal relationship between depressed mood and negative thoughts (interpretations) in explaining the maintenance of depression, while Beck's theory assigns a causal role to negative thoughts (Teasdale & Barnard, 1993). According to the associative network model, a self-perpetuating vicious cycle is formed in depressed mood states. Depressed mood states activate corresponding nodes related to the emotion, leading to selectively increased accessibility of negative cognitions and subsequently exacerbating the severity of depression.

What implications for depressive memory deficits can be drawn from these schemata/network-related models? From Beck's cognitive theory of depression, depressive memory deficits can be predicted from the idea that negative automatic thoughts can intrude into depressed people's minds either consciously or unconsciously, thus interfering with ongoing mental activities. Similarly, modeled after the associative
network theory, the information processing theory of depression by Ingram (1984a) implies that depressive memory deficits occur due to increased activation of depression-related cognitions once a depression-linked node is activated, which occupies available processing capacity.

### 1.3.3 Depressive Self-Focused Attention

On the basis of the self-focused attention and self-regulation model (Carver & Scheir, 1981; Duval & Wicklund, 1972), and from many similarities between depression and states of self-focused attention, Pyzczynski and Greenberg (1987) proposed the self-regulatory perseveration model of reactive depression. The main thrust of Pyzczynski and Greenberg's (1987) self-regulatory model is that depression occurs where no response to reduce the discrepancy between actual and desired states is available after the loss of an important source of self-worth. In this situation, the person can not exit the self-regulatory cycle, facing virtually constant self-focus, resulting in intensified negative affect, self-derogation, and future negative outcome. And finally a depressive self-focusing style is developed from this process, in which an individual self-focuses a great deal after negative outcomes but very little after positive outcomes. Thus, this depressive self-focusing attention maintains and exacerbates depression. It is suggested that a depressive self-focusing style is accompanied by the following symptoms; depressed affect, internal attribution for failure, self-criticism, low self-esteem, and performance deficits.

Carver and Scheier's (1981) cybernetic model of self-regulation conceptualized self-focus as part of a self-regulatory negative feedback cycle that keeps a person "on track" in pursuit of important goals. Self-focus is considered as the test segment of a test-operate-test-exit sequence in which a comparison is made between current state and a standard. If the person meets or exceeds the standard, he or she exits the cycle, and self-focus is terminated. On the other hand, if the person falls short of the standard, he or
she goes into the operate phase, in which attempts are made to bring the current state into line with the standard. Subsequent tests will detect whether or not the operate phase has been successful in eliminating the discrepancy. If the discrepancy is eliminated, the person exits the cycle. Otherwise, the test-operate-test phases continue. From this cycle, depressed people can not exit, thus remain in a constant state of self-focus on awareness of the irreducible negative discrepancy.

Many studies have explored how depression is associated with self-focused attention (Smith & Greenberg, 1981; Ingram & Smith, 1984; Smith, Ingram, & Roth, 1985; Ingram, Lumry, Cuet, & Sieber, 1987). Some of these studies found a significant correlation between self-focused attention and depression (Smith & Greenberg, 1981; Ingram & Smith, 1984; Smith, Ingram, & Roth, 1985). The more depressed subjects get, the more self-conscious they are in the private self-conscious scale (Fenigstein, Scheier, & Buss, 1975). Secondly, depressed people are associated with more negative self-focused attention compared to nondepressed people (Ingram & Smith, 1984), along with negative self-evaluation and negative affect. Other studies manipulated self-focused attention by the presence and absence of a mirror after depressed and nondepressed subjects were exposed to success and failure experiences (Pyszczynski & Greenberg, 1985; Greenberg & Pyszczynski, 1986). The results from those studies are consistent with the prediction from a depressive self-focusing style; depressed people tend to be more self-focused after failure compared to nondepressives. Greenberg and Pyszczynski (1986) showed that depressives persist in spontaneous self-focused attention after failure longer than nondepressed subjects. They investigated how self-focused attention interacts with depression.

Other studies were concerned with whether induced depression creates self-focused attention by using the mood induction procedure (Wood, Saltzberg, & Goldsamt, 1990; Salovey, 1992; Sedikides, 1992) and have been successful in showing that an induced sad mood creates self-focused attention.
In sum, many studies showed consistent findings that depressed mood is associated with self-focused attention toward internal feeling and thoughts, particularly focused on the negative aspects. Unlike the assumed specificity of self-focused attention to depression, a recent review (Ingram, 1990) claimed that self-focused attention is not a specific disposition of depressive mood states, but a nonspecific process in psychopathology. Ingram (1990) claimed that evidence of self-focused attention has been found in various psychopathological disorders such as alcohol abuse, schizophrenia, psychopathy, and anxiety.

In relation to depressive memory deficits, Ingram and Smith (1984) suggested that depressive self-focusing style can contribute to cognitive impairment in depression. Pyszczynski and Greenberg (1987) also proposed that a self-focusing style on the part of depressed individuals may contribute to difficulty concentrating on current tasks. The construct of a self-focusing tendency in depressed mood states can be seen as a mediating factor of task-irrelevant thoughts and poor concentration on the current task.

1.4 Summary and Discussion

Various theoretical models of effects of depression on memory were discussed from three major categories; reduced capacity, schema/network, and self-focused attention in relation to depressive memory deficits and selective memory bias. The cognitive effort account of memory deficits, drawn from the reduced-capacity model, provides a useful framework for explaining memory deficits, but the lack of independent measurement of allocation of resources flawed the model. To overcome this drawback, Hartlage et al., (1993) defined several criteria to classify tasks in terms of automatic and effortful processes and using those criteria, support the assumption that depression interferes with effortful processing. On the other hand, Hertel and her colleagues put constraint on such an argument, proposing a reduced initiative model. They claimed that effortful processing is not always impaired by depression, rather it is impaired when the
task requires self-initiation of effortful processing. Furthermore, contradictory to the
cognitive effort account, depressive memory deficits can be shown in a condition
requiring relatively automatic processing such as in word identification (Hertel, 1994).
Other supportive evidence comes from a study (Channon et al., 1993a) in which task
difficulty and initiative were directly compared in the varying structure of word lists.
Depressed subjects showed memory deficits in the condition requiring self-initiative
rather than in the most difficult task condition. Compared to the cognitive effort account,
the reduced initiative model appears more testable by showing depressive memory
deficits in the condition requiring subject-initiation in the first place and then reversing
memory deficits by providing a useful cognitive strategy which depressed people did not
elect spontaneously.

As discussed earlier, even if the reduced initiative model provided the locus of
effect in depression, making the model more testable, compared to other models, it does
not address whether the source of reduced intiation of cognitive strategy is from
motivational or the reduced cognitive resources (Ellis, 1990; Baker & Channon, 1995).
If it originates from motivational deficits, it would focus on the lowered expectations of
depressives and diverted attention to task-irrelevant thoughts without assuming a
reduced capacity. The model become similar to narrowing attentional focus (Hartlage et
al., 1993). If the reduced intiative is due to the reduced capacity, it is similar to the self-
initiated activity hypothesis (Hasher & Zacks, 1988). As a result, it assumes both
reduced resources and narrowoing attentional focus (Hartlage et al., 1993). Apart from
this ambiguity in a theoretical aspect, one contradictory finding was reported by Baker
and Channon (1995) study, which failed to show any differential effects between
depressed and nondepressed people when helpful cues in the reasoning task of the
Levene task was provided. In effect, regardless of the provision of helpful cues, overall
depressive deficits were found, lending more support for the reduced capacity hypothesis
with or without narrowing attentional focus. These contradictory findings suggest further
work to elucidate the relationship between the reduced initiative vs. reduced resources is necessary.

In addition, in relation to depressive memory deficits, various theoretical concepts from various theoretical frameworks such as irrelevant/extra-task processing, off-goal path thoughts, negative automatic thoughts, narrowing attentional focus, and self-focused attention have been proposed. However, they are not exclusive, rather complimentary to each other and appear interlocked in explaining depressive memory deficits. These diverse concepts can be classified into two different concepts; overall depressive thoughts and depressive self-focusing style (narrowing attentional focus) apart from the problem of reduced capacity. These various claims can be integrated in the following way; depressive thoughts characterising depressed people, may interfere with or intrude into working memory functioning through their self-focusing attentional style as a mediating variable. Due to this process, depressed people are expected to show poor elaboration, concentration deficits, and poor performance because the priority of their attentional focus is assumed to be given to depressive thoughts rather than to the criterial task at hand. This assumption does not necessarily argue that depressive thoughts and self-focusing style is necessarily causative in accounting for cognitive deficits. In effect, it is very difficult to test for the reduced capacity’s prediction; in most of studies related to this prediction, the evidence for reduced capacity was inferred from the lowered performance such as in recall and cued recall. Therefore, more tractable factors such as negative thoughts should be explored in the first place in the area of memory deficits, as in effects of context-dependent encoding/retrieval (mood-congruent/state-dependent learning). More work in the role of depressive thoughts should be undertaken either by measuring depressive thoughts during task performance or by the direct manipulation of depressive thoughts. Therefore, one of purpose of the thesis is to explore the role of depressive thoughts during the task performance as measured by the ATQ-N/-P and CIQ.
CHAPTER 2
Memory Deficits in Depression

2.1 Depression and Memory Performance

Recent reviews of memory deficits in depression suggested that the degree of memory deficits are influenced by three factors; the severity of depression (subject factor), task characteristics, and emotional valence of materials (Ellis & Ashbrook, 1989; Johnson & Magaro, 1987; Weingartner & Silberman, 1982; Hartlage et al., 1993; Kuiper, MacDonald, & Derry, 1983; Williams et al., 1988). The general prediction from the above review is that the more severe depression and the more effortful the task, the greater the deficit with neutral stimuli employed. Also emotional valence of materials appears to affect the performance of depressives; neutral materials including concrete/abstract materials encoded semantically are adversely affected by depression, but personal and emotional ones processed with reference to the self are not (Kuiper et al., 1983; Ellis & Ashbrook, 1988). In regard to these differences, Ellis and Ashbrook (1988) claimed that emotional materials pertinent to subjects require minimal attentional capacity and thus, do not cause depressive memory deficits. Memory performance with emotional contents will be discussed in another chapter on schema/network-related studies. The following sections review the previous literature on depressives memory deficits in terms of two broad categories; one is subject characteristics and the other task characteristics. The reason for this distinction is that depressive performance is considered to be determined by the interaction of those two variables.

2.1.1 Subject Characteristics

2.1.1.1 Severity of Depression

Memory impairment is more frequently found in clinical depression than in mild/moderate depression (Hartlage et al., 1993). The relationship between severity of
depression and memory deficits has become apparent through studies of treatment using ECT (Electric Convulsive Therapy) and drug treatment (Stromgren, 1977; Cronholm and Ottoson, 1961; Sternberg & Jarvik, 1976). The general findings are that clinical improvement of depressive symptoms seems to be positively related with improved memory performance. The severity of depression contributes to the impairment of memory in depression.

Cronholm and Ottoson (1961) compared endogenously depressed patients with surgical patients, who were matched on educational level, age, sex, and area of residence. Subjects were tested on three kinds of memory tests (Twenty Figure Test, Thirty Word Pair Test, Thirty Personal Data Test) immediately and three hours later. In both testing sessions, depressed patients showed memory deficits across all three memory tests. After ECT, clinical improvement was associated with improved learning. In a subsequent study replicating Cronholm and Ottoson's (1961) study, Sternberg and Jarvik (1976) found similar results. Before the treatment, depressed patients showed poorer memory performance than normal controls on all measures. After 26 days of treatment, depressed patients were divided into four groups: recovered, markedly improved, moderately improved, and unimproved according to the degree of improvement in their depressive symptoms. The comparison of the four groups in their memory performance showed that the greater improvement of the depressive states, the greater improvement in immediate reproduction. Similarly Stromgren (1977) explored memory deficits of depressed patients before and during a course of ECT using the Wechsler Memory Scale (WMS). The general findings are consistent with the above two studies; severity of depression was correlated with degree of impairment and degree of clinical improvement was correlated with degree of improved performance. Depressed subjects showed more sensitivity to digit span forward, mental control, and orientation tasks compared to other tasks.
In contrast with those positive findings, Glass, Uhlenhuth, and Weinreb (1978) found that clinical state of depression has no any consistent relationship with memory performance as measured by errors in an item recognition procedure. They interpreted these finding as that clinical improvement in depression states may occur via increased arousal. Such an argument indicates that depressive memory deficits may be mediated by another variable rather than be directly related with the severity of depression.

In sum, it seems that the severity of depression is negatively correlated with memory performance and that a third variable, such as arousal may mediate memory performance.

2.1.1.2 Psychomotor Retardation

One complaint by depressed people is about their slowed motor and mental functioning. This self-reported complaint of psychomotor retardation has been tested using a variety of objective tests, eg., writing speed, Digit Symbol Test, and speech rate etc. Depressed people were found to be retarded in the tapping test, Digit Symbol Test, writing speed, and speech rate (Szabadi et al., 1976; Glass et al., 1978; Berndt & Berndt, 1980). Among these tests, the retarded speech rate is particularly interesting to the current thesis as speech rate is assumed to determine memory span (Baddeley, 1986).

Szabadi et al. (1976) wanted to find a single index of behaviour, which is sensitive to the short-term mood variation in depressives over two months’ treatment. Several tests were employed; speech rate, tapping test, nurses’ rating of mobility and talkativeness, and the Hamilton Rating Scale for Depression (HRSD; Hamilton, 1960). Four normal and four depressed patients were employed as subjects. Sampling of speech rate was conducted over the period, with subjects instructed to count from 1 to 10 in their own time. For the tapping test, the total time was measured for subjects to press the lever 210 times. The results showed that the speech rate (pause time) was most sensitive to improvement in depressive symptoms; the decrease in pause time was paralleled by a
decrease in depressive symptoms when depression is measured by the HRSD. For normal subjects, pause time was constant over a long period. Teasdale, Fogarty, and Williams (1980) complemented the study by Szabadi et al. (1976) by investigating the covariation of self-reported depression and speech pause time. As dependent measures, mean pause time between digits and total time when subjects were asked to count from 1 to 10 were used in single case study experiments employing naturally occurring depression, some subjects showed that variation of depressed mood and speech rate was significantly correlated over time; when they were more depressed, the longer mean pause time. Also similar findings were found for experimentally induced mood variation. As mean pause time is highly correlated with total time, having the same relationship with self-reported mood measures, the total time measure can be used instead. In subsequent studies, using the Velten-like mood induction procedure, Teasdale et al. (1980) and Teasdale and Taylor (1981) replicated the finding that induced depression slows down speech rate relative to induced elation. However, Williams (1980) also employed speech rate as the manipulation check for the effectiveness of a story mood induction procedure, but he did not find a difference between depressed and neutral subjects. These discrepant findings may be associated with different mood induction procedures (VMIP vs. tape recorded story) but a more important difference is that Teasdale and his colleagues employed an elated group for the comparison with the depressed group, while Williams (1980) used neutral controls. So the slowed speech rate found in Teasdale and his colleagues could occur due to either slowing effects of depression or speeding up effects of elated mood states. In a standardized interview situation, Natale (1977) examined the relationship between induced mood states (elated, depressed, and neutral) and various indexes of psychomotor function; mean words per response, response time, speech rate, articulation rate, and silent quotient. Depressed subjects showed more total duration of all pauses and no difference in other measures, compared to neutral subjects. Speech rate and articulation rate were calculated by a word count divided by total speech time and
phonation time respectively. In contrast, elated subjects revealed shorter response latencies, faster speech and articulation rates, and less total duration of all pauses, compared to neutral subjects. Thus, depressed mood lengthens the duration of pauses during communication.

Some studies distinguished between cognitive and motor retardation (Cornell, Suarez, & Berent, 1984; Byrne, 1976). For example, Cornell et al. (1984) examined psychomotor function in subtypes of depressive patients (melancholic vs. nonmelancholic) on a reaction time task and a matching task. Cognitive and motor retardation were measured by a cognitive reaction time task, simple reaction time task, and a motor reaction time. The simple reaction time task was measured by asking subjects to press the button when the stimulus appear. The motor reaction time task was measured by instructing subject to hold down the "ready" key and when the stimulus appears on the computer screen, to move to a "response" key. In the cognitive reaction time task, Posner's method (Posner, Boies, Eichelman, & Taylor, 1969; Posner & Mitchell, 1967) was employed in which subjects were presented with two letters to identify if they are the same in terms of physical or nominal aspects. In the simple reaction time task, there was no difference among groups. In the more complicated motor task, both depressive groups were slower compared to normal controls. In the cognitive reaction time task, only melancholic patients were slower than normal controls in both physical and nominal tasks. Such a difference in cognitive task according to subtypes of depression was found using a different methodology (Byrne, 1976). A choice-reaction time performance was divided into two components; a decision phase and an executive phase. Psychotic depressives were retarded in both phases, whereas neurotic depressives were retarded only on the movement time.

In summary, relatively consistent findings were found with the speech rate across induced and clinical depression except Williams' (1980) study. The other measurements such as the writing test and the digit symbol test also revealed a depressive retardation.
Thus, in general it can be claimed that depressives suffer from psychomotor retardation. One restriction to this argument is that such a retardation is subject to the type of task and subtype of depression (Cornell et al., 1984; Byrne, 1976). Cognitive retardation is found in endogenous depressives, while psychomotor retardation is found in both endogenous and nonendogenous groups. Some reasons for these differential effects of subtypes of depression on psychomotor and cognitive retardation were considered by Williams et al., 1988. Cognitive retardation in endogenous depressives is possibly due to their higher proportion of negative thoughts relative to neurotic depressives (Nelson & MaZure, 1985) and/or the low arousal typical of endogenous depressives. On the other hand, retardation in psychomotor function was attributed to motivational deficits (Miller, 1975). Natale (1977) interpreted this excessive pause time in depressed people as due to their excessive awareness of self and others.

2.1.1.3 Negative and Positive Cognitions

Depressed people are characterized by negative thoughts of self and the world as well as their depressed feeling (Beck, 1967). Depression as a thought disorder can be explored from two perspectives; process disorder and content disturbances (Braff, Glick, & Griffin, 1983). The process disorder was studied by investigating abstraction ability of depressed patients (Braff & Beck, 1974; Dennelly, Waldman, Murphy, Wyatt, & Goodwin, 1980; Braff et al., 1983). The current discussion will focus on thought content disturbances (idiosyncratic thinking). Nelson and Maze (1985) defined ruminative thinking as one of the distinctive symptoms of melancholic depression, whose characteristics are repetitive and intrusive thoughts and in its milder forms self-preoccupation. In a similar vein, negative automatic thoughts were proposed by Beck (1967), the attributes of which seem similar to ruminative thoughts. These depressive thoughts can be classified into two groups; negative self-referent thoughts (called negative automatic thoughts) and task-irrelevant thoughts (Ellis & Ashbrook, 1988).
Negative and positive automatic thoughts are self-referent (e.g., I will be successful in the future), while task-irrelevant thoughts include any thought or images excluding self-referent things.

When the possible disruptive effects of automatic thoughts are discussed, caution needs to be taken. The processes leading to automatic thoughts may be automatic, but the thoughts themselves may occupy considerable attention (Moretti & Shaw, 1989; Brewin, 1988; Dalgleish, & Watts, 1990). So it is important to distinguish the automatic process from the products-negative automatic thoughts. Automatic thoughts are assumed to occupy some portion of limited attentional resources, while automatic processing uses only minimal resources. Putting it another way, automatic thoughts tend to intrude into consciousness, whereas automatic processes occur outside of the subject’s awareness. The automatic features of negative thoughts are discussed in view of the automaticity of self-referent processing (e.g., Bargh & Tota, 1988; Wenzlaff, Wegner, & Roper, 1988). The possible logic behind disruptive effects of automatic thoughts is as follows. Assuming that automatic thoughts get priority for cognitive processing, depressed subjects are put into a dual task situation in which they have to deal with both automatic thoughts and the current task (Krames & McDonald, 1985).

Two questionnaires have been developed to measure negative and positive automatic thoughts in depression separately (Hollen & Kendall, 1980; Ingram & Wisnicki, 1988). As these two questionnaires were used in the current studies several times, a detailed discussion of these questionnaires follows. The positive automatic thought questionnaire (ATQ-P) consists of 30 items, and each item (e.g., I am in a great mood) is rated on a 5 point Likert scale according to how frequently each thought or similar thoughts had occurred to subjects during the past week (Ingram & Wisnicki, 1988). The scale ranges from never (1), to sometimes (3) to all the time (5). The results of a factor analysis on this scale produced four factors; positive daily functioning, positive self-evaluation, others evaluations of self, positive future expectations. These
factors reflect a positive cognitive triad the opposite of a negative cognitive triad (Beck, 1967); positive cognition about the self, the world, the future, plus other’s evaluation of the self. As most of the items are related to self, the ATQ-P seems to represent positive self-referent processing.

Similarly the ATQ-N (Hollen & Kendall, 1980) consists of 30 items (e.g., My future is bleak) and each item was rated in the same way as the ATQ-P. The factor analysis of the items indicated four distinctive factors; personal maladjustment and desire for change, negative self-concept and negative expectations, low self-esteem, and helplessness. It has good concurrent validity and reliability (Hollen & Kendall, 1980; Dobson & Breiter, 1983; Hollen, Kendall, & Lumry, 1986; Harrell & Ryon, 1983; Burgess & Haaga, 1994).

To determine the discriminative validity of the ATQ-P and ATQ-N, they were administered to three different levels of depressed groups; depressed, mildly depressed, nondepressed groups, which were classified by the BDI (Ingram & Wisnicki, 1988). The results from the ATQ-P showed that the more seriously depressed group reported significantly fewer positive automatic thoughts than the mildly depressed group, which in turn, reported marginally fewer positive thoughts than the nondepressed group. On the ATQ-N, both depressed groups reported more negative automatic thoughts, compared to the nondepressed group. The ATQ-N and ATQ-P were relatively independent with a correlation coefficient of -.17, suggesting that negative and positive self-referent thoughts tap different processes in depression.

Regarding the specificity of positive automatic cognition to depressive symptoms, Burgess and Haaga (1994) examined whether the ATQ-P is inversely related to depressive symptoms. They administered seven questionnaires to the subjects including the BDI, ATQ-P, and ATQ-N etc, with intercorrelations calculated. Showing concurrent validity, the ATQ-P was inversely related to depressive symptoms. After controlling for anxiety symptoms, the number of positive automatic thoughts was inversely related to
depressive symptoms. Also the ATQ-P showed high internal consistency (coefficient alpha was .95). So infrequent positive thinking seems to be specific to depression.

As the ATQ-P/-N mainly relies on the frequency measurement of depressive thoughts, some other attributes of such thoughts are ignored such as the controllability of thoughts. Thus, some studies investigated the relationship between depressed mood and controllability of the intrusive thoughts from daily life experiences (Edwards & Dickerson, 1987; Sutherland, Newman, & Rachman, 1982). Both studies found that depression reduced controllability for intrusive thoughts (similar to automatic thoughts, but more intense). In a normal college student population, Edwards and Dickerson (1987) examined the characteristics of positive and negative thought intrusions. Positive and negative intrusive thoughts and subjects mood states were collected over two weeks using questionnaires. The analysis was conducted on the positive and negative intrusion from the same subject in terms of controllability, duration, frequency etc. The mood states were evaluated by the Profile of Mood States (PMS, McNair, Lorr & Droppleman, 1971). The results showed that the increased depressed mood states are associated with more uncontrollability for both positive and negative intrusive thoughts. Similarly, Sutherland, Newman, and Rachman (1982) more directly explored the dismissal of unwanted intrusive thoughts in either depressed or elated mood states induced by the VMIP and MMIP. Intrusive thoughts were defined as unacceptable and distressing ones which occur regularly twice a week. After having been induced into either a happy or a sad condition, subjects were instructed to form either neutral or intrusive thoughts and then to dismiss them. Across mood induction procedures, intrusive thoughts took more time to remove than neutral thoughts and particularly in the sad condition it took more time to remove intrusive thoughts compared with the happy condition. These results suggest that the controllability of intrusive thoughts is reduced in depression, possibly contributing to the maintenance of depression. As a reason for such
poor controllability, Sutherland et al. (1982) suggested the reduced accessibility of positive thoughts, being able to replace negative thoughts.

In sum, from the above studies, it become clear that under depressed mood states, it is difficult to remove negative intrusive thoughts. Compared to negative automatic thoughts measured on the ATQ-N, intrusive thoughts are more individually selected and thus directly related to individual problems. However, it seems desirable to consider other dimensions of automatic thoughts such as controllability when the role of negative automatic thoughts in depressive performance is explored.

The following studies are different from the above studies in that they focused on task-irrelevant thoughts while subjects are doing some cognitive task (Ellis, Seibert, & Herbert, 1990; Seibert & Ellis, 1991). Task-irrelevant thoughts measured in these studies do not seem to be exclusively negative/positive self-referent thoughts. Ellis et al. (1990) measured the accessibility of unfavourable thoughts while subjects were doing a cognitive task, using the thoughts-listing procedure, subjects were asked to report whatever thoughts came to their mind during two situations, and after that the thoughts were rated on the favourable vs. unfavourable dimension. The results showed that immediately after the VMTP, depression-induced subjects reported having more unfavourable thoughts than neutral subjects. However, in a second experiment, the results of thought listing measured after 4 minutes of interfering task (incidental recall task) after the mood induction procedure, did not show any difference among the three groups (depressed, neutral, and elated) in the proportion of unfavourable thoughts. These results suggest that the intensity of induced depression reduces sharply over time, and accordingly the accessibility of unfavourable thoughts reduces. Using the VMIP, Seibert and Ellis (1991) investigated the relationship between task-irrelevant thoughts and memory performance. Task-irrelevant thoughts were collected immediately after the task or concurrently while doing the task. After mood induction, subjects were asked to study seven lists of trigram doublets (e.g., RI TW EL, LI NF UZ) for three minutes and
asked to recall them. The results showed that both emotional states (depressed and elated) created more task-irrelevant thoughts than a neutral state, and also their recall performance was poorer than neutral controls. The task-irrelevant thoughts were negatively correlated with performance. In summary, task-irrelevant thoughts tend to increase during temporary variation of emotional states, whose relationship with the task-performance is negative.

Taken together, depression makes negative thoughts more accessible and at the same time reduces the accessibility of positive thoughts. Both emotional mood states can produce more task-irrelevant thoughts, relative to neutral mood state and are negatively associated with task performance (Ellis et al., 1990; Seibert & Ellis, 1991). This negative relationship of task-irrelevant thoughts with performance supports the capacity-reduced hypothesis (Hasher & Zacks, 1988; Ellis & Ashbrook, 1988). However, as there was no direct manipulation of negative cognitions, it is still unclear whether negative cognitions have a causal relationship with poor recall performance. Secondly, the reduced controllability of intrusive thoughts under depression supports the inefficient inhibition mechanism proposed by Hasher and Zacks (1988), and Kuhl and Helle (1986), claiming that due to an inefficient inhibition mechanism, more negative/intrusive cognitions are allowed to get into the mind.

2.1.1.4 Response-bias

Some researchers raised a question of whether performance deficits and/or negative memory bias in depression is based on response bias rather than a true difference between nondepressed and depressed groups (Miller, 1975; Johnson & Magaro, 1987). These two types of phenomena typical of depression were examined to check whether a response bias can account for them. The response bias hypothesis attempts to explain memory deficits and selective memory in depression on the basis of differences of response strategy rather than of a pure memorial process, between nondepressed and
depressed people. In a study on selective recall and recognition, Zuroff, Colussy, and Wielgus (1983) defined response bias as follows: "at the most general level, response bias refers to those motivational factors that, independent of a subject's encoding, storing, or retrieving of information, affect his or her decision to respond in a certain manner on tests of memory". This argument suggests that depressives do not differ in their ability to retrieve the information from memory from nondepressives, rather that more or less strict criteria in response bias can be chosen by depressives, depending upon the emotional contents of stimuli. That is, they can choose a more or less lenient criterion to negative and positive information respectively.

In relation to neutral materials, often observed depressive memory deficits can be artifacts rather than poor performance of memory and learning (Miller, 1975; Johnson & Margo, 1987). In spite of the fact that depressed people have the same memory capacity as nondepressed people, they may use a more conservative cognitive strategy; that is, unless they are sure that their answers are correct, they may be withdrawn from responding. The response bias hypothesis has met with mixed findings. In this area, most studies employed a recognition memory test using signal detection theory and/or analysis of types of errors (commission, omission) with either neutral or emotional materials (Miller & Lewis, 1977; Larner, 1977; Dunbar & Lishman, 1984)

Miller and Lewis (1977) investigated the response bias among elderly depressed, demented, and normal groups on the continuous recognition signal detection procedure (Kimura, 1963) using geometric designs. The signal detection theory assumes that the measure of d' reflects the sensitivity of pure memory processes, whereas the criterion (β) indicates the adopted decision strategy. On the d' measurement, elderly depressives did not differ from normal controls, but on the β measurement, they differed from normal controls. These results suggest that depressives take a more conservative response strategy. On the basis of these results, they concluded that memory deficits found in depressives do not result from memorial functioning but rather reflect their conservative
decision strategy on memory tasks. Similar results were found by Larner (1977) who explored response bias among three groups (demented, depressed, physically ill groups) using a signal detection task. The results showed that depressed and physically ill patients adopted a cautious response bias, while demented patients appeared to adopt an optimal response strategy.

Contrary to the above supportive findings, Cornblatt, Lenzenweger, and Erlenmeyer-Kimling (1989) did not find a conservative response strategy in depressed patients on a recognition memory test of number and shape. The analysis of errors showed that particularly in the shape recognition task with distraction, depressives tend to emit more commission errors compared to schizophrenic and normal controls. However, in the hit rates both depressives and normal controls did not differ. These results of more commission errors in depressives are hard to fit into a conservative response style of depressives. These different results might be due to the distracting task leading depressives to adopt a different cognitive strategy (Williams et al., 1988).

Other supportive evidence is that even if subjects were required to guess when they did not know the answer to remove the response bias, depression-induced students still obtained lower recall scores (Leight & Ellis, 1981). Hertel and Rude (1991b) administered free recall in the first place and then forced recall, where subjects were encouraged to guess the answers. The difference between recall and forced recall conditions was not significant, suggesting that any conservative response style of depressives did not lower recall performance.

These conflicting results were considered by Watts, Morris, and MacLeod (1987). The study aimed to examine recognition memory of words using a signal detection procedure in depressed patients and normal controls. However, they added another variable (vocalization vs. silent) to the experiment. In the vocalization condition, subjects were to speak aloud the word presented, whereas subjects in the silent condition read the word silently. Depressed patients showed poor performance on the ‘hit’ rates
across vocalization conditions, compared to normal controls. For false alarm rate, depression interacted with vocalization. In the vocalization condition, depressed patients showed more false alarms than normal controls, while in the silent condition, the opposite pattern was true. These results were interpreted as being due to procedural differences affecting the rate of false alarms. The finding that in the vocalization condition, there is an increased false alarm rate and at the same time a decreased hit rate in depression can be contrast with a conservative response bias. It seems that the vocalization could draw more attention from depressed patients to the words. In parallel, the analysis of signal detection showed significant differences on d' but not on β. Thus memory deficits in the vocalization could not be attributed to a conservative response criteria. These results suggest that a procedural variable can affect the level of false alarm.

Some studies have examined how response bias in depression is affected by the emotional contents of stimuli (Zuroff et al., 1983; Dunbar & Lishman, 1984). They examined whether depressed people use a more lenient criteria accepting negative stimuli, relative to positive and neutral materials. Zuroff et al. (1983) argued that most studies related to the preferential recall of negative memory in depressed state can be explained in terms of a response bias rather than in terms of a difference in pure memory process. Three groups were employed; depressed, formerly depressed, nondepressed students. They were presented with negative and positive adjectives for rating how descriptive of them each adjective was and then for selecting adjectives (positive and negative) which are most self-descriptive. One hour delayed recall, 2-day and 7-day recall tests, and a 7-day recognition test were conducted.

The results for the recall data averaged over the three tests were consistent with previous findings; depressed subjects showed a recall bias toward negative adjectives and a negative intrusion when their errors in recall were analyzed. In the recognition test for negative adjectives, as expected, depressed subjects produced the most false alarms,
compared to the other groups. The tendency of depressives to negative self-relevant information was also confirmed from the signal detection procedure. For negative adjectives, the $\beta$ value of depressives was significantly lower, compared to nondepressives, suggesting that they employed less stringent criteria. These results indicate that depressives have a tendency to endorse negative self-relevant information as previously seen items, thus supporting a response bias. Negative recall bias in depression can be accounted for to some extent by a response bias.

Dunbar and Lishman (1984) also used emotional materials on an unexpected recognition test among depressed patients and normal controls. There was no difference in overall performance (Hit rate). On the $d'$ values, types of words interacted with depression. Depressed patients show higher $d'$ value for unpleasant words than controls, suggesting that unpleasant memories seem to be more discernible for them. For nondepressed people, the opposite pattern was true, indicating that pleasant memories appear to be more accessible. The analysis of $\beta$ showed that depressed patients obtained higher values in pleasant and neutral words than control groups. But nondepressives did not show such a bias according to the type of words.

Taken together, the above studies show that response bias varies depending on the types of words; response bias seems to be content-specific. Depressed patients show greater bias against pleasant and neutral words and employ less stringent criteria to negative self-referent information. On the basis of these results, the effects of depression on memory are not wholly explicable in terms of poverty of output. In the case of neutral materials, mixed findings were obtained, but procedural differences seem to affect the level of false alarms. Thus, to examine a pure memorial difference between a depressed and a nondepressed group, some measures should be taken to exclude the possibility of the alternative explanation of response bias.

2.1.2 Task Characteristics
It is generally accepted that tasks requiring relatively effortful processing are likely to show depressive memory deficits (Hartlage et al., 1993; Hasher & Zacks, 1979). For example, depressives are more subject to memory deficits in recall tests than in recognition tests (Calev & Erwin, 1985). The following sections discuss cognitive processes which are considered as requiring effortful processing and explore whether depression interferes with such processing. Unfortunately there has been no systematic examination of the attentional demands required by experimental tasks used to assess performance deficits in depression (Ellis & Ashbrook, 1988). However, according to Hasher and Zacks (1979), cognitive operations requiring elaboration, rehearsal, imagery, and mnemonic activity were considered as effortful processes. Studies of organisational/clustering processes, encoding effort, semantic encoding, rehearsal, and problem solving will be discussed. These studies examined depressive memory deficits in neutrally valenced materials.

2.1.2.1 Organisation/Clustering

Russell and Beekhuis (1976) compared schizophrenics and depressives to normals on a list of randomly distributed nouns through a multitrial free recall task. Despite the high semantic content produced in the to be remembered lists, both patient groups disclosed inferior recall clustering relative to normals. These results suggest that both depressives and schizophrenics displayed organisational memory deficits, such that they are unable to impose any personal or idiosyncratic organisational structure on the list. As a result, the failure of organisational process in memory impairs subsequent memory performance. Similarly, depressed patients showed a low level of item clustering in their free recall, compared to normal controls (Calev & Erwin, 1985). These organisational deficits were found to be affected by types of stimuli (self-descriptive adjective vs. abstract noun) used and a duration of depression (Davis, 1979b, Davis & Unruh, 1980; Davis & Unruh, 1981) Among depressed students, the level of depression
was negatively associated with the subjective organisation of self-descriptive adjectives on the multtrial free recall, which did not hold for the subjective organisation of abstract nouns (Davis, 1977b). Davis and Unruh (1980) did not find those organisational deficits on the multtrial free recall test of randomly ordered abstract nouns among short-term, long-term, nonpsychotic depressives and normal subjects. Unexpectedly, short-term depressed subjects put a high subjective organisation on the recall test, compared to long-term, and normal controls. Another study (Davis & Unruh, 1981), comparing short-term, long-term depressives and nondepressed people in multtrial free recall, found that short-term depressives showed lowest degree of subjective organisation for neutrally toned personal adjectives, compared to other groups, which did not differ. These results suggest that the content of stimuli and duration of depression affect an organisational ability of depressives. Particularly short-term depressives appear in a transitional phase to the development of well differentiated negative self-schema, thus, showing a poor performance in the self-referent processing of neutrally toned personal adjectives due to their unstable self-schema (Davis, 1979a).

Weingartner et al.'s (1981) second study examined how much organisation is imposed on information and how that organisation is utilised for later recall. Subjects were presented with a group of unrelated or related words and instructed to sort words into categories and then to freely recall words. For related words, both groups did not show a difference in grouping words, indicating that both groups take advantage of the inherent relationship among words when the relationship is self-evident. However when random words were used, depressed patients imposed more categories than normal controls. In recall performance, the groups were not different in the related word condition, whereas in the unrelated word condition, depressed patients recalled less than normal controls. However, the correlation between the degree of organisation and recall performance was not significant for word conditions and groups. A third experiment varied the number of categories in lists of related words. In each category, the
presentation of related words was either clustered or unclustered. The results showed that depressed patients recalled fewer words when the structure of lists was not obvious to them (unclustered presentation), but when the organisation of words was presented by the experimenter (clustered presentation), memory deficits disappeared. Particularly when the least organised words (random word list) were used, depressed patients showed the largest difference from normal controls. The analysis of the degree of clustering of recalled words showed that depressed patients were not different from normal controls when words were presented in an organised way, whose structure is apparent to them. In the randomly presented condition, much less sequential recall of related words was found.

These structural/organisational deficits on word lists in depression were extended to the recall of prose (Watts & Cooper, 1989). The question was to test whether depressed patients take advantage of the structural organisation of prose as well as normal controls. The selective recall of the prose provides an index of the degree of organisation imposed on the passage. Two variables (structuring vs. imageability) were investigated; structuring was seen as effortful processing, while imageability as a control variable is as reflecting automatic processing. The results showed that the effects of imageability of prose were comparable in both groups (relatively automatic processing); depressed patients show a strong bias towards selective memory for highly imageable units as well as normal controls. However, depressed patients showed significantly less bias towards recall of central units than did normal controls. Thus these results suggest structuring deficits of depressives. On the contrary, contradictory findings were obtained by Levy and Maxwell (1968). They found that depressed patients benefit less than normal controls as the level of approximation-to-text of 10 and 20 word lists increased from random words to text. While normal controls showed an increased recall as the degree of structure of the list rose, this did not hold for depressed patients. Group differences in recall were more strong in the 20 word-lists condition than in the 10 word-
lists condition. These results are contrast with the finding that less organised word lists lead to greater memory deficits, relative to organised word lists (Weingartner et al., 1981).

These discrepant findings were taken up by Watt, Dalgleish, Bourke, and Healy (1990) who applied both tasks from two studies (Levy & Maxwell, 1968; Weingartner et al., 1981) to a single depressed patients sample. Also the experiment was designed to test the prediction from the resource allocation model (Ellis & Ashbrook, 1988); depression interferes with processing of unstructured materials more than with structured/organised materials. In each task (approximation to text lists and semantic category lists), three levels of structure were employed; high, medium, and low. Averaging across both types of task, there was no interaction between groups and levels of structure, which is expected. At the post-hoc analysis of low and medium structure, the results were opposite to the prediction from the resource allocation theory; depressed patients benefit less on the medium level of structure than on the lowest level of structure, compared to normal controls. Results supporting the resource allocation model were obtained from the comparison between medium and high levels of structure for approximation to text; less difference between groups was found in the high level of structure than in the medium level of structure. Similarly the Channon et al. (1993a) study mentioned earlier, compared recall performance across varying level of structure of word lists (high, medium, unstructured) among depressed patients and nondepressed normal controls. Depressive memory deficits were found only in the medium structure condition where the categorised words were presented in a random order.

Two studies have employed the recall of stories containing emotional elements (positive, negative, neutral). One study on dysphoric students (Hasher et al., 1985) did not find any recall deficits across the immediate and delayed recall tests. In contrast, Breslow, Kocsis, and Belkin (1981) found overall memory deficits among depressive patients. The analysis on contents of materials showed that the recall of neutral and
negative elements remained intact and the recall of positive elements were suppressed rather than the preferential recall of negative elements of the story in depressed mood states. So overall, recall deficits in depression are seen as a result of poor recall of positive elements.

These discrepant findings by Hasher et al. (1985) may be attributed to the severity of depression and/or the experimental procedure used. Hasher et al. (1985) used dysphoric students, while Breslow et al. (1981) employed clinically depressed patients. So memory deficits in the latter can be attributed to the severity of depression. A procedural difference was that Hasher et al. (1985) induced subjects to identify themselves with the protagonist of the story (self-referent processing), while Breslow et al. (1981) simply asked subjects to read the story about person (close to other-referent processing). According to Kuiper (1983), the self-referent processing paradigm seems to be resistant to depressive memory deficits. Secondly, the filled retention interval used by the Breslow et al. (1981) can make the task more difficult than an unfilled retention interval condition (Hasher et al., 1985).

In summary, the structural/organisation deficit in depression is affected by i) the level of structure of materials used, ii) affective valences of stimuli and iii) the duration and severity of depression. In general, depressives have some difficulties in putting an organisation/structure on the materials when such a cognitive process is implicitly required, such as in the recall of words (e.g., Calev & Erwin, 1985; Russell & Beekhuis, 1976). Although conflicting results in the level of structure and recall were found, it seems that depressive memory deficits are most likely to occur in the medium level of structure in which organisation of materials should be put by subjects rather than when organisation of materials is self-evident or too difficult (Channon et al. 1993a). With emotional contents being presented with neutral ones, depressives seem to suppress the processing of positive materials, causing memory deficits (e.g., Breslow et al., 1981).
Finally, severe depression rather than mild/moderate depression interferes more with organisational process.

### 2.1.2.2 Encoding Effort

Cognitive effort expended in encoding processes has been found to have a positive relationship with memory performance on some tasks in normal people; the items given more encoding effort were more memorable than those given less encoding effort (Jacoby, Craik, & Begg, 1979; Tyler, Hertel, McCallum, & Ellis, 1979; Krinsky & Nelson, 1981; Johnston & Uhl, 1976). However, sometimes such a beneficial effect of cognitive effort has produced contradictory findings (Zacks, Hasher, Sanft, & Rose, 1983; Kellog, 1984; Hertel, 1989). Despite such mixed findings, several studies have asked whether such a beneficial effect of cognitive effort holds for depressed people. The reason for this is because several theoretical frameworks predict that depression has more disruptive effects on cognitive-effort demanding tasks than on automatic tasks requiring little cognitive effort (Hasher & Zacks, 1979; Ellis & Ashbrook, 1988). In this regard, Mitchell and Hunt (1989) described cognitive effort as a boundary condition for studies of depression rather than a sufficient cause for a poor memory performance in depression. They suggested that it is desirable to study memorial processes which consume the limited capacity, energising cognitive effort. As with the normal population, several studies relating cognitive effort and memory performance in depression show inconsistent findings.

Regarding cognitive effort in depression, the study of normal people by Tyler, Hertel, McCallum, and Ellis (1979) has been frequently cited and whose materials have been used in subsequent studies. Their second study was designed to test the relative effects of cognitive effort and levels of processing in an incidental paradigm. Two levels of processing (anagram solving vs. sentence completion) were factorially combined with two degrees of effort (high vs. low effort) in an incidental learning paradigm. For the
In the low effort condition, anagrams were scrambled very little, while in the high effort condition, anagrams were scrambled a lot. For the sentence completion task, in the low effort sentence condition, sentences had an obvious completion, whereas in the high effort sentence condition, sentences were more difficult to complete. For example, for the missing word 'dream', “the girl was awakened by the frightening_____” (low-effort) and the man was alarmed by the frightening’_____’ (high-effort). The results showed that across both tasks, the high effort condition was associated with greater recall than the low effort condition. Cognitive effort was measured by a secondary tone detection task, and probe latencies were longer for the high-effort sentence-completion task than for the low-effort sentence-completion task. Furthermore, a difference in reaction time was parallel to a difference in recall performance; that is, high effort led to better recall.

The cognitive effort effect was applied to studies of depressive memory deficits (Ellis et al., 1984, study 3). Ellis et al. (1984) reported several experiments on normal subjects who had undergone the VMIP. They compared the recall performance of depressed subjects with a neutral mood induced group in the sentence completion task. They replicated findings of superior recall of words processed in high-effort sentence completion to that of words processed in low-effort sentence completion. However, such a recall superiority in the high-effort condition disappeared in an experimentally induced depressed mood state. They interpreted poor performance of depressed subjects in the high-effort condition as inadequate allocation of cognitive effort. However, as there was no secondary task to measure the degree of expended effort, such an interpretation is not conclusive.

Potts, Camp, and Coyne (1989) examined whether poor elaborative processing found in a mood induction study (Ellis et al., 1984, study 1) could be generalised to a naturally occurring depressed population. Using similar types of sentences (base vs. elaborated sentences) as a within-subjects variable, they did not find an overall recall
difference between groups but nondepressed subjects recalled more targets words in the elaborated condition than in the base sentence condition, whereas depressed subjects did not show superior recall in the elaborated condition. These results were interpreted as, that depression interferes with adequate allocation to the elaborative condition (cognitive effort deficits). Like Ellis et al. (1984), they did not employ any measurement to verify the allocation of resources.

A study by Hertel and Rude (1991a) also attempted to extend the study of cognitive effort deficits found in experimentally depressed states to naturally occurring depressed people. Using a sentence-completion task similar to that of Tyler et al. (1979), they varied sentence difficulty and task instruction. A secondary task with a varying delay of tone detection, was employed with sentence frame task while processing sentences. Three groups were employed: naturally dysphorics, induced dysphorics, and normal controls (study 2). The experimentally induced subjects replicated Ellis et al.,'s (1984) results; they showed overall recall deficits and did not benefit from difficult sentences, compared to normal controls in the unstructured condition. In contrast, naturally occurring depressives did not show overall recall deficits. Natural depression interacted with task instruction and sentence difficulty. In the unstructured condition, no significant effect including depression was not found, but in the structured condition, they recalled fewer words from easy sentences but similar amount of words from difficult sentences (study 2). Across three experiments, they did not find memory deficits with natural depression as predicted by cognitive effort account. The lack of depressive memory deficits in the difficult task are contrasted with the previous study (Ellis et al., 1984). Three experiments taken together, induced mood subjects perform differently from naturally depressed subjects; induced depressed subjects show overall poor deficits, while naturally depressed subjects did not. The beneficial effects for later recall from difficult decision task (difficulty task) are disrupted in induced depression but not in natural depression. These results of naturally depressed subjects do not fit resource
not fit resource allocation and capacity-reduced models. Particularly, the finding that naturally depressed subjects recalled equal amount of words from difficult sentence frames but recalled less from easy sentence frames in the structured task condition, appears to support reduced initiative hypothesis. This is because mildly depressed subjects could allocate adequate resources to a difficult task. This argument was tested again in clinically depressed patients in a subsequent study (Hertel & Rude, 1991b).

Hertel and Rude (1991b) applied the same encoding effort procedure described previously (Hertel & Rude, 1991a) to outpatients. This was because the equal performance of naturally occurring depressed subjects in difficult sentences seems to be associated with the mild depression of the student population. The aim of the study was the same as the previous study (Hertel & Rude, 1991a), to investigate whether cognitive effort effects are impaired in depressed outpatient subjects. Recovered, depressed, normal controls were employed. The results showed that depressive memory deficits varied upon attentional manipulation; unfocused attention produced memory deficits, while focused attention did not, compared to normal controls. So effortful encoding does not always accompany depressive memory deficits and thus puts a restriction on the cognitive effort account of depressive memory deficits. These results suggest that a more controlled task procedure, like the focused task, could prevent depressive memory deficits by mustering their attention to the current task instruction.

2.1.2.3 Semantic Encoding

Using a depth of processing paradigm (Craik & Lockhart, 1972), materials given semantic processing are better recalled than those given acoustic processing. The following studies which questioned whether this is true of depressed people assumed that semantic processing requires more attentional capacity than acoustic processing. Weingartner et al. (1981; study 1) compared semantic and acoustic processing in depressed patients and normal controls. In the semantic processing condition, subject
were instructed to produce semantically related words in response to the stimulus word, and in the acoustic processing condition subjects were told to produce an acoustically related word to the stimulus word. After 24 hours, free recall of stimulus words were tested. The results showed that normal controls remembered significantly more semantically processed words than acoustically processed words, but this pattern did not hold for depressed patients. The superior recall of semantic processing to acoustic processing disappears in depressed people. Such results were interpreted as due to the poor elaborative encoding of depressives.

A similar experiment was conducted by Ellis et al. (1984, study 2), in which the VMIP was used to induce depressed and neutral mood states. For semantic processing, subjects rated words on a pleasantness scale and for nonsemantic processing, subjects were instructed to count the number of “s” in each word. In an unexpected recall, depressed subjects recalled less words than nondepressed subjects in both semantic and nonsemantic conditions. However, the superior performance of semantic processing over nonsemantic processing held in depressed mood states. These results suggest that induced depression reduces the effectiveness of both semantic and nonsemantic orienting tasks in its effect on recall. Roy-Byrne, Weingartner, Bierer, Thompson and Post (1986) induced semantic processing using comparative judgement of noun pairs in depressed patients and normal controls. Once subjects completed the task and were asked to recall words and to identify which of 4 judgemental attributes had been applied to each word pair presented. Depressives showed memory deficits in the recall test but not in the identification of judgemental attribute. Roy-Byrne et al. (1986) interpreted these results on the dimension of effortful (free recall) vs. automatic processes (identification). However even though the identification task at retrieval is more close to automatic processing, both tasks involve the same semantic encoding process. Depressive memory deficits may occur due to incongruence between encoding and retrieval which made the recall test more difficult, relative to the identification test. The identification test at
retrieval is congruent with identification-oriented encoding, while the free recall test is incongruent with identification-oriented encoding. Thus, rather than the effortfulness of cognitive operations demanded by the task, incongruency between encoding and retrieval stages may be responsible for the memory deficits (cf. Tulving & Thomson, 1973; Morris, Bransford, & Franks, 1977).

In summary, semantic processing of neutral materials seems to be disrupted, and the encoding requiring deeper elaborative processing is more likely to be interfered with by depression. Induced depression is different from clinical depression in that it disrupted nonsemantic as well as semantic processing. This difference could be caused by temporarily strong depression induced by the mood induction procedure (Hasher et al., 1985).

2.1.2.4 Rehearsal

According to the working memory model of Baddeley and Hitch (1974), rehearsal rate is responsible for memory span in the normal population. Many studies have been conducted as to whether memory span (serial recall) is interfered with by depression. Such a question is relevant to the assumption by Hasher and Zacks (1979) that rehearsal as an effortful process is impaired by depression. The claim of rehearsal deficits by Hasher and Zacks (1979) reviewed earlier was supported by the finding that depressives made less semantic confusions in the forced choice recognition test than normal controls. These results were interpreted as due to the lack of elaborative rehearsal by depressives. However, this argument is based on the performance of depressives, but not on the actual measurement of rehearsal strategy/rate taken. The previous studies in this area show inconsistent findings due to various tasks, diverse subjects population, and some methodological problems assessing short-term memory functioning (Colby & Gotlib, 1988).
Many studies explored the serial recall of digits and words in depressed people but did not find memory deficits. One of the most extensive studies on severe depression's effects on cognitive and perceptual functioning was conducted by Friedman (1964). On only 4% of the possible 82 test scores were depressed patients significantly different from matched nondepressed controls. Examples of the tests are reaction time to a light signal, reaction time for a common object and Digit Symbol. On the basis of these findings, he suggested that the possible depressive memory deficits lie in short-term memory or the capacity for sustained concentration. In effect, he did not find poor performance of depressives in the digit span task.

Whitehead (1973) compared elderly depressed patients with demented patients on a variety of learning and memory tasks including the digits span forward test. Depressives served as their own controls. The performance on the digits forwards of depressives did not differ from one when they recovered from depression, suggesting that depressives do not suffer from impaired immediate recall of digits. One of the problems, as he suggested, lies in that recovered depressives were retested on remission, which might not be complete. Thus, the results would be different if healthy elderly people had been employed as normal controls and such a limitation makes the null findings in immediate recall inconclusive. Henry, Weingartner, and Murphy (1973) tested short-term memory functioning as a part of serial learning (6 trials) when the first trial is considered as representing short-term memory. The depressed patients comprised both unipolar and manic-depressed patients. Subjects served as their own control; the comparison was made between when they are more and less depressed during the antidepressant treatment. The immediate recall of random words was not different between more depressed and less depressed phases. Gibson (1981) tested immediate free recall for elderly depressed, dementing elderly, and normal controls. A list of 10 words were auditorily presented and a set of pictures were also presented, and subjects were asked for immediate free recall. In comparison to normal controls, depressed subjects showed
lower overall performance in both the verbal and visual task. But the pattern of a U-shape appearing in the serial position curve in free recall was similar in depressed and normal subjects, with memory loss in depressed subjects being more severe at the absolute level. Across depressed and nondepressed groups in either task, there was a strong recency effect on the last position. Assuming that the recency effect comes from the short-memory store, it can be claimed that the short-term memory in the depressed group remains intact.

Slife, Miura, Thompson, and Shapiro (1984) compared serial learning of trigrams (consonant-vowel-consonant) among elderly depressed, matched normal elderly and normal college students. The trigrams were simultaneously presented for 30 seconds and three trials of recall of the same list of trigrams were administered. Considering the first trial as reflecting short-term memory, the depressed elderly did not differ from the normal elderly, but on the third recall trial the depressed elderly recalled less trigrams than normal elderly. This result suggests that the depressed elderly have a learning difficulty, but no short-term memory deficits.

Berndt and Berndt (1980) did not find short-term memory deficits in depressed college students. The task they used was remembering consonant-vowel-consonant trigrams in a Brown-Peterson task with 10 seconds filled retention interval. Gass and Russell (1986) investigated the relation among organicity, depression and memory performance on the Digit Span Scale (WAIS) and Logical Memory test (30 minutes delayed recall, WMS-revised). Subjects included four groups; depressed and organic (brain-damaged), depressed and not organic, nondepressed and organic, nondepressed and not organic. The organicity variable impeded digit span performance and logical memory, while the depression variable did not. On the basis of these results, they concluded that depression has a negligible effect on both STM and LTM.

Unlike those studies aforementioned, a more extensive study on STM functioning was conducted employing a range of working memory tasks among depressed patients
and normal controls (Channon, Baker, & Robertson, 1993b). A range of tasks were designed to tap components of the working memory model proposed by Baddeley and Hitch (1974). The working memory model proposed a central executive as a supervisory system which controls the allocation of resources and mediates problem-solving and decision making, and two subordinate systems i.e., articulatory loop and visuospatial sketch pad. The articulatory loop is responsible for verbal STM and the visuospatial sketch pad is for visual STM. On several measures involving the articulatory loop and visuospatial sketch pad, depressed patients and normal controls did not differ. On the basis of these measures, they concluded that the articulatory loop and visuo-spatial sketch pad responsible for verbal and visual rehearsal respectively remain intact in depression.

In contrast with the above null findings, several studies claim that serial recall is disturbed by depression. Colby and Gotlib (1988) investigated whether mild/moderate depressed mood states can have disruptive effects on rehearsal in short-term memory task. A Digit span task with varying length (6, 8, 10, and 12 items) was employed with varying retention intervals (1, 20, 30 seconds). In overall performance, depressed subjects were poorer than nondepressed subjects. A depressive memory deficit was found in 8 and 10 digits strings. In longer retention intervals (20, 30 seconds), depressives showed poor performance compared to immediate recall, whereas such a pattern did not hold for nondepressives. On the basis of these results they proposed that depressives have difficulties in maintaining information in short-term memory, that is, a rehearsal difficulty. However, it seems possible that the simultaneous presentation of digits as used in their experiment may allow subjects encoding strategy to improve later recall rather than to just retain information. As the duration of presentation was equivalent to 1 second per digit, there must be enough time to use an encoding strategy such as chunking in case of 8 or 10 digits presented. Also rehearsal difficulty might be caused by the psychomotor retardation frequently found in depressed mood states.
Krames and MacDonald (1985) assumed that negative automatic thoughts from negative schemata will occur recurrently, thus occupying the STM space. Under this assumption depressed people seem to be forced to divide their attention to both the immediate task and the negative thoughts competing for the STM space. To test the idea, the concurrent memory task was employed; subjects were asked to recall digits visually presented and a list of words read to them at the same time. The memory load of numbers varied from zero, to three, to six digits. The results of the free recall of words showed that normal controls recalled more words than depressed patients across memory load and serial position. When serial position was divided into three sections: primacy, middle, recency the performance in the primacy segment was determined by the interaction of memory load and depression. A group difference was found in the zero memory load condition which is relatively easy and the difference disappeared in the six digit memory load condition, which is more difficult. The middle and recency parts were not affected by depression. For the recall of digits, the two groups did not differ according to memory load. On the basis of no group difference in the recency part, they concluded that there is no decrement in STM capacity for the depressives. Instead, on the basis of interaction in the primacy part, they proposed cognitive interference of depressive thoughts during maintenance of information in STM. That is, depression does not reduce STM capacity but interferes with encoding of information and/or the maintenance rehearsal.

Dannenbaum, Parkinson, and Inman (1988) compared three groups (elderly depressed, demented, normal elderly) on the letter span task. The letter span was based on the longest list length recalled when 70% or better accuracy was obtained over 10 trials. They found that the elderly depressives have a shorter memory span than normal controls, suggesting memory span deficits. These individuals’ difference in letter spans were considered on the Brown-Peterson task in immediate and delayed recall with distractors. Equating for capacity differences resulted in equivalent overall performance
in both immediate and delayed performance. On the basis of these results, they suggested that depressive memory deficits in serial recall appear to be restricted to encoding information. This interpretation is contrasted with one by Colby and Gotlib (1988), proposing rehearsal difficulty for memory deficits in delayed recall. With considering the limitation of Colby and Gotlib (1988) study, it seems a tentative conclusion that depressive memory deficits are associated with encoding strategy.

In summary, the previous literature on STM functioning in depression showed inconsistent findings. The possible reasons for these contradictory findings are that some studies have methodological problems; e.g., no control for effects of statistical regression when subjects serve as their own controls (e.g., Henry et al., 1973; Stromgren, 1977), and mixed used of subtypes of clinically depressed patients (e.g., Henry et al., 1973). Secondly, studies employed various methods and subject groups. Subjects groups varied from clinically depressed patients, elderly depressed people, mildly/moderately depressed subclinical people. Also various tasks have been used; serial learning, serial recall, immediate free recall, and recognition. The presentation of stimuli is sometimes simultaneous rather than sequential, allowing subjects to use a cognitive strategy (Colby & Gotlib, 1988; Slife et al., 1984). Finally, some studies were not conducted in the context of a clearcut theoretical framework. This diversity in subject population and tasks among studies makes forming a conclusion on STM functioning in depression difficult.

2.1.2.5 Problem Solving Strategy

As claimed in the reduced initiative model (Hertel & Hardin, 1990), the failure of spontaneous election of beneficial cognitive strategy in depression is responsible for depressive memory deficits. This argument stresses the importance of cognitive strategy in the study of memory functioning in depression. According to Hasher and Zacks
(1979), problem solving strategies belong to effortful processes and the review by Hartlage et al. (1993) showed difficulties of depressives in solving problems.

In a category learning task, Smith, Tracy, and Murray (1993) tried to understand depressive learning strategy. In terms of automatic vs. effortful processing, it was assumed that holistic processing is fast and effortless (automatic processing) and an analytic approach is slow and effortful (effortful processing). Accordingly, depression is more likely to show performance deficits on a task requiring an analytic approach rather than a holistic approach. To test this hypothesis, subjects (depressed vs. nondepressed community students) were subject to category learning which allowed either an analytic and systematic approach, or holistic processing. Two types of category membership were developed; criterial-attribute (CA) and family resemblance (FR). In the CA task, only one attribute contributed to categorisation of stimuli, all the others were uninformative about the category membership. This task requires subjects to use selective attention and flexible analysis. On the other hand, in the FR task, no attributes are diagnostic of category membership. The results showed that across groups, the CA task produced overall better performance than the FR task. However, depressed subjects revealed performance deficits in the CA task, but not in the FR task. It appears to contradict the prediction from the effortful processing because the FR task is more effortful than the CA task; the difficulty of the FR task was evidenced by the failure of a number of subjects to meet the criteria. Thus performance deficits with the CA task indicate that depressives suffer from rigid and inflexible strategy of analysis rather than from effortful or difficult task processing.

This poor analytic and systematic cognitive strategy employed by depressives was also evidenced by Abramson, Alloy, and Rosoff (1981) study on hypothesis testing strategy. The comparison between a subject-generated hypothesis condition and an experimenter-provided hypothesis condition was made. The subject-generated condition required subjects to arrive at the solution of the problem (controlling a green light), while
the experimenter-provided condition supplied subjects with several alternative hypotheses including the correct one. The task was to control the green light onset by pressing a button. They found that in the self-generated condition, depressed students gave fewer correct responses than nondepressed students, but in the experimenter-provided condition, the groups were not different. These results may be due to a tendency that depressives are less likely to engage themselves in hypothesis testing in the self-generated condition. On the basis of these results, they concluded that depressives do not seem to actively engage in cognitive strategies; for example, attention focusing, memory search and rehearsal.

Similarly, Silberman, Weingartner, and Post (1983) also investigated problem solving behaviour on a discriminant learning task (Levene, 1966) for depressed patients (unipolar and bipolar) and normal controls. The task is to gradually reduce the number of possible correct hypotheses according to the feedback from the experimenter (yes or no). There are two conditions, standard vs. report. In the reported condition, subjects were asked to list all hypothesis sets after the first and second feedbacks, while in the standard condition, they did not. The results showed that depressives generated fewer correct hypotheses than nondepressives across both standard and report conditions. In the standard condition depressives did not differ from nondepressives after the first feedback, but after the second feedback, they could not reduce the set of possible correct hypotheses, sampling from an overly large set of hypotheses. However, in the reported condition, both groups did not differ. These results were interpreted as an inability of depressives to narrow down a set of possible solutions and by discarding hypotheses, reflecting a cautious response strategy. Using a similar Levene task (1966), Baker and Channon (1995) found depressive impairment only on the 4 dimensional problems. Despite various strategies such as memory aid and focusing attention, there was no clear-cut evidence that any of these experimental manipulations had a differential facilitatory effect on the performance of the dysphoric group and moreover, overall poor
performance was found. The overall poor performance is consistent with results of Silberman et al. (1983), but no facilitatory effects are contradictory to them.

In a conceptual problem solving task, Dobson and Dobson (1981) also studied a cognitive strategy that depressed students use. The problem that subjects had to solve was to learn an operational rule by discovering through card choices (and; conjunctive, and/or; inclusive disjunctive, if and only if; biconditional). The problem solving strategy score as well as the number of card choices were calculated, based on the degree of a chosen card giving new information relevant to the solution of the problem and on hypothesis generation. They found that depressives needed more cards to reach the solution criteria in the inclusive disjunctive and biconditional conditions, but no difference was found in the conjunctive condition. Similarly, in the strategy score, depressives were less efficient than nondepressives in inclusives, disjunctive and biconditional conditions, but not in conjunctive condition. However, depressives and nondepressives did not differ in the number of hypotheses generated. Assuming that inclusive distinctive and biconditional conditions are relatively more difficult than the conjunctive condition, these results suggest that depressives are more likely to show problem solving deficits in tasks requiring a more complex cognitive strategy.

All the above results taken together suggest that depressive deficits in the use of cognitive strategy are more easily found in the situation where subjects generate their own hypothesis, employ an analytic approach, and are required to use a more complex strategy. These consistent results of poor problem solving seem to lend more support to the reduced initiative model, emphasising the lack of spontaneous cognitive strategy election in depression, than the reduced capacity model, which emphasises task difficulty. One of contradictory findings to the reduced capacity model is from the Smith et al. (1993) study using a category learning task; poor performance was found in the task requiring the flexible and analytic approach rather than in the difficult task. This contradictory finding can be explained because in a flexible condition using cognitive
strategy, the reduced initiative of those strategies can impair the performance of depressives. Depressive deficits in either subject-generated-hypothesis or a no cue condition presented by the experimenter might result from the poor focused attention of depressives in an uncontrolled task condition. However, the finding by Baker and Channon (1995) appears to be difficult to fit into the reduced initiative model because the helpful strategy of reporting hypotheses in the Levene task did not facilitate performance of the depressed group compared to the normal group. Rather this finding of overall poor performance is consistent with the reduced capacity model that depressive deficits may arise from an actual reduction in total cognitive resources with or without narrowing attentional focus. In summary, neither models can give a satisfactory explanation of current findings in the problem solving area. Further work is needed to elucidate the relationship between the reduced cognitive initiative and the reduced capacity model on problem solving tasks.
CHAPTER 3

Relationship among Self-schemata, Negative Cognitions, Self-focused Attention, and Depressed mood

3.1 Self-schematic processing

Much evidence supporting the operation of negative self-schema in depression has been accumulated using a self-referent processing paradigm. The idea of self-referent processing was borrowed from the depth of processing approach in cognitive psychology (Craik & Lockhart, 1972). The typical paradigm is as follows. Subjects are presented with a list of personal adjectives (e.g., bleak, weary, dismal: Kuiper & Derry, 1982) and are asked to respond yes/no in terms of whether the adjective describes themselves or not. As dependent measures, decision time of the yes/no decision and incidental recall performance are used. Using this paradigm with a normal population, Rogers, Kuiper, and Kirker (1977) found that greater incidental recall occurred for adjectives rated under a self-referent decision task (Does this word describe you?) than for the same adjective rated under a structural or semantic decision task. The results were interpreted as that the self-schema, activated via the self-referent judgement task, acted as an interpretative frame to facilitate deep and elaborate memory encodings. They concluded that this schema-based elaborative encoding accounts for the enhanced recall of self-referenced adjectives. Similarly, Markus (1977) defined self-schemata as the knowledge about oneself stored in long-term memory. Regarding the operation of self-schemata, she claimed that within a specified domain, one should make a relatively rapid judgement of consistent behavioural evidence and one should be able to resist counter-schematic information. Consistent with her prediction, people with a dependence schema took less time in deciding on whether words (e.g., conforming, obliging) related to such traits were self-descriptive than they did to describe themselves as independent adjectives (e.g.,
The opposite pattern was true of aschematic people (independent). The concept of a self-schema can be seen as both a knowledge about self and also a process engaged in the selection and interpretation of incoming information. A subsequent study (Bargh, 1982) using the same criteria to classify people into aschematic and schematic groups showed that information about a person’s self-schema receives automatic processing through the use of a dichotic listening paradigm. Subsequently the attributes of these self-schema operations were applied to explore negative self-schemata operation of depressed people.

3.1.1 Self-referent Processing and Depression

According to Beck (1967), depressed people have negative self-schema, characteristics of which are maladaptive and give rise to distortion in the way information is encoded and evaluated. Thus, in the perspective of self-schema prediction (Rogers, et al., 1977), depressed people give a more rapid judgement to and better recall of adjectives related to negative self-references than nondpressed people. Davis (1979a) applied a self-referent processing paradigm to depressed patients, utilizing the same personal adjectives used in the Roger’s et al. (1977) study whose content is not negative/depressed. The results replicated earlier findings of enhanced recall for self-referent decisions in the nondepressed group but not in the clinically depressed group. On the self-referent level, depressives recall significantly fewer words than nondepressives, which contradicts the prediction from depressive self-schema (Beck & Rush, 1978). These results were taken to cast doubt on the existence of a well-differentiated negative self-schema in depression. However, since Davis (1979a) did not include negative or depressive content adjectives congruent with a depressive self-schema, he was not able to appropriately test the question of negative self-referent processing in depression (Derry & Kuiper, 1981, pp. 145).
Derry and Kuiper (1981), building on Davis’ experiment of information processing in depression added an adjective list that contained both depressive (e.g., loser, inferior, hopeless) and nondepressive (e.g., amiable, sociable, capable) content into the similar paradigm used by Davis (1979a). The results showed that depressed patients showed superior recall of depressives adjectives under self-referent rating. Conversely both normal and non-depressed psychiatric control subjects exhibit superior self-referent recall for non-depressed content. In addition to addressing the negative content of the adjective list, Derry and Kuiper (1981) drew attention to the efficiency with which depressive content is processed; that is, schema-congruent materials are processed more efficiently in terms of time taken judging adjectives when adjectives characterize their self-schema. As predicted, clinical depressives were no less efficient in their speed of negative content processing than normal controls when response times for the self-referent decisions were employed as an index of processing efficiency. These results in recall performance and processing efficiency suggest that both depressives and non-depressives employed an efficient and well-organized self-schema to assist in self-referent processing, which supports Beck’s negative self-schema model of depression. This content-specific hypothesis predicts that information (adjectives) congruent with content of a self-schema would give rise to the most elaborative encoding and analysis in memory.

The same depth of processing paradigm was also utilized with mildly depressed students to take account of the possible effects of different levels of depression on self-referent encoding (Kuiper & Derry, 1982; Kuiper, Olinger, & MacDonald, 1985). Their experiments required both the depressed and normal subject to make semantic and self-referent ratings on depressed and nondepressed content adjectives. In the analysis of subsequent incidental recall, nondepressed subjects recalled more nondepressed than depressed self-referent information, while depressed subjects showed the equal amount of recall for both depressed and non-depressed self-referent content. On the basis of
these results, they suggested that mild depressives utilize a self-schema that incorporates both depressed and non-depressed content. This even-handedness of depressed and nondepressed content in mildly depressed subjects was further supported by Greenberg and Alloy's (1989) study on self-referent judgment of, and reaction time to, positive and negative adjectives; depressed subjects did not show any preference for positive or negative adjectives in terms of their self-descriptiveness and no difference in reaction time to positive and negative adjectives. These data indicate that mildly depressed subjects process positive and negative content with relatively equal facility, but at the expense of efficient processing for either. In relation to this even-handedness of response, Ingram and Reed (1986) suggested that the pool of stimuli used (loser, weak, inadequate) is too strongly depressive, which are not appropriate to tap their particular depressive self-schema. Mildly depressed subjects would have shown efficient processing of less strong stimuli (e.g., blue, criticized, troubled).

Ingram (1984a) investigated the content specificity hypothesis by giving nondepressed and depressed students either success or failure experience immediately before the depth of processing task. The stimulus adjectives were nondepressed content, which was used in the Roger et al.'s (1977) study. After the the depth of processing task, the recalled words were assessed by subjects in terms of favourability and self-descriptiveness. Nondepressed subjects in the success condition gave more favourable ratings on words recalled under a self-reference rating. However, depressed subjects did not show any difference in favourability for recall of words between success and failure conditions. These results suggest that depressed people have difficulties in using a success experience to activate the processing of positive self-referent information, compared to nondepressed. Depressed people inhibit the use of positive information rather than facilitate the activation of negative information. However, this conclusion is tentative because no treatment (neutral control) was included as a criteria to compare with other treatments. On the other hand, this lack of differential favourability of recalled
words as a function of treatment condition is consistent with the even-handedness of
response in mildly depressed people.

In summary, in the review of self-referent processing in depression, Ruehlman,
West, and Pasahow (1985) concluded that depressed patients show a negative recall bias,
mild depressives even-handedness of recall, and normal controls a positive recall bias.
These results support the negative self-schema theory of depression in terms of
development of a negative self-schema. That is, as the severity of depression increases, a
more organized negative self-schema develops, accordingly, facilitating processing of
negative information (cf. Davis & Unruh, 1981; Davis, 1979a). In relation to the
development of negative self-schema, Davis and Unruh (1981) emphasized the duration
of the depression episode. Other supportive evidence of the efficiency of the stable
negative self-schema comes from the finding that the self-referent processing of negative
contents of depressed patients is as efficient as that of positive self-related information of
nondepressed patients. Finally what happens when depressed episode remits? Slife et al.
(1984) showed that this negative information processing of the self is reversed over
psychotherapy.

3.1.2 Criticisms of Self-referent Processing

Even though much evidence on negative self-schema has been accumulated in
studies using the depth of processing paradigm, it is still not clear from the normal
population why there is this superior recall of self-referent over semantic processing.
According to Rogers et al. (1977), the recall superiority of self-referent material over
semantically encoded materials indicates that the self-referent encoding creates richly
elaborated memory traces (elaborative processing explanation). The self is seen as a
highly elaborated memory structure. In contrast, Klein and Kihlstrom (1986) proposed
an organizational processing interpretation. They noted that the self-referent question
(e.g., Does this word describe you?) encourages subjects into categorical organization;
words which describe me or words which do not describe me. The study by Klein and Kihlstrom (1986) showed that self-reference and semantic encoding produce virtually identical free recall levels if the categorical organization of the material is controlled. Furthermore, self-referent encoding may result in significantly poorer recall if it does not encourage categorization as self-descriptive vs. non self-descriptive. In a subsequent study, Klein and Loftus (1988) tested the relative contribution of both factors (elaboration vs. organization) to self-referent recall. The superiority of self-referent encoding depends on the properties of the words presented (unrelated vs. related). In the unrelated word condition, recall performance of subjects given an organizational process task using category sorting was equal to that of ones given self-referent encoding. In the related word condition, recall performance in the elaborative encoding condition was equal to that of the self-referent encoding group. So the advantage of self-referent encoding may be partly due to both elaborative and organizational processes.

In relation to the use of rating latencies as a measure of the efficiency of schema, Bargh and Tota (1988) argued that raw judgement latencies are inappropriate indices of efficient or automatic processing because multiple factors besides the activation of stored interrelated constructs may influence the response times (e.g., subject’s degree of confidence in his or her judgement; how much of it was due to the construct activation stage and how much of it was due to the decision and response selection stage?).

The review by Segal (1988) of studies related to self-schema in depression suggested that the difference found among depressed and nondepressed subjects can also be explained by an alternative framework such as accessibility or mood itself rather than a deeper elaboration by the operation of self-schema structure. First of all, the preferential recall of negative trait adjectives of depressive patients could be due either to negative self-schema or the mood congruence effect between the content of adjectives and subject’s affective states when subjects were asked to rate or recall. Thus, these results could be explained under mood-congruent encoding and recall in terms of
network theory (Bower, 1981). Segal (1988) himself tried to explain this differential recall between depressed and normal controls as a heightened accessibility of negative and positive adjectives as a function of mood. Similarly, in regard to the role of depressed mood, Hammen, Marks, deMayo, and Mayol's (1985) study on depression-vulnerability strongly suggests that mood plays a part in the maintenance of depressive symptoms rather than self-schema. Similarly, Teasdale and Barnard (1993) suggested the pivotal role of depressed mood in the maintenance of depressive symptoms rather than a negative self-schema. In a similar context, the review by Blaney (1986) noted that the problems with current schema-related studies is to distinguish response effects of mood itself and the response effects of cognitive schema structures associated with mood.

In sum, Beck's negative self-schema theory of depression has received supportive findings from those self-referent studies using the depth of processing paradigm. However, with the above criticisms, the necessity of negative self-schema as a cognitive structure remains ambiguous in explaining the superiority of negative self-referent information. This is because other alternative explanations are feasible, such as mood-congruent learning and recall, and heightened accessibility as a function of depressed mood itself. There are some difficulties in distinguishing mood effects and the effects of cognitive structures. Furthermore, even in the case of the normal population, there is some controversy of whether the underlying mechanism of self-referent processing lies in the elaboration activities of the self as a knowledge structure.

3.1.3 Relative Accessibility of Negative/Positive Cognitions

Unlike the self-referent processing studies focusing on the existence and operation of negative self-schema, the following studies are interested in the change in relative accessibility of negative/positive cognitions as a function of emotional mood states; thus, more focus was on the role of depressed mood. The two areas seem
complementary rather than antagonistic to each other, in terms of dealing with negative memory bias, particularly in depression. Perhaps the first study in this area, Lloyd and Lishman’s (1975) study examined the accessibility of personal memories among depressed patients using a correlational study. The accessibility of personal memories was measured as the time taken to retrieve a memory. Subjects were presented with a list of neutral words and then asked to recall either a pleasant or unpleasant personal memory that was somehow associated with each word. They found that the more severe the depression measured by the BDI, the less time it took to retrieve unpleasant memories and the greater the time to report pleasant experiences. Thus depression increases the accessibility of negative personal memories, while decreasing the accessibility of positive personal memories. However, their study could not clarify whether the increased accessibility of negative memories was due to the retrieval of genuinely depressing experiences with the severity of depression and/or whether the more severely depressed may simply be evaluating more of their neutral or ambiguous experiences as more unpleasant (Teasdale & Fogarty, 1979).

Taking account of these drawbacks, Teasdale and his colleagues conducted a series of experiments to examine the effects of depressed and elated mood states on associated variables such as a differential memory effect and psychomotor retardation in each mood state (for review, Teasdale, 1983; Teasdale & Barnard, 1993). The reason for using a mood induction procedure is because emotional contents of personal experiences can be equalised across depressed and elated groups. The differential memory effect was to assess the relative accessibility of negative and positive cognitions in depressed/elated mood states. Some studies employed a mood induction procedure (Teasdale & Fogarty, 1979; Teasdale, Taylor, & Fogarty, 1980; Teasdale & Taylor, 1981; Teasdale & Russell, 1983) and one study used clinically depressed patients (Clark & Teasdale, 1982). Through these experiments, he concluded that depressed mood state increases the accessibility of negative cognitions and decreases the accessibility of positive cognitions.
Three studies (Teasdale & Fogarty, 1979; Teasdale, Taylor, & Fogarty, 1980; Teasdale & Taylor, 1981) examined a differential effect of mood variation on retrieval of personal past experiences when subjects are induced by the Velten-like mood induction (depressed vs. happy). According to their prediction, subjects in depressed mood take less time to retrieve unpleasant memories, relative to pleasant memories. On the other hand, when they are induced into happy mood, it takes less time to retrieve happy memories than unpleasant memories. That is, current mood states regulate the relative accessibility of pleasant and unpleasant memories. The typical experimental procedure is as follows. The same subject experienced both depression and happy induction on different occasions. Stimulus words prompt subjects to retrieve past real life experiences and the latency to remembering the actual experience is measured. Except for the results of Teasdale and Fogarty (1979), the general results are consistent with the prediction. However, Teasdale and Fogarty (1979) showed that depressed mood state increased the latency to retrieve pleasant memories rather than decreased the latency to retrieve unpleasant memories. Clark and Teasdale (1982) subsequently replicated the earlier results by examining diurnal variations in the mood of depressed patients. Patients were given words as cues and asked to respond with the first personal memory which came to mind. These were rated for pleasantness/happiness. It was again found that high levels of depression were related to significantly more unpleasant than pleasant memories recalled. For time periods of relatively low depression in these same patients, more pleasant than unpleasant memories were retrieved. Negativity in ratings of the experiences were also mood-congruent; the more depressed ratings which were given, the more depressive the current mood which existed.

Teasdale and Russell (1983) shifted their focus from the retrieval of personal memories to recall of verbal materials which subjects had learned. The study aimed to explore the differential accessibility of positive, negative, and neutral personality trait words at recall. The results are consistent with the prediction of the differential
accessibility hypothesis. Subjects in elated mood states recalled more positive words than subjects in depressed mood states. More negative words were recalled in depressed mood states than in elated mood states. The recall of neutral words was not affected by mood manipulation.

One of the drawbacks across Teasdale and his colleagues mood induction studies is that they did not employ a neutral group or no induction group and instead used the happy group as a control group. As suggested by Williams et al. (1988), significant effects obtained in their experiments can be attributed to either slowing effects of depression or speeding up effects of elated mood, in explaining the differential accessibility of negative and positive contents obtained in the mood induction studies. In this regard, Blaney (1986) maintained that elated mood seems to contribute more to a differential recall effect rather than depressed mood, because the actual depressed mood change by the VMIP was very small as measured on the dispondency rating on the visual analogue scale. When a neutral group (no induction) was employed as a control, Natale and Hantus (1982) found that the elation induction significantly increased the number of happy memories recalled, but the depression induction did not increase the number of sad memories retrieved. Elated subjects also recalled significantly more happy than sad memories, while depressed normal control subjects recalled a fairly equal number of happy and sad memories. So it seems that temporary depression inhibits the accessibility of positive memories rather than increases the accessibility of negative memories. This conclusion is also consistent with findings from Ingram et al. (1984a) and Breslow et al. (1981), which were mentioned earlier. One of the problems with employing the retrieval of personal memories as an index of accessibility is that temporarily depressed people still might inhibit the recall of negative memories for self-esteem serving reasons even if they are readily available. Thus, it seems desirable to employ more unconsciously processed tasks such as the Stroop interference task.
A more basic question in relation to the relative accessibility of negative and positive cognitions is as to whether such an effect is achieved either through a changed mood (depressed or elated), a priming of a cognitive structure (schema), or self-focused attention. In this aspect, the finding by Teasdale and Russell (1983) is of interest in that subjects who did not meet the acceptance criteria on the mood manipulation check did not show differential recall by contents of words. These results suggest that mood states play an important role in affecting accessibility of emotional words. In contrast with an emphasis on mood for memory bias, cognitive priming effects were proposed (Riskind, Rholes, & Eggers, 1982; Riskind & Rholes, 1984, 1985; Rholes, Riskind, & Lane, 1987). According to this argument, the cognitive information provided by the mood-inducing events such as mood induction procedures (e.g., VMIP, success or failure) can directly prime memory independently of subject mood, consequently affecting memory accessibility. As a supportive evidence, Riskind, et al.,'s (1987) study using the VMIP, found that independent of mood state, negative self-evaluative statements of VMIP had a significant impact on recall latencies for real life experiences.

Taken together, the current results from both experimentally induced mood and clinical depression, suggest that the current depressed mood state plays an important role in regulating the relative accessibility of negative and positive memories/words whether this is measured by latency of retrieval or probability of recall. Depressed mood increases the relative probability of recall of negative memories against positive memories, while the opposite is true for elated mood. Compared to Beck's cognitive theory of depression assuming that depressed mood is a consequence of negative cognitions, these results suggest the converse may be true. If there is a selective bias of depressed mood in access to memory, more negative material can be retrieved and used. However, relative accessibility of negative and positive memories as a function of depressed and elated mood states seems to be more dependent upon the elated mood (Natale & Hantas, 1982, Teasdale & Forgarty, 1979). The reason for this asymmetry effect in temporarily
depressed mood states could be because depressed people suppress reporting or responding to negative memories to protect their self-esteem. However, this possibility can be excluded by the finding that when subjects are instructed to record every emotional incident over the course of a week and then to recall every incidents under either depressed or elated mood, (Bower, 1981), the results support the relative accessibility hypothesis. To ward off this possible response tendency in depression, tasks involving relatively automatic processing are required. The following section will explore whether an attentional bias toward negative/positive information is found in such tasks as the Stroop interference task and dichotic listening.

3.1.4 Attentional Bias in Depression

As with memory bias, several studies have explored whether the attention of depressives is drawn to negative information in the first place (attentional bias). If this is the case, the ongoing information processing of negative contents in depression might interfere with encoding of other information. This attentional bias is contrast with memory bias in that the former is a relatively automatic process, while the latter is effortful and elaborative. This suggestion was tested by Gotlib and MaCann (1984) through the use of a modified Stroop task (Stroop, 1935). Depressed and non-depressed subjects were shown rapidly presented words with depressed, neutral, and manic content, and required to name the colour that the words were printed in. They expected that the ongoing negative cognitive thinking might interfere with the colour-naming response latencies for depressive content words. As expected with this hypothesis, response times in the presence of depressed words were slower for depressed subjects but not for non-depressed subjects. However, such interference effects of depressed words were not the case in experimentally induced depressed subjects. These results suggest that the deployment of attention to depressed contents get priority, relative to the other information, thus causing the performance deficits. They explained these results in terms of depressive self-schema (construct
accessibility), and suggested that it is not a transient mood which is responsible for the interference. However, this biased attention towards depressed contents has not been replicated when a visual probe task was used. Gotlib, McLachlan, and Katz (1988), contrary to the findings in the Stroop task, found that depressed people did not show any attentional bias according to the emotional valence of manic, depressed, and neutral words. Only nondepressed people showed a positive attentional bias to manic stimuli. Similarly, MacLeod, Mathews, and Tata (1986) did not find an attentional bias of depressed subjects to threat words in a visual probe test.

In another experiment using a dichotic listening task with a concurrent light-probe reaction time task, McCabe and Gotlib (1993) showed that depressed patients were more distracted by negative- than positive- and neutral- content words presented through the unattended channel. However, nondepressed subjects did not differ among the three content words. This attentional bias toward negative content words disappeared when they recovered from depression. These findings suggest that depressed contents are automatically processed and the accessibility to negative content material increases during depression.

More recently Ingram, Bernet, and McLaughlin (1994) also investigated attentional bias among nondepressed and remitted depressed people who were subjected to the mood induction procedure (depressed vs. neutral). To this end, the dichotic listening task was employed; in the attended ear, a 3 minute neutral story was played, while in the unattended ear, at 10 seconds intervals, positive, depressive, and neutral words were presented. The subjects were to repeat the story aloud, which was recorded for analysis. The total error scores in reading the story aloud was used as a dependent measure. The results showed that remitted depressed people under the negative mood induction produced more errors when both positive and negative materials were presented, compared to neutral materials. In contrast, never-depressed people in the negative mood induction did not show any differential bias towards emotional materials.
Subjects in a non-mood primed condition did not show any difference according to the valence of materials. These results were interpreted as a re-activation of a negative schema, which has been dormant, but was primed by the negative mood induction, leading to a biased attentional allocation to emotional materials. These results were interpreted as emotional diffusion of depressives in the early information stage. The finding of no bias effect towards positive and negative stimuli in nondepressed people whose mood was induced into a transient depressed mood is consistent with one by Gotlib and MaCann (1984). This result supports the idea that an attentional bias does not occur during a transient depressed mood state.

In sum, the findings of effects of depression on attentional allocation to negative materials have been mixed. The results varied on tasks used (visual vs. dichotic listening), materials (depressed vs. threat words) and subject population (natural depression vs. induced depression). In general, naturally occurring depression, but not temporarily induced depression, biased attentional processing towards negative contents when a dichotic listening test is employed with depressed content words. This difference between natural and induced depression suggests that negative cognition preceeds rather than follows depressed mood, which contrasts with the depressed mood priority position by Teasdale and his colleagues. This difference in relative accessibility of negative cognition between natural and induced depression was attributed to the different types of memory tasks used (Gotlib & McCann, 1984). They claimed that episodic memory such as in the recall of personal experiences used in Teasdale's studies seems to be influenced by mood, while attentional processing is affected by the activation of schema.

3.2 The Effects of Distracting Procedures on Depressed Mood, Negative Cognitions, and Performance.

The previous section suggests that maintenance of depression depends on relatively higher accessibility of negative cognitions, so that depressed people are
characterized by persistent ruminative activity on depressive themes. Putting it another way, this implies that depressives are self-preoccupied and their attention is inward-directed. According to the self-focused attentional model (Pyszynski & Greenberg, 1987), depression is maintained and exacerbated due to their tendency to direct attention inward to negative cognitions. Assuming that this depressive self-focused attention as a mediating variable is redirected outward by distraction procedures, it can be expected that depressed mood is relieved, the frequencies of negative cognitions are reduced, and also performance deficits can be reversed by distraction. Although most of the studies related did not measure self-focused attention as a mediating variable, these studies were included when they seem possible to interpret in terms of self-focused attention. Several studies investigated the distracting effects on mood, thinking, and performance of depressives (e.g., Lyubomirsky & Nolen-Hoeksema, 1993; Morrow & Nolen-Hoeksema, 1990; Foulds, 1952; Fennell & Teasdale, 1984).

3.2.1 The Effects of Distracting Procedures on Depressed Mood

Morrow and Nolen-Hoeksema (1990) induced a depressed mood state using the combination of a sad story and depressing music and then explored how initially induced depressed mood state interacted with four different types of response style to depressed mood. They were interested in how the ways of responding to their depression are related to the severity of depression. Two factors (ruminative vs. distracting; active vs. passive response) was factorially combined, making up four groups. The manipulation of ruminative and distractive dimension was achieved by directing their attention to internal or external aspects respectively while reading appropriate notes. The passive and active dimensions were manipulated by instructing subjects to either sit and read notes or to walk forward and backward to sort cards into appropriate slots. The most effective method of alleviating a depressed mood was a distracting plus active response, followed by a distracting plus passive response. The degree of distraction had a greater impact on
alleviation of depressive affect than the level of activity. These findings suggest that diverting self-focused attention to external matters can relieve depressive symptoms including depressed mood.

In the subsequent study by Nolen-Hoeksema and Morrow (1993), they tried to generalise the findings in an induced mood condition to naturally occurring depression. Subjects (depressed vs. nondepressed) and treatment (ruminative vs. distracting) were factorially combined. Consistent with the findings in the mood induction study, for depressed subjects, ruminative treatment significantly worsened the level of depressed mood and distracting treatment significantly relieved the level of depressed mood, compared to the initial mood level before treatment. The amelioration of depressed mood by distracting self-focused attention was also found for clinically depressed patients (Fennell, Teasdale, Jones, & Damle, 1987). When depressed patients were instructed to focus on slides of outdoor scenes, they showed a greater reduction of depressed mood than patients in a control condition who simply focused on a picture of a white rectangle. Stile, Schroder, and Jonansen (1993) found distracting effects on dysphoric mood states induced by the VMIP. Unexpectedly, the induced depressed mood states were alleviated by either neutral or elated statements to the same extent. These findings suggest that regardless of the contents of distracting materials, preventing depressives from focusing on negative aspects of the self is effective in relieving dysphoric mood states. In sum, the effects of distracting task on the depressed mood state are positive. It seems that the contents of stimuli (positive, neutral) do not contribute to the alleviation of depression. However, as no measurement of self-focused attention was taken, it is not clear whether such effects are mediated by a change in self-focused attention. The other questions are concerned with how long such effects last, relative effectiveness among different distracting tasks, and with how a distracting task interacts with personality variables.
3.2.2 The Effects of Distracting Procedures on Negative Cognitions

Teasdale and Rezin (1978) explored the effects of external information presented at a high rate on the frequency of negative cognitions and depressed mood in depression in single case-study experiments. The subjects were selected by their symptom (negative content thoughts) rather than diagnostic criteria for depression. The speed of presentation of information (A, B, C, D) varied from the 0 bit/sec, 1/2 bit/sec, 1 bit/sec, and 2 bits/sec. Subjects were asked to repeat aloud each letter immediately after they heard it through the headphones. After each trial, subjects were asked whether they experienced negative thoughts during the trial and after each block (5 trials) they rated their current mood on the 1-10 scale ranging from “I am not at all depressed” to “I am extremely depressed”. The results showed a general decreased frequency of negative thoughts at a high rate of information presentation, also accompanying decreased depressed mood.

Teasdale and Rezin (1978) used thought stopping (eg., Wolpe, 1958) to reduce negative thoughts and examined their effect on depressed mood. In the treatment session, whenever spontaneously occurring negative thoughts arise, depressed patients were taught to say “stop” to themselves and to think a substitute thought. In the control procedure, subjects were allowed to mind-wander. They found that the thought-stopping method was not effective in reducing the frequency of negative thoughts. The reason for this seems to be either due to the lack of consideration of personal contents of thoughts or due to a strong intensity of intrusiveness in severe depression.

Considering the relatively unsuccessful attempt to reduce negative thoughts, Fennell and Teasdale (1984) also investigated the effects of a brief distracting procedure on the frequency of negative cognition and depression. The thoughts patients were experiencing were sampled by asking subjects to report their thoughts aloud. Each subjects experienced two interventions; in the distraction condition (5 minutes), subjects
concentrated on outdoor scenery projected on the wall, in the control condition (5 minutes) they looked at the square of white light projected on the wall. They found that only the low endogenous depressives with low scores on the Newcastle Diagnosis Scale (NDC, Carney, Roth, & Garside, 1965) showed a significant change in self-report depression, speech rate, and writing speed in the predicted direction. The NDC is a questionnaire consisting of 10 items measuring the endogeneity of depression. Furthermore, the distraction condition produced thoughts (83%) related to the current task, while the control condition did person concerns (88%). These results indicate that directing their attention outward can reduce spontaneously occurring depressive thoughts and is also effective at relieving depressive symptoms, but these positive effects can be different for low and high endogenous depression. The low endogenous depressives are more responsive to treatment than the high endogenous depressives. In a subsequent study, Fennell, Teasdale, Jones, and Damle (1987) replicated previous findings using a similar distracting procedure. In detail, distraction reduced particularly the frequency of thoughts related to actual life in both high and low endogenous groups and did not affect the frequency of thoughts related to the experiment. Depressed mood was significantly more reduced after distraction than after the control condition in low endogenous patients, which did not hold for high endogenous patients. In regard to these differences, they suggested that low endogenous depressives are associated with reactive, ruminative thoughts about past loss, disappointment, personal problems in their life, whereas high endogenous depressives are associated with some internal, biological factors.

In sum, beneficial effects of distraction on negative cognitions and depressed mood were affected by the types of distracting tasks and subtypes of depression (endogenous vs. nonendogenous). Why is the occurrence of negative cognitions reduced? As in the case of depressed mood, diversion of the depressive self-focusing style to external stimuli, which attract subjects’ attention, seems to account for it. Stimuli
requiring more attention from subjects (outdoor scenery) was more effective than just passive watching (square of light) in reducing the frequency of negative cognitions (Fennell & Teasdale, 1984). In the same way, rapid presentation demands more attention than slow presentation. However, if depressive thoughts are taken as a ratio of positive to negative thoughts, it would be more desirable to consider the ratio than only negative cognitions, and to investigate how positive thoughts are affected by the distracting procedure.

3.2.3 The Effects of Distracting Procedures on Performance

As suggested by the previous sections on distracting tasks, self-focused attention in depression contributes to the maintenance of depressed mood and cognition. This section will turn to performance deficits in depression and is concerned with whether performance deficits would be reversed or alleviated by manipulating the self-focused attention or using a distracting task. Reversal of performance deficits as well as reduced depressed mood was found by lowering self-focused attention in depressed subjects (Strack, Blaney, Ganellen, and Coyne, 1985). Three studies were conducted; in the first study, they found that depressed subjects had performance deficits, lowered expectancy of success, and higher self-focused attention while doing in anagram solving task, compared to nondepressed subjects. On the basis of these findings, in the second study performance deficits in normal controls were elicited by the manipulation of expectance and self-focused attention. As predicted, the most worst performance deficits were found in the lowered expectancy and increased self-focused attentional condition. In the third study, task-focus instructions (reducing self-focused attention condition) significantly reduced performance deficits, compared to a control group (depressed subjects who were not given any manipulation of expectancy and self-focused attention). These results suggest that self-focused attention plays a part in depressive performance deficits, and
performance deficits can be reversed by redirecting self-focused attention to the current task.

Williams (1980) used a tape recorded story for mood induction and examined the effects of induced mood states on a behavioural indice (speech rate; Teasdale et al., 1980) and problem solving behaviour. In the finger shuttle box test, subjects were to stop the escapable noises by sliding the knob. The results showed that immediately after the story, induced depression did not affect speech rate, but when speech rate was measured while performing the shuttle box task, there was a tendency for depressives to speed up their speech rate. Also depressed subjects were faster in escaping from the noise than normal controls.

Fould (1952) also found that distraction by a secondary task could improve maze performance speed in depressives. As a distracting task subject were asked to repeat digits after the experimenter while they were doing the maze task. His explanation of the facilitating effects of a distracting task was that the distracting task disrupts depressive self-preoccupation (self-focused attention). Taken together, distracting tasks sometimes facilitate performance of depressives. Even though some studies (Williams, 1980; Fould, 1952) did not measure self-focused attention, facilitative effects of distracting tasks seem to arise from reducing the heightened self-focused attention.

However, Williams et al. (1988) was doubtful of such an interpretation of reduced self-focused attention (self-preoccupation). They argued that such beneficial effects of a secondary task is specific to the speed of performance because errors rates were increased in depressed patients (Fould, 1952). Instead, they suggested a strategy change of depressives in performing the maze task; without a secondary task, they opt for a conservative strategy, but with a secondary task, they speed up at the expense of accuracy. However, a similar result to Fould (1952) was found in a free recall test with a concurrent memory load. Increase in a concurrent memory load while performing the free recall task facilitated recall performance practically to the same level of
nondepressed people in the primacy component (Krarnes & MacDonald, 1985). However, the analysis of digit recall errors showed that depressed subjects made more commission errors and that the errors tend to increase as the memory load increases. There was no interaction between memory load and depression. This result in error rates seems to be consistent with the argument of a strategy change of depressives in a more difficult task condition (Williams, et al., 1988). Krarnes and MacDonald (1985) explained this beneficial effect as follows; as memory load increases, self-preoccupied depressed thoughts are gradually replaced by task-relevant thoughts.

However, distracting tasks do not always accompany facilitatory effects on the performance of depressives. Cornblatt, Lenzenweger, and Erlenmeyer-Kimling (1989) studied attentional recognition tests on both numbers and shapes with or without distraction. Both visual and auditory distraction tasks were employed by modifying the target stimulus and playing a background story respectively. Schizophrenic, depressive, and normal subjects were to decide whether two successively presented stimuli (numbers or shapes) were identical and then to respond as fast as they could. Contradictory results to the above supportive studies were found. Regardless of types of distraction (visual vs. auditory), distractions impaired the performance of depressed patients. These results contrast with previous facilitating effects of a distracting task. What factors are responsible for such discrepant findings? The facilitative effects seem to rely on the types of tasks used. According to Cornblatt et al. (1989), their tasks are attention demanding. So, when the task requires most of attentional capacity, distracting tasks seem to debilitate performance in depressives.

The possible mechanism of facilitative effects on depressive performance is that the negative cognitions accompanying the heightened self-focused attention are reduced by distracting tasks so that more attentional capacity is available to the current task. That is, more task-relevant processing is feasible. As an alternative perspective to this argument, the distracting task may increase the arousal level of low-aroused depressed
people, enhancing performance. Also a change in cognitive strategy under the secondary task condition may account for improvement of performance in depression. In a broad sense, the cognitive strategy view can be accommodated into the self-focused attention view. That is, when a conservative strategy used by depressives is seen as a kind of self-preoccupied behaviour, the improved performance of depressives can be seen as redirecting self-focused attention to task-oriented attention.

In sum, the distracting procedures can achieve the alleviation of depressed mood and a decrease in the frequency of negative cognitions when more active involvement of depressed people in the distracting task is required rather than a passive involvement. In relation to increase in performance with a secondary task, depressed people seem to change their strategy from a conservative response to maximum effort in a dual task condition, so that they can increase their performance at the expense of error rate. These beneficial effects of distracting procedures or secondary task on depressed people seem to be achieved by redirecting their self-focused attention to a task-relevant processing by breaking up depressive thoughts, even though a direct measurement of self-focused attention was not undertaken in most studies. This argument suggests that negative cognitions, depressed mood, and self-focused attention is closely interwoven.

3.3 Summary and Implications for Depressive Memory Deficits

A number of experimental paradigms have now been used to examine differences between depressed and control subjects in the processing of emotional materials: incidental recall of self-referent adjectives, cued autobiographical memory, intentional recall of stories with mixed affective content, dichotic listening, and the Stroop test. To summarise these experiments, it might be said that in depression, attention is biased and memory biased towards negative contents. In general, this would be consistent with the predictions of two main frameworks: associative network theory (Bower, 1981) and the negative schema model (Beck, 1967).
In relation to the operation and existence of Beck's negative self-schema theory of depression, a number of studies employing the self-referent processing paradigm have been conducted and their results were positive, supporting the negative self-schema theory. However, an important source of difficulty Beck's negative schema model faces is whether negative thinking in depression originates purely from the negative schema. That is, negative thinking in depression may be a consequence rather than an antecedent to depressed feelings. This question was raised by a series of experiments by Teasdale and his colleagues and Teadale and Barnard (1993). The purpose of these experiments was to investigate the possible biasing effects of depressed mood on aspects of memory thought to be related to negative thinking. These findings suggest that negative thinking may be the result of depressed mood selectively biasing access to memory so that negative materials are more likely to be accessed and used, and positive materials are less likely to be accessed and used (relative accessibility of negative and positive cognitions). Also these results suggest that the biasing effects of depressed mood is partly responsible for negative thinking. In contrast with the biasing effect of depressed mood for negative thinking, cognitive priming effects were proposed, claiming that the mood inducing events such as mood induction procedures like the VMIP can directly prime memory, consequently affecting memory accessibility (Riskind, et al., 1982; Riskind & Rholes, 1984 Rholes, et al., 1987).

Two contradictory positions can be accommodated by the associative network model focusing on the reciprocal relationship between negative thinking and depressed mood; that is, negative thinking can be a consequence of depressed mood as well as an antecedent to depression. This reciprocal relationship places depressed people into a self-perpetuating vicious cycle. Once in a depressed mood more negative interpretation of experiences is likely to be made. The patterns of thinking reactivated are exactly those that had been involved in the production of depressed mood in the past. Consequently those same negative patterns of thinking are likely to act to maintain depression in the
present. This vicious cycle is also in line with the differential accessibility hypothesis of negative and positive cognitions (Teasdale, 1983). The differential accessibility hypothesis claims that depressed mood increases the relative probability of recall of negative memories against positive memories.

From a different perspective, the self-focused attention model maintains that depressed mood is maintained and exacerbated due to depressive tendency to direct attention inward to negative cognitions. This claim is consistent with the heightened accessibility of negative thoughts (Teasdale, 1983), implying that self-focused attention might be a mediating variable to the heightened accessibility of negative cognitions. This hypothesis can be supported by the evidence from studies of the beneficial effects of distraction on negative thoughts, depressed mood, and depressive performance deficits. Here the distracting procedure was assumed to act to redirect attention outward from internal focusing on negative cognitions. Taken together, the integration of the differential accessibility hypothesis with the self-focused attention could provide a better explanation of the currently available data.

What does this integrated framework view suggest about depressive memory deficits? Once the negative self-schema is activated during a depressive episode, negative automatic thoughts (self-statements) as cognitive products appear to play a part in interfering with the current task (Beck, 1967). Similar reasoning can be drawn from the heightened accessibility of negative cognitions in the depressed mood states. Brown (1988) suggested that negative automatic thoughts in depressives intrude on the attentional capacity area with or without consciousness. The role of negative automatic thoughts was not given much attention in terms of memory task performance relative to negative self-schema or content. Williams et al. (1988) claimed that their correlation with task performance is not clear. Furthermore, the role of positive automatic thoughts characterising normal controls has been neglected in the area of memory performance. Assuming that for nondepressed people, positive self-schema structure is more activated
and accessible, as with negative automatic thoughts in depression, they are assumed to intrude or occupy attentional capacity area, presumably having the same disruptive effect on task performance.

A stronger prediction of depressive memory impairment can be made from self-focused attention. As many studies on self-focused attention have shown, depressed people have a heightened self-focused attention towards internal matters. If this self-focused attention is influential during the task performance, depressive memory deficits should occur. Finally, how these negative cognitions, self-focused attention, and depressed mood are interrelated was discussed in the previous section of the distracting procedures. In conclusion, regardless of theoretical frameworks, they converge on the prediction that depressives will show memory deficits.

The following experiments aim to explore depressive memory deficits and consists of three major parts. The first part was to investigate the long-term memory functioning based on the precision of elaboration hypothesis. The aim of the second part was to compare three mood induction procedures in terms of the strength and duration of their initially induced depressed mood states. The third part was to examine the short-term memory functioning in verbal and visual memory span tasks. More specific rationales for the experiments are provided in the introduction section of each chapter. An additional goal of these experiments was to explore the role of negative/positive automatic thoughts and task-irrelevant thoughts in determining task performance.
CHAPTER 4

Experiment 1A

The Effects of Naturally-Occurring Depression on Elaborative Encoding and Recall in College Students

Many studies have shown that disturbances of memory frequently accompany depressive states (Williams, et al., 1988; Teasdale & Bernard, 1993; Hartlage et al., 1993; Burt et al., 1995). There is considerable evidence that the availability of memories depends on their congruence with current mood (see for a review, Blaney, 1986; Bower, 1981). Also, there is some evidence for state-dependent effects of depression in memory, such that memory is superior if learning and retrieval occur in the same state (Leight & Ellis, 1981; Weingartner, Miller, & Murphy, 1977; Eich, Macaulay, & Ryan, 1994). There is also evidence for a more general memory deficit in depressive states, which is shown by reduced performance in learning and retention of neutral stimuli which have no mood associations (Ellis & Ashbrook, 1988; Williams et al., 1988, ch. 3; Hartlage et al., 1993). This general deficit suggests that the neural or cognitive processes which mediate memory are disrupted by depressive states. The current study is concerned with this general deficit in depression, particularly memory deficits in elaborative processing of simple sentences.

The disruptive effects of depression on memory performance of neutral materials have been suggested by many studies (e.g., Hasher & Zacks, 1979; Ellis & Ashbrook, 1988, Pysyzenski & Greenberg, 1987; Williams et al., 1988; Hertel & Hardin, 1990; Miller, 1975). However, the literature in this area has shown inconsistent findings (cf. Hertel & Hardin, 1990; Ellis & Ashbrook, 1988; Colby & Gotlib, 1988). Memory effects observed with depression appear to vary depending on the population studied and the task used. For example, recall of stories has been investigated by Hasher et al. (1985),
using dysphoric students. No memory deficit or mood congruence effects were observed in these studies. However, in clinical depressives, poorer recall of a prose passage occurred, compared to normal controls (e.g., Watts & Sharrock, 1987; Breslow et al., 1981). Similarly, using induced depression, recall of target adjectives from a sentence completion task was reduced when the appropriateness of the target adjective to the sentence frame was difficult to decide (Ellis et al., 1984). Subsequently, in a similar task condition, an overall deficit in recall was found with the experimentally depressed group but not with the naturally occurring dysphoric group (Hertel & Rude, 1991a). Depressed populations employed in previous studies are various; clinically depressed in-patients (Roy-Byrne et al., 1984), outpatients (Hertel & Rude, 1991b), induced depression (Ellis et al., 1984), and dysphoric students (Hasher et al., 1985). These various subject populations might be different from each other in many aspects such as marriage, education, age, and the severity of depression (Gotlib & Hammen, 1992). Particularly, according to various populations, the severity of depression is associated with memory deficits (e.g., Cronholm & Ottosson, 1961). These differences among subject populations contributed to inconsistent findings in the previous literature.

In addition, a review by Ellis and Ashbrook (1988) claimed that various task variables affect depressive memory deficits such as task difficulty, organization of materials, and personal relevance. More poorly organized and fragmented material shows depressive memory deficits more than well organized and meaningful material does (e.g., Weingartner et al., 1981, study 3). In a more difficult task, depressives are likely to show memory deficits (e.g., Ellis et al., 1984, study 3). Memory performance of personally relevant materials is relatively impervious to disrupting effects of depression (cf. Kuiper, MacDonald, & Derry, 1983).

Accordingly, a boundary condition for depressive memory deficits should be required (Kuiper et al., 1983; Hertel, 1994). Three boundary conditions will be considered; the distinction of neutral vs. emotional materials (Ellis & Ashbrook, 1988),
of automatic vs. effortful processing (Hartlage et al., 1993; Hasher & Zacks, 1979), and reduced cognitive self-control (Hertel, 1994). Firstly, when a mixture of positive, negative and neutral materials has been employed, it has been difficult to find depressive memory deficits (e.g., Derry & Kuiper, 1981). Secondly, tasks requiring more effortful processing show depressive memory deficits rather than ones requiring automatic processing (cf. Ellis & Ashbrook, 1988; Hartlage, et al., 1993; Hasher & Zacks, 1979). Finally, a more uncontrolled task condition in which subjects can elect some strategy for their later performance can show depressive memory deficits (Hertel & Hardin, 1990).

To describe the boundary condition, several theoretical frameworks have been proposed and put forward different reasons for disruptive effects of depression on memory.

Inadequate allocation of limited attentional resources on neutral material, compared to emotional materials leads to poor elaboration of neutral materials, consequently causing depressive memory deficits (Williams et al., 1988). In a similar vein, reduced mental capacity under depressed mood states accounts for memory deficits, which are found in difficult tasks requiring a high mental load (Ellis & Ashbrook, 1988; Hasher & Zacks, 1979). In contrast with the reduced capacity model, the lack of initiative view (close to motivational deficits, Miller, 1975) claims that given specific task instruction, mustering their attention, depressive memory deficits can be reversed (Hertel & Rude, 1991b). These results suggest that depressive memory deficits lies in the reduced initiation of effortful processing rather than inherent limitation on their capacity for effortful processing. Similarly to the reduced initiative model, several other studies also posit the lack of self-initiated activities in depression particularly when the task requires the subjects self-generated solution, in contrast to an experimenter-provided one (e.g., Abramson, et al., 1981). Also, consistent with this argument, Hasher and Zacks (1988) contend the lack of self-initiated activities due to reduced mental capacity, which causes poor elaborative processing, in turn laying down a less distinctive memory trace, leading to poor performance. In addition, it was claimed that due to
inadequate allocation of attentional resources to neutral task, memory deficits can occur through poor elaborative processing (Williams et al., chap 10).

More specifically, in the area of elaborative processing of sentences under depression, the literature suggests that depressed subjects are unable to make use of the more precisely elaborated information, compared to base sentences (Ellis et al., 1984, study 1; Potts et al., 1989). Similarly, using the depth of processing framework (Craik & Lockhart, 1972), depressed people showed relatively poor performance at the semantic level of processing, compared to acoustic processing of words (Weingartner et al., 1981, study 1; Ellis et al., 1984, study 2). Assuming that the usual superiority of semantic processing to acoustic processing is based on elaboration, depressive memory deficits found in semantic processing of words can be attributed to poor elaborative processing. In a general theoretical framework, these elaborative deficits can be explained by a cognitive effort account of depressive memory deficits, predicting that depressive memory deficits are found in an effortful task. This is because poor recall performance was found in relatively more effortful tasks such as in the processing of elaborated sentences or in semantic processing of words. However, this cognitive effort account for memory deficits was challenged by several subsequent studies (e.g., Channon, et al., 1993b; Hertel & Hardin, 1990; Hertel, 1994; Hertel & Rude 1991b). This is because simply more difficult tasks requiring more cognitive effort did not show depressive memory deficits or that the provision of helpful cognitive strategy for later performance can reverse depressive memory deficits. Rather in a situation in which the subjects’ attention is not contrained by the demands of tasks, that is, allowing subject-initiated activities, depressive memory deficits were found.

Considering recall deficits found in elaborative processing of sentences and words (Ellis et al., 1984, study 1, 2; Weingartner, et al., 1981, study 1; Davis, 1979a on the self-referent level), an inability to use elaborative information (Potts et al., 1992), the lack of self-initiated activities particularly self-generated problem solving approach
of poor elaborative encoding (Hasher & Zacks, 1988), it is expected that depression impairs elaborative processing particularly when the subject-generated elaboration method is employed. However, the argument for such elaboration deficits in depressive memory was mainly supported by the poor recall performance of depressed people, but the investigation of the quality and/or quantity of elaboration was not made as was done in the studies of problem solving strategy in depression. In this regard, the self-generated approach to elaboration of sentences seems better than the experimenter-provided approach because the former gives an insight into the actual processing of elaboration activities of depressed people. The following section will discuss "elaboration and recall" in normal people, which was applied to the current experiment.

According to Craik and Tulving (1975) the beneficial effect of elaborative processing on retention is increased by the addition of rich contextual information to the items provided in the experiment, relating new information to what one already knows. If presented information is elaborated at encoding, the trace is more distinctive and more durable, and consequently facilitates later recall (Jacoby & Craik, 1979; Fisher, 1981; Fisher & Craik, 1980). However, additional context does not always facilitate retention of the target; subjects must make use of the appropriate knowledge for elaboration to be effective (cf. Anderson & Reder, 1970; Stein, Morris, & Bransford, 1978; Franks, Bransford, Auble, 1982; Stein, Littlefield, & Bransford, 1984).

Stein & Bransford (1979) investigated the effect of quality of elaboration, in which subjects were asked to recall target adjectives in the two types of sentences varying in the quality of elaborated detail but with the same amount of elaboration. A base sentence such as The tall man purchased the biscuits containing the target word tall was extended by either (i) an imprecise elaboration consisting of a congruous but irrelevant phrase e.g. that were on sale or (ii) a precise elaboration that were on the top shelf which had a direct relation to the target adjective.
Precise or imprecise elaboration of this type can be experimenter-provided as in the case of Stein et al. (1978) or subject-generated, in which the subject is asked to supply his or her own elaborations (Stein & Bransford, 1979; Stein, Bransford, Franks, Owings, Vye, & McGraw, 1982). In both cases recall of target words with precise elaborations is superior to recall of the same words given imprecise elaborations. Stein and his colleagues (1979, 1982) concluded that precision of elaboration is important in improving recall.

With the concept of this precise vs. imprecise elaboration concept, the present study aims to explore memory deficits for natural dysphoria in an elaborative processing paradigm where subjects supply their own elaborations. This study measures both the extent to which elaborative processes are used and the extent of recall. This experiment follows the Stein and Bransford (1979) study by using subject-generated elaboration of base sentences. Similar types of base sentence have been employed as an experimenter-provided elaboration (Ellis et al., 1984, study 1; Potts et al., 1989). Assuming that all students have the necessary knowledge to elaborate base sentences precisely, the important point is whether they are able to use their knowledge to provide precise elaboration of sentences. Secondly, based on previous findings, it can be expected that depressed subjects will not take advantage of precise elaborations for later recall whereas nondepressed subjects will (cf. Ellis et al., 1984; Potts et al., 1989).

In summary, three predictions were made. First, that with subject-generated elaborations the recall of target adjectives in naturally depressed subjects would be worse than in normal subjects. Second, that the depressed group will not benefit from precisely elaborated context for later recall but the nondepressed group will. Third, that naturally depressed subjects would generate less precisely elaborated phrases than normal subjects.

Method

Subjects
Thirty-nine subjects from an introductory psychology class volunteered and received course credits for participation. Subjects were allocated to either the depressed or nondepressed group using a median split on the Beck Depression Inventory (BDI), which was administered at the end of the experiment. The nondysphoric group consisted of 21 subjects with a Beck score in the range 0 - 6, whereas the dysphoric group included 18 subjects with scores ranging from 7 to 23. The mean of the nondepressed group was 4.33 and the mean of the depressed group was 11.5.

Materials

Fifteen common adjectives were employed as target words. Ten of the base sentences were selected from Stein et al. (1984) and five new ones were constructed following the procedure described by Stein et al. (1978). The base items consisted of simple and coherent sentences, for example, the old man went into the library. The base sentences were recorded on tape in a female voice, with a 15 second gap between sentences. Subjects spoke a short phrase to continue the base sentence, and a second tape recorder was used to record these elaborations. In the recall phase, the same sentences were presented in a random order, but with the word blank substituted for the target adjective, and with only 7 seconds between each item.

Procedure

Once subjects arrived in the experimental room, they filled out a experimental consent form. They were told that the aim of the experiment was to measure the frequency of phrases generated in response to each sentence, which was played by the cassette recorder. Sentences were presented auditorily at a rate of 1 every 15 seconds and each sentence was preceded by a beep sound. Subjects were instructed to extend the base sentence by speaking a short phrase, without repeating the initial base sentence. All subjects received the sentences in the same order. After all fifteen sentences were presented, subjects were given an interference task, counting backward by threes, for 60 seconds to eliminate any short-term component of recall. At the recall stage, subjects
were read the same 15 base sentences, in a different order, as cues for the recall of target adjectives. The target adjectives were substituted by the word "blank". Subjects were to write down a target adjective on an answer sheet provided. Subjects were encouraged to guess if they could not remember the answer. Following the recall task, subjects completed the BDI.

To evaluate the elaborations generated by subjects, three judges rated each base sentence plus its generated phrase on a five-point Likert scale ranging from (1) "very badly elaborated" to (5) "very well elaborated" in terms of how well the target words were clarified in the context of sentence. Each rater was blind to the experimental condition and given three blocks of 168 sentences. Within each block sentences were shown in a random order and the order of the three blocks presented was randomized among judges.

Results

1) Recall scores

The mean number of target words recalled for nondepressed and depressed subjects were 5.38 (SD=2.7) and 3.39 (SD=2.9) respectively. The mean difference between groups was significant, $t(37) = 2.18$, $p < .05$, indicating that the depressed group recalled fewer target words than the nondepressed group. Thus in the present experiment, using subject-generated elaborations, a deficit in recall performance of naturally-occurring mild depressives was observed. The relationship between depression and memory performance was further examined by measuring the correlation between BDI scores and recall. The Pearson correlation coefficient was significant ($r = -.35$, $p < .05$), showing that across both groups, the more severe levels of depression were associated with poorer performance on the recall test.

(2) Precision of sentence elaborations
Because of recording failure, sentence completion were not obtained for five subjects, three of them from nondysphoric and two from dysphoric groups. Analysis of sentence elaboration was therefore based on 34 subjects only. Interrater agreements were correlated ($r = .73$, for raters 1,2; $r = .64$, for raters 2,3; $r = .66$, for raters 1,3 all $p < .01$) with mean ratings of 2.77 (SD=1.66), 3.00 (SD=1.45), and 2.03 (SD=1.33) respectively on the 5-point scale. When analyzing the ratings, the average score of the 3 judges was used. The mean ratings for the nondysphoric and dysphoric subjects were 2.56 and 2.65 respectively and the difference between groups was not significant, $t(32) = .50$, $p > .05$. This result shows that the elaboration activity of the two groups did not differ.

To assess the relationship between elaboration rating and accuracy of recall, a repeated measure analysis was conducted on the ratings of correctly and incorrectly recalled words with a mean elaboration rating as a within-subject variable. The results are shown in Table 4.1. The effect of recall accuracy was marginally significant, $F(1, 32)=3.52$, $p= .07$ and also an interaction between group and recall accuracy was marginally significant, $F(1,32)=3.39$, $p = .075$. These results showed that targets words recalled were given more precise elaboration rating than those not recalled. The further analysis of interaction effect was carried out using a paired t-test. It revealed that for the nondysphoric group, elaboration ratings were higher for words that were recalled than for words that were not recalled, $t(18)=3.76$, $p < .01$. However, the depressed group showed no difference in the degree of elaboration according to recall accuracy, $t(14)=.04$, $p > .05.$, indicating that the depressed group did not benefit from the precise elaborations in later recall.

Table 4.1 Mean Elaboration Rating Score for Each Group as a Function of Recall Accuracy.

<table>
<thead>
<tr>
<th>Target words</th>
<th>Recalled</th>
<th>Not recalled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nondysphoric</td>
<td>2.81 (.72)</td>
<td>2.17 (.47)</td>
</tr>
<tr>
<td>Dysphoric</td>
<td>2.55 (1.22)</td>
<td>2.54 (.70)</td>
</tr>
</tbody>
</table>

Note. Standard deviations in brackets.
To confirm the significant difference between mean ratings for correctly and incorrectly recalled items for the nondepressed subjects, an additional paired t-test by items was conducted, which was significant, \( t(14)=3.20, p < .01 \). This result provides clear evidence that nondysphoric subjects benefit from precise elaboration. Also this result is consistent with previous results in normals showing that target adjectives given more precise elaboration are better recalled (Stein & Bransford, 1979; Stein et al., 1982).

Discussion

An overall recall deficit found in this study using a subject-generated elaboration task, supports the capacity-reduced model (Hasher & Zacks, 1979; Ellis & Ashbrook, 1988). The model suggests that there are more chances to observe the impairing effect of depression by imposing a high encoding demand on depressed subjects. In that sense, the subject-generated elaboration method seems to increase the encoding demand, relative to the experimenter-provided elaboration. These results suggest that the subject-generation task appear more sensitive for naturally depressed subjects than relatively passive learning tasks such as story recall (Hasher et al., 1985) and experimenter-provided elaboration (Ellis, et al., 1984; Potts et al., 1989) in revealing depressive memory deficits. However, we should be cautious in accepting that the subject-generated method is more demanding than the experimenter-provided method because there was no independent measure of cognitive demand of subject-generated elaboration, compared to experimenter-provided elaboration. This tentative conclusion is based on recall deficits of depressives. The two previous studies using similar sentences to the current study met with inconsistent findings. Ellis et al.,’s (1984) first study using a mood induction found overall recall deficits but attempts to generalize this finding to naturally depressed subjects have not been successful, ie., no overall deficits (Potts et al., 1989). Compared to Potts et al. (1989)’ study, one major difference from the current study is that they employed an experimenter-provided approach, while the current study used a subject-
employed an experimenter-provided approach, while the current study used a subject-provided approach.

Secondly, the elaborative encoding activities of dysphoric and nondysphoric groups were investigated. Such a self-initiated elaboration activity like subject-generated elaboration was assumed to be interfered with by depression (Hasher & Zacks, 1988; Abramson et al., 1981). Contrary to expectation, the precision of elaboration did not vary between the groups. This result could suggest one possibility, that dysphoric students could elaborate as well as nondysphoric students even under relatively ambiguous task instruction. In particular, in this task instruction, mild depression in students does not seem to interfere with the generation of elaboration of base sentences. Another possibility is that the task instruction is so ambiguous that subjects could generate any thoughts which pop into their minds. This assumption is based on the argument that a task instruction variable can affect memory performance in depression (e.g., Hertel & Hardin, 1991; Ellis & Ashbrook, 1988).

Thirdly, a more detailed analysis was conducted to assess the effectiveness of precise elaborations in promoting recall accuracy. The nondysphoric group produced more precise elaborations in sentences whose target word was recalled than in sentences whose target word was not recalled. Thus, for the nondysphoric group the precision of elaboration facilitated recall. For the depressed group there was no such relationship between precision of elaboration and recall, their elaborations were equally precise regardless of whether the target word was recalled or not. This suggests that dysphoric subjects do not take advantage of precise elaborations for remembering target words. These results extend previous findings (e.g. Ellis et al., 1984; Potts et al., 1988) which used experimenter-provided elaborations. Depressives appear to be insensitive to the precision of elaboration for some reason, irrespective of how the elaboration occurred.

Generally, memory deficits in overall recall performance in this study are consistent with the idea from the capacity-related model that the encoding demands of
the task play an critical role in finding depressive memory deficits. So the subject-generated elaboration method seems to place a relatively high mental load on subjects. However, the finding that nondysphoric and dysphoric subjects do not differ in elaboration activities is contradictory to the argument that self-initiated activities are impaired by depression (Hasher & Zacks, 1988; Abramson et al., 1981). A weaker and incomplete elaborative processing was proposed by Weingartner et al. (1981) study using depth of processing in depressed patients. This argument was based on the finding that depressed patients suffer from a semantic processing deficit. However they did not measure elaboration activities like in the current study.

On the other hand, the reduced initiative model (Hertel & Hardin, 1990) states that depressives are apt to show memory deficits in an uncontrolled experimental situation, in which nondysphoric students can elect any beneficial strategy for later recall (Hertel & Hardin, 1991; Hertel, 1994). According to this model, depressive memory deficits found in spite of the same extent of precise elaboration, imply that little use of their own elaborations is made at the retrieval stage even if their elaborations are available. In sum, tentative conclusions are that i) depression is more likely to interfere with recall performance when subject-initiated elaboration is required. ii) dysphorics have some problems in taking advantage of elaboration at the recall phase and iii) their memory deficits seem related to the task instructions. Two subsequent experiments were conducted to investigate each of these last two problems; one manipulated the availability of their own elaboration at retrieval and the other manipulated the task instruction given at the encoding stage.

**Experiment 1B**

The results from experiment 1A suggest the availability of the subjects own elaboration at the time of the cued-recall test may explain depressive memory deficits. To examine this possibility, the availability of elaboration at retrieval was manipulated. For
half of the sentences subjects were given their own self-generated phrases plus a base sentence to aid with recalling target words, while for the other half they were only provided with the base sentences. If the unavailability of their own elaborations in the retrieval stage is responsible for memory deficits, depressives should reveal a deficit in the non-elaborated retrieval condition, but not in the elaborated retrieval condition, in which their elaborations are provided. That is, there should be an interaction between the retrieval condition and group.

Method

Subject

According to the recommendation by Kendall, Hollen, Beck, Hammen, and Ingram (1987), the selection of dysphoric students was changed to a two stage screening to get more stable depression. In the first screening phase of selection, 21 nondysphoric and 15 dysphoric students were screened out from the first year psychology students pool who filled out the BDI. Those who scored less than 6 and higher than 9 were contacted by the telephone and were asked to volunteer for a further experiment on “mood and thinking”. In the second administration of the BDI on the day of experiment, subjects who shifted out the range were discarded. All volunteers received an extra point in return for their participation.

Materials and Design

The similar type of 20 base sentences was constructed. A 2 (group) X 2 (retrieval condition) ANOVA was employed with the last variable as a repeated measure. Two blocks of 10 base sentences were counterbalanced across group.

Procedure

All subjects were given the second BDI when they arrive in the experimental room. Subjects who shifted out of the range were dismissed. The task instruction was changed from experiment 1 to "to continue each base sentence with a short phrase in a
semantically congruous way". Two examples of base sentences were orally presented by the experimenter without having subjects recall the target word to make sure that subjects understood the instruction. Any questions about the task instruction raised by the subjects was answered. Subjects appeared to understand what they had to do. All sentences were presented auditorily in the same way as in the experiment 1 except that subjects were instructed to write down their continuation from the base sentence on the answer sheet provided rather than speaking to the microphone as in experiment 1. When they completed two blocks of 10 sentences, the experimenter collected the answer sheets and gave them the next instruction for recall.

In the recall phase, each subject went through two retrieval conditions. In the elaborated retrieval condition, he/she was read the base sentence plus their own elaboration, while in the nonelaborated retrieval condition they were read only the base sentence. The experimenter read aloud 20 sentences from their answer sheet in a different order from the initial order of presentation, 10 of which are base sentences plus their own short phrases and the other ten without their own short phrases. A fixed order of presentation was used and two blocks of sentences were counterbalanced across group. Subjects had to try to recall the target adjective substituted by the word "blank". Subjects were given 7 seconds for a response.

Results and discussion

On the second BDI test, the mean scores of nondysphoric and dysphoric students were 1.5 and 14.5 respectively, which was significantly different, $t(34)=10.88, p < .01$. Mean recall scores are shown in the Table 4.2

<table>
<thead>
<tr>
<th></th>
<th>Elaborated retrieval condition</th>
<th>Non-elaborated retrieval condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nondysphorics</td>
<td>6.29 (2.19)</td>
<td>5.10 (2.83)</td>
</tr>
<tr>
<td>Dysphorics</td>
<td>5.88 (2.03)</td>
<td>4.73 (2.81)</td>
</tr>
</tbody>
</table>

The analysis of 2 x 2 repeated measures ANOVA reveals a significant main effect of the retrieval condition, $F(1, 34) = 16.23, p < .01$, suggesting that the elaborated retrieval condition enhanced recall performance, relative to the base retrieval condition. The interaction of group and retrieval condition was not significant, $F(1, 34) < 1$ and neither was the main effect of group, $F(1, 34) < 1$.

The possibility that dysphoric students have a problem with the availability of their own elaborations at the retrieval stage was not supported. The significant effect of retrieval condition suggests that providing their own elaboration at retrieval enhances the recall of target adjectives for nondysphoric and dysphoric students to the same extent. So these results suggest that the cause of depressive memory deficits does not lie in the availability of elaborations at retrieval. However, the overall recall deficits found in experiment 1 disappeared in this experiment. A possible reason for this seems to be associated with the change in the task instruction. Another possible reason lies in the selection method of depressed subjects. In experiment 1A, the BDI was administered at completion of the experimental task and using a median split, subjects were classified into depressed and nondepressed groups. In contrast, in the current experiment, the BDI was administered twice in a group testing in the first place and on the day of experiment on the second occasion. Thus, in the experiment 1A, recall performance can affect subjects' response to the BDI. In the subsequent experiment 1C, the task instruction was varied with the same subject selection criteria.

Finally, to investigate whether depressive memory deficits are related to task instruction, experiment 1C was conducted. Task instruction was varied to investigate its effects on recall performance among dysphoric and nondysphoric students using similar types of sentences. Task instruction is claimed to affect the memory performance of depressives (Ellis & Ashbrook, 1988) and also that the well controlled task instruction could reverse depressive memory deficits (Hertel & Rude, 1991b).
Experiment 1C

The experiment is designed to explore how two different types of task instruction during encoding of base sentences affects recall. These two task instructions are assumed to guide subjects to elaborate base sentences in either more or less precise elaborations. More specifically, with the specific instruction, subjects are instructed to ask themselves "why might xxx person be engaged in this particular type of activity" when they continue the base sentences with a short phrase. The xxx represents the target adjective to be remembered. Such a specific task instruction is assumed to guide more precise elaboration by lessening the arbitrary relationship between type of person and his action, so that it facilitates recall performance (Stein & Bransford, 1979; Stein, et al., 1982). On the other hand, with a nonspecific task instruction, subjects are instructed "to continue each base sentence with a short phrase in a semantically congruous way". So the nonspecific task instruction is the same as the one in experiment 1B. In the Stein and Bransford's (1979) study, the question of “What else might happen in this context?” was used for a nonspecific task instruction (imprecise elaboration). They found that the specific task instruction helped subjects to recall more target adjectives than the nonspecific task instruction.

So in the case of normal controls, they will recall more adjectives in the specific instruction than in the nonspecific instruction. According to the capacity-related models, a reduced attentional capacity (Hasher & Zacks, 1979; Ellis & Ashbrook, 1988), predicts that regardless of task instruction, dysphorics should show overall depressive recall deficits because both instructions require effortful processing of sentences. More specifically as these models predict a poor and weaker elaborative processing in depression, dysphoric subjects should differ in a quality of elaboration in terms of the extent of precise elaboration, relative to nondysphorics. In sum, due to the reduced attentional capacity, dysphoric students should show an overall performance deficit and less precise elaboration of base sentence regardless of task instruction. In contrast,
according to the reduced initiative model (Hertel & Hardin, 1990), the dysphoric group will be affected by the type of task instruction; particularly, in the specific task instruction, dysphoric subjects are apt to be subjected to memory deficits because they are less likely to utilize their prior knowledge to elaborate base sentences precisely, requiring more self-initiated activities. On the other hand, in the nonspecific condition, depressive memory deficits are not found because such elaboration activities are not assumed to affect the extent of precise elaboration.

Method

Subjects

The selection procedure was same as the experiment 1B. 60 subjects were screened out, 30 subjects in each of dysphoric and nonsyphoric groups. Half of the subjects in each group were randomly allocated to the specific and nonspecific task conditions.

Materials and Design

The factorial combination of group and task instruction produced four groups with 15 subjects in each group. A 2 (nondysphoric vs. dysphoric) x 2 (specific vs. nonspecific) full factorial design was employed, and 15 base sentences were newly constructed including some of old sentences used in experiment 1A and 1B.

Procedure

All sentences were auditorily presented in a female voice through the cassette recorder as in experiment 1A. In the specific task instruction condition, subjects were instructed to ask themselves the following question when they continued each base sentence with a short phrase; “why might xxx person be engaged in this particular type of activity”, while in the nonspecific condition subjects were asked to continue a base sentence with a short phrase in a semantically congruous way as in the experiment 1B. They were given an answer sheet on which they wrote a short phrase. Before they
started the main experiment, they went through three practice sentences without being asked to recall a target word. Through these three example sentences, subjects were ensured to understand the task instruction. The experimenter explained any question in regard to experimental instructions. Upon completion of the sentence elaboration task, all subjects were asked to count backward for a minute. Afterwards, all base sentences were read again aloud with “blank” spoken for the target adjective, in a different order from the initial presentation. Subjects were given 7 seconds to recall a target word and were encouraged to guess the answer if they do not know. Finally they filled out the combined version of ATQ-N and ATQ-P and also the cognitive interference questionnaire (CIQ, Sarason, 1980), in order to measure how frequently subjects experience task-irrelevant thoughts during the experimental session. The combined version of ATQ-N/-P was produced by randomly reordering all items of both questionnaires (Ingram, Kendall, Smith, Donnell, & Ronan, 1987). As with Ingram et al. (1987), the instruction of ATQ was modified from the “in the past week” to the “during the experiment”. The CIQ included two additional questions measuring controllability and mind-wandering as well as task-irrelevant thoughts.

It should be noted that these kinds of delayed self-report of thoughts are subject to possible distortions from various sources. One of the confounding factors is that subjects’ awareness of their level of performance influences the ratings of thoughts occurring during the task. Therefore, subjects could report having experienced depressive thoughts more or less frequently. Another potential problem is whether all items included in the questionnaire represent all thoughts subjects experienced during the task. Despite these problems, similar kinds of self-report techniques have been employed by researchers (e.g., Ellis et al., 1990; Seibert & Ellis, 1991; Folkman & Lazarus, 1985). Among the others, to my knowledge, no previous studies have been undertaken to explore the intrusion of negative/positive cognitions using ATQ-N/-P. The inclusion of
these self-report measurements can be a useful means of providing some information on
the role of negative/positive thoughts in terms of memory impairment in depression.

Results

The mean BDI scores in four groups are as follows; 2.00 for nondysphoric-
precise instruction, 2.33 for nondysphoric-imprecise instruction, 13.60 for dysphoric-
precise instruction, 13.27 for dysphoric-imprecise instruction. The analysis of the BDI
scores did show a significant difference between dysphoric and nondysphoric groups,
$t(58)=14.39, p<.001$.

(1) Recall scores

The results are shown in Table 4.3. The 2-way full factorial ANOVA on recall
scores revealed no main effect of group or instruction variables, $F(1,56) < 1$ and $F(1,56)$
$= 1.78$, nonsig, respectively. However, the interaction between group and instruction
was significant, $F(1,56) = 4.8$, $p < .05$. The simple main effect of the interaction showed
that in the specific task instruction nondysphoric people recalled more target adjectives
than dysphoric people, $t(28)=2.06$, $p <.05$, while in the nonspecific task instruction the
groups did not differ, $t(28)=1.06$, nonsig.

<table>
<thead>
<tr>
<th>Recall Scores</th>
<th>Nondysphoric (n=15)</th>
<th>Dysphoric (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recall in specific</td>
<td>10.73 (1.99)</td>
<td>8.73 (3.20)</td>
</tr>
<tr>
<td>Instruction</td>
<td>(n=15)</td>
<td>(n=15)</td>
</tr>
<tr>
<td>Recall in nonspecific</td>
<td>8.27 (3.15)</td>
<td>9.33 (2.29)</td>
</tr>
<tr>
<td>Instruction</td>
<td>(n=15)</td>
<td>(n=15)</td>
</tr>
</tbody>
</table>

Note. ( ) means standard deviations. Maximum recall score is 15.
Also nondysphoric students recalled more adjectives in the specific task instruction, compared to the nonspecific condition, $t(28)=2.57, p < .05$ while this result was not true of dysphoric students, $t(28)=.59$, nonsig. These results replicated those of the Stein and his colleagues' study and suggest that the dysphoric students did not take advantage of the specific task instruction for later recall.

(2) Extent of precise elaboration and recall

As with study 1A, three raters judged how well phrases generated by subjects elaborated the target adjectives. The raters were blind to subject group and task instruction. The sentences were randomly presented by the computer one at a time and the rater was asked to rate each sentence on a five point likert scale ranging from “1 - very badly elaborated” to “5 - very well elaborated”. Interrater agreements were highly correlated ($r=.91$, for raters 1,2; $r=.82$, for raters 2,3; $r=.88$, for raters 1,3 all $p < .01$) with mean ratings of 2.25 (SD=.66), 2.46 (SD=.72), and 2.99 (SD=.85) respectively on the 5-point scale. In the following analysis, an average score of the 3 judges was used.

To assess the relationship between average rating scores and accuracy of recall, a 3 way ANOVA on mean ratings was conducted with group and instruction as between subject variables and recall accuracy as a repeated measure. The results are shown in the table 4.4. The results showed significant main effects of all three factors, group, instruction, and recall accuracy, $F(1,56)=13.03, F(1,56)=9.49, F(1,56)=20.71$, all $p < .01$ respectively. However there were no interactions amongst these variables. The significant group difference in average elaboration rating scores means that nondysphoric subjects give more precise elaboration of base sentences, compared to dysphoric students. The significant effect of task instruction is in the unexpected direction; nonspecific task instruction gave more precise elaboration, compared to specific task instruction. This unexpected finding may arise from the rating process as the three raters evaluated subject-generated elaborations in terms of its relevance to the target adjective rather than how well it explained the behaviour described in the sentence, which could
give rise to better elaboration scores in the nonspecific task instruction. For example, "The slow man went into the library", the completion can be evaluated by the relevance to the target adjective (slow), rather than by the reason why the slow man went into the library. The provision of elaboration in terms of its association with the target word would be much easier than one in terms of its reason for that action. To exclude this possibility, a new rating was conducted in a manner close to the specific task instruction, but none of the correlations among raters was significant, suggesting that it is very difficult to evaluate the completion in terms of the precision of elaboration. This finding suggests that the sentence completion task in this experiment was too difficult to be completed in a precise way.

Examination of the subjects responses revealed that very few of the sentences were elaborated in the way the instructions requested. Evidence for this argument is provided by the low average elaboration scores by the three raters (2.25 (SD=.66), 2.46 (SD=.72), and 2.99 (SD=.85), on the 5 point scale), suggesting that in general subjects elaborated less precisely than the raters would expect on average (3 on the scale).

The significant main effect of recall accuracy means that the more precise elaboration of base sentences is associated with a greater probability of the target adjective being recalled, which is consistent with the results of Stein and Bransford’s (1979) study. This relationship between recall and the extent of precise elaboration was further supported by the significant correlation between mean rating scores and recall, r=.212, p < .05 (one tailed). In contrast, mean elaboration rating scores showed a negative correlation with the BDI, r=-.37, p < .01 (two tailed), suggesting that the more depressed subjects the less precisely they elaborated. In sum, i) dysphoric people produced less precise elaboration to a base sentence, relative to nondysphoric people, ii) the probability of a target adjective being recalled is contingent on the extent of precise elaboration; the more precise elaboration resulting in higher recall and iii) the severity of depression is negatively correlated with the precision of elaboration.
**Table 4.4 Mean Elaboration Rating Score as a Function of Recall Accuracy.**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>recalled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spe. Inst.</td>
<td>2.78</td>
<td>2.27</td>
<td>(.39)</td>
<td>(.79)</td>
<td>(.45)</td>
</tr>
<tr>
<td>Nonspe Inst.</td>
<td>3.17</td>
<td>2.59</td>
<td>(.43)</td>
<td>(.45)</td>
<td></td>
</tr>
<tr>
<td>Dysphoric group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spe. Inst.</td>
<td>2.22</td>
<td>1.96</td>
<td>(.51)</td>
<td>(.74)</td>
<td>(.75)</td>
</tr>
<tr>
<td>Nonspe. Inst.</td>
<td>2.27</td>
<td>2.22</td>
<td>(.61)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note ( ) indicate standard deviations.

n=30 in each group

Despite the lack of interaction between group and recall accuracy, a between group comparasion was made as a function of recall accuracy across task instruction as part of a planned comparasion. Paired t-tests revealed that for both nondysphoric and dysphoric groups, mean elaboration ratings were higher for words that were recalled than for words that were not recalled. Mean rating scores of the nondysphoric group was 2.97 (SD=.45) and 2.43 (SD=.65) for target adjectives recalled and not recalled respectively, which was significant, t(29)=5.60, p < .001. The counterparts for the dysphoric group were 2.46 (SD=.59) and 2.09 (SD=.74), which was also significant, t(29)=2.12, p < .05. In the specific task instruction, nondysphorics produced significantly more precise elaboration than dysphorics. In general, these results suggest that more precise elaboration regardless of type of task instruction, facilitates recall of target adjectives. However, these results are different from experiment 1A in that dyphoric subjects recalled more target adjectives from more precisely elaborated sentences, which was not true for experiment 1A. This discrepant finding will be addressed again in the discussion section.

(3) ATQ-P/ATQ-N and Recall.
A ratio of the ATQ-P to ATQ-N was calculated which was considered as an index. As shown in table 4.5, dysphoric students reported relatively equal numbers of negative and positive automatic thoughts, whereas nondysphoric students reported more positive automatic thoughts experienced during the experimental session. A 2 (group) X 2 (task instruction condition) ANOVA was conducted with the ratio as a dependent measure. Only the main effect of group was significant, $F(1, 55) = 7.7$, $p < .001$, suggesting that dysphoric students experienced more negative automatic thoughts, compared to nondysphorics. However, in the total scores (ATQ-P + ATQ-N), there was no group difference, $t(57) = 1.27$, nonsig., suggesting that nondysphoric and dysphoric students experienced the same amount of automatic thoughts during the experimental session. It seems that depression reduces the availability of positive cognitions, while increases the availability of negative cognitions, which is also consistent with the content specificity hypothesis (Derry & Kuiper, 1981; Kuiper, et al., 1983).

Table 4.5 The indices of depressive thoughts measured as on the ATQ-P/-N and CIQ

<table>
<thead>
<tr>
<th></th>
<th>Nondysphorics</th>
<th>Dysphorics</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATQ-P</td>
<td>58.76 (34.81)</td>
<td>51.36 (20.66)</td>
</tr>
<tr>
<td>ATQ-N</td>
<td>32.93 (3.90)</td>
<td>51.63 (15.37)</td>
</tr>
<tr>
<td>Ratios (ATQ-P/ATQ-N)</td>
<td>1.75 (n=29)</td>
<td>1.02 (n=30)</td>
</tr>
<tr>
<td>CIQ</td>
<td>21.73 (n=30)</td>
<td>27.20 (n=30)</td>
</tr>
<tr>
<td>Controllability</td>
<td>2.45 (n=29)</td>
<td>3.17 (n=30)</td>
</tr>
<tr>
<td>Mind-wander</td>
<td>2.50 (n=30)</td>
<td>3.14 (n=29)</td>
</tr>
</tbody>
</table>
The content specificity hypothesis claims that the ratio of positive to negative thoughts is decreased as depression becomes more severe. Particularly, in the state of mild depression, people show an even-handedness of positive and negative cognitions.

To examine how these ratios are associated with performance, the correlation between ratios and recall was calculated, which was not significant, $r = .11$. This result suggests that the ratio of positive automatic thoughts to negative automatic thoughts is not associated with recall performance. The correlations of each of ATQ-P and ATQ-N to recall performance were not significant either, $r = -.02$, and $r = -.23$ respectively. These results further suggest that regardless of the contents of automatic thoughts, they are not associated with recall performance. Furthermore, given that positive automatic thoughts are as disruptive as negative automatic thoughts, a lack of difference in the total frequencies of both types of automatic thought suggests no overall performance deficits between groups. So the disruptive role of negative automatic thoughts predicted by several theoretical frameworks was not obtained (Beck, 1967; Hasher & Zacks, 1988; Ellis & Ashbrook, 1988). Common in these frameworks is that these negative automatic thoughts are assumed to compete for the limited mental capacity with task-relevant thoughts, causing performance deficits. However, as no direct manipulation of negative automatic cognition was made, this conclusion of no impairing effects of negative automatic thoughts should be tentative.

(4) CIQ and Recall

The analysis of a 2 X 2 ANOVA on CIQ scores as a dependent measure revealed a significant main effect of group, $F(1,56) = 11.62$, $p < .01$. The other effects were not significant. These results suggest that dysphoric students experience more task-irrelevant thoughts than nondysphoric students. The correlation between the CIQ scores and recall performance was significant $r = -.28$, $p < .05$. Taken together with results in the ATQ-N/-P, dysphoric people experience more task-irrelevant and automatic thoughts, compared to nondysphoric students. The difference between automatic thoughts on the ATQ-P/N
and the CIQ in their relationship with recall performance seems to be related to the fact that the CIQ includes both negative self-referent and task-irrelevant thoughts, while the ATQ-N/-P only covers self-referent thoughts.

(5) Controllability, Mind-wandering and Recall

Two separate questions were included to measure controllability of task-irrelevant thoughts and mind-wandering on 7 point likert scales. On the controllability scale ranging from (1) "not at all difficult" to (7) "extremely difficult", subjects were asked to report "how difficult was it for you to remove these thoughts you just report in the CIQ and ATQs from your mind". On the mind-wandering scale ranging from (1) "not at all" to (7) "very much", subjects were asked to indicate the degree to which you felt your mind wandered during the task you just completed". A 2 X 2 ANOVA on the controllability measure showed that only the main effect of groups was marginally significant, $F(1, 55) = 3.96, p < .051$. An analysis on the mind-wandering measure also found a marginally significant difference between groups, $F(1, 55) = 3.13, p < .081$. In relation to their correlation with performance, both controllability and mind-wandering measures showed a significant negative correlation with recall, $r(59) = -.29$ and $r(59) = -.37$, all $p < .05$ respectively. These results suggest that dysphoric students have more difficulties controlling automatic thoughts and let their mind wander more frequently, relative to nondysphoric people. In comparison with the results in the ATQ-N/-P, the controllability and mind-wandering measure appear to be a better predictor of recall performance than the frequency of automatic thoughts.

To examine the relative contribution to various variables of recall performance, a stepwise multiple regression was conducted. The dependent variables entered in the equation were BDI, ratio, controllability, mind-wandering, and CIQ. The results showed that only the mind-wandering factor was significant, $F(1, 55) = 8.71, p < .01$, $R$ square $= .14$. These results suggest that losing concentration (mind-wandering) is the best predictor of poor memory performance.
Finally, to ward off multicollinearity among the variables entered into the multiple regression, some caution was required as intercorrelations among these variables are assumed to be high. According to Tabachnick and Fidell (1989), multicollinearity causes logical and statistical problems when a bivariate correlation is .70 or more including two variables. However, none of the bivariate correlations among the five variables included in the current experiment exceeded .60, therefore there appears to be no serious multicollinearity problems in this analysis. Moreover, when the high correlation among these variables suggest the possibility of multicollinearity, most statistical programs including SPSS-X have a routine screening procedure against it. If the multicollinearity causes statistical instability, such variables do not enter the analysis (Tabachnik & Fidell, 1989).

General Discussion

Several studies suggested that depression interferes with elaboration for different reasons (Hasher & Zacks, 1979, 1988; Williams et al., 1988; Abramson et al., 1981; Weingartner et al., 1981). Some studies (Ellis et al., 1984, study 1, 2; Potts, et al., 1989; Weingartner, et al., study 1) investigated recall performance through the elaborative processing of sentence and words in induced depression, naturally occurring mild depression, and clinical depression. However, elaborative deficits have not been directly investigated in terms of the amount or quality of elaboration given to words or sentences, and this has only been inferred from the poor recall performance of depressives.

In this regard, the current three experiments aimed i) to examine overall memory deficits of dysphoric students in the subject-generated elaboration of sentences, ii) to investigate how depression affects the extent of their precise elaboration activities for reducing the arbitrary relationship between type of person and his action in an arbitrary base sentence, iii) to investigate whether recall performance in both groups is facilitated
by precise elaboration to the same extent, and iv) to explore the relationship between task-irrelevant and positive/negative automatic thoughts and recall performance.

(1) Recall and the Extent of Precise Elaboration

The major findings from the three current experiments are as follow. Firstly, in terms of recall performance, depression interacts with the task instruction (study 1C). Nondysphoric people benefit from the specific task instruction whose aim is to reduce the arbitrary relationship between type of person and his action, consequently enhancing memory performance. In contrast, such a beneficial effect of specific instruction did not hold for dysphoric people. On the other hand, in a nonspecific task instruction, the groups did not differ in their recall performance. These results suggest that dysphoric individuals did not make good use of the specific task instruction in producing more precise elaboration to a base sentence, hence aiding later recall, relative to nondysphoric individuals. When we assume that both groups have knowledge to elaborate a base sentence in a more precise way, that is, reducing the arbitrary relationship between the person and his action, the possible reason for this difference is that dysphoric subjects appear to suffer from reduced self-initiated activity (cf. Hertel, 1994; Hasher & Zacks, 1988). However, the depressive deficits in overall performance in the experiment 1A were not replicated in a similar condition of the subsequent experiments 1B and 1C. Two possible reasons can be taken into account. First, the method of subject selection in experiment 1A is different from experiment 1B and 1C. In experiment 1A, after the completion of the experimental task, the BDI was filled out, so subjects' performance could have affected their response to the BDI. Using the median split, subjects were classified into dysphoric and nondysphoric groups. On the other hand, in experiments 1B and 1C subjects were selected according to the recommendation by Kendall et al. (1987).

A second possible explanation of this difference between experiments is concerned with the difference in task instruction. The task instruction in experiment 1A
seems more ambiguous relative to the one in experiment 1B and 1C. As subjects in experiment 1A were asked to continue each base sentence with a short phrase, this situation is more uncontrolled and requiring self-initiative, thus leading to poor performance in depressive as suggested by the reduced initiative hypothesis (Hertel & Hardin, 1991).

Secondly, it was investigated whether recall superiority under specific task instruction compared to nonspecific task instruction is associated with more precise elaboration. However, the results showed that there was no corresponding interaction between task instruction and groups when the extent of precise elaboration was used as a dependent measure. Despite the lack of interaction, nondysphorics produced more precise elaborations in the specific task instruction than dysphorics. Unexpectedly, sentences under nonspecific task instruction were given more precise elaboration rating scores by raters, compared to ones generated under specific instruction. This unexpected finding, as discussed earlier, suggests difficulties in evaluating the precision of elaboration and that the base sentences are difficult to be elaborated precisely. Furthermore, the facilitation of recall of target adjective seems to rely not only on precision of elaboration but also on relatedness of the completion to the target word. This unexpected result might be associated with the rating process. To exclude this possibility, a new rating was conducted with a different rating instruction in which raters attempted to evaluate sentences in a manner close to the specific task instruction - how well does the completion explain why the action described was performed by that particular person. However, this new rating procedure yielded very low intercorrelations among three raters; none of the correlations among the three raters was significant. The failure to obtain a significant correlation among raters suggests that it is very difficult to evaluate sentences consistently in the “why-question” context.

Thirdly, the question was asked of whether recall probability of target adjectives from more precisely elaborated sentences is higher than adjectives from less precisely
elaborated sentences. In general, regardless of group and task instruction, target adjectives recalled were given more precise elaboration ratings than target adjectives not recalled (study 1A and 1C). These results are consistent with the precision of elaboration hypothesis saying that in a relatively novel situation such as the elaboration of a base sentence, quality (precision) of elaboration plays an important role in facilitating learning (Stein & Bransford, 1979; Stein et al., 1984; Franks et al., 1982). 

Finally, even though depression did not interact with either recall accuracy or task instruction, dysphoric people made less precise elaborations to a base sentence than nondysphorics, suggesting elaborative deficits in dysphorics. This elaboration deficit in depression was also supported by the negative correlation between the extent of precise elaboration and recall performance found across all variables. However, this conclusion seems contradictory to the results of experiment 1A, because experiment 1A did not find a difference between groups in terms of elaboration precision. This difference may be because experiment 1A and 1C employed different task instructions. A direct comparison appears difficult, but the type of task instruction affects the quality of elaboration. As suggested in the discussion section of study 1A, the task instruction can lead subjects to speak out whatever phrases pop into their minds. In contrast, both task instructions used in the study 1C must have encouraged subjects to think in the direction of precise elaboration.

(2) Depressive thoughts and their relationship with performance

The previous literature put an emphasis on an etiological role of negative cognitions for the maintenance of depression and on the disruptive impact on performance of intrusive thoughts (e.g., Beck, 1976; Brewin, 1988; Hollen & Kendall, 1980). Particularly, impairing effects of negative thoughts on performance are the focus of various theoretical frameworks (Hasher & Zacks, 1988; Ellis & Ashbrook, 1988; Kuhle & Helle, 1986; Hartlage, et al., 1993). However, according to Williams et al. (1988, chap 2), the assumed negative relationship between negative cognition and
performance is not clear. Furthermore, those theoretical frameworks did not pay much attention to the role of positive automatic thoughts, compared to negative automatic thoughts.

Experiment 1C showed that nondysphoric students experienced more positive automatic thoughts, relative to negative thoughts, while dysphoric students experienced equal amounts of both types of thought. Considering that all items in both ATQ-P/N are self-referent (e.g., I am a failure), depression reduced the accessibility of positive self-referent thoughts while increasing the accessibility of negative self-referent thoughts, which is consistent with previous studies by Teasdale and his colleagues. Putting it another way, these results are consistent with the content specificity hypothesis that clinical depression is characterized by a higher proportion of negative thoughts, mild/moderate depression by an even proportion of both negative and positive thoughts, and normal mood by a higher proportion of positive thoughts, relative to negative thoughts (for review, Ruehlman, et al., 1985). Thus, the dysfunctional thoughts shown by dysphoric people support Beck's cognitive model of depression. Secondly, despite a higher proportion of negative self-referent thoughts, the total frequency of automatic thoughts was not different among groups. So if frequencies of these automatic thoughts (negative and positive) have a detrimental effect on task performance as intrusive thoughts, groups would not be differentially affected by these thoughts. In effect, there was no group difference in recall. Furthermore, each frequency of negative and positive automatic thoughts is not associated with performance. Thus, the assumed disruptive role of positive/negative automatic thoughts as performance correlates was not found. These results do not appear to be supportive of the assumption that automatic thoughts can occupy some portion of the limited capacity, leading to the cognitive interference with performance. This conclusion is tentative because there was not an actual manipulation of negative and positive automatic thoughts to observe their effects on performance.
On the measure of task-irrelevant thoughts on the CIQ, the results are similar to those in the ATQ-N except that the frequency of task-irrelevant thoughts showed a negative correlation with performance. That is, dysphoric students experienced more cognitive interference during the task, compared to normal controls. Similar finding was found in the Seibert and Ellis’ (1991) study using a mood induction procedure. Regardless of depressed and elated mood states, subjects in these mood states produced greater proportions of irrelevant thoughts than neutral controls. The proportions of irrelevant thoughts and recall performance were negatively related. Subjects reported their thoughts after the memory task or while they were doing the task. However, of all the other variables such as the BDI, ATQ-P/N, CIQ, the best predictor of recall performance was the “mind-wandering” indice, suggesting that losing concentration on the current task is associated with poor performance. Dysphoric people reported having experienced more “mind-wandering” during the task, relative to normal controls.

In sum, depressed people show recall deficits in a more uncontrolled experimental situation (experiment 1A), but in a more specified situation (experiment 1C), such overall memory deficits disappear. Thus, these results seem to lend support to the reduced initiative hypothesis (Hertel & Hardin, 1991) rather than the reduced-capacity hypothesis (Hasher & Zacks, 1979). According to the prediction from the capacity-reduced model, overall memory deficits should have been found regardless of task instruction because the subject-generated elaboration task is seen as effortful. A caution on this interpretation should be made that the different elaboration task instructions may not be equally effortful; a more uncontrolled instruction (experiment 1A) could be more effortful than a more specified instruction (experiment 1C), hence causing memory deficits. Further work is needed in which the task instruction and cognitive effort factors can be factorially combined to elucidate the relationship between reduced initiative and cognitive effort in elaboration tasks.
The extent of precise elaboration processing also seems to depend upon the task instruction; in an uncontrolled condition, dysphoric people elaborate as well as nondysphoric people (study 1A), but in a more controlled condition (study 1C), dysphoric subjects have difficulties in taking advantage of the instruction. Dysphoric subjects have difficulties utilizing their previous knowledge to precisely elaborate seemingly arbitrary information, so that it can be more memorable. Across experiment 1A and 1C, for nondysphoric subjects, the probability of recall of a target adjective was contingent upon the extent of precise elaboration, replicating the previous studies; the more precisely elaborated the target adjective, the more likely it is to be recalled (Stein & Bransford, 1979; Stein, et al., 1984). On the other hand, for dysphoric subjects, a facilitative effect of precise elaboration on recall was not found in a more uncontrolled condition (experiment 1A), but in a more controlled condition (experiment 1C), they could benefit from the precise elaboration. Thus, nondysphoric people benefit from precisely elaborated information regardless of task instruction, while the effect in dysphoric students depends upon the task instruction. In general, these results suggest the importance of task instruction in both recall performance and elaborative activities particularly for dysphoric students.
CHAPTER 5

Comparisons of Three Procedures for Inducing Depressed Mood

5.1 The Rationale and Purpose of the Present Study

The current chapter consists of two large sections; one is a previous literature review of mood induction procedures of the Velten Mood Induction Procedure (Velten, 1968; VMIP) and Musical Mood Induction Procedure (MMIP), the other section attempts to develop a better mood induction procedure by combining both mood induction procedures. The first section addresses characteristics of the VMIP, MMIP, effectiveness of each procedure in creating experimentally induced depression and, whether induced depression has parallel effects on such variables as affected by natural depression. The second section compares the relative effectiveness of the three mood induction procedures (the VMIP plus MMIP, VMIP, MMIP) in inducing depression, compared to neutral controls. One of reasons for the development of a new mood induction procedure is that sometimes it is difficult to get large enough numbers of naturally depressed subjects and the mood induction procedure is a convenient alternative chosen by many researchers.

Many studies on depression employed mood induction procedures to experimentally induce depressed mood states rather than to select naturally occurring depressives by dint of psychometric measures. Also various types of mood-induction techniques have been developed (for reviews, Blaney, 1986; Goodwin & Williams, 1982; Gerrards-Hesse, Spies, & Hesse, 1994); eg., VMIP (Velten, 1968), MMIP (Sutherland et al., 1982), autobiographical recollections methods (Brewer, Doughtie, & Lubin, 1980), taped depressing story (Williams, 1980), success/failure feedback (Isen, Clark, Shalker, & Karp, 1978), hypnosis (Bower, 1981) etc. Sometimes, the combination of those procedures was employed to increase their effectiveness. For example, Natale and Hantas(1982) and Richardson and Taylor (1982) combined the VMIP with
hyponosis and imagination respectively. A recent review (Gerrards-Hesse et al., 1994) of the comparative evaluation of mood induction procedures for depressed mood states, showed that the VMIP, a mood induction procedure using imagination evoking or re-experience the past experiences, the film/story mood induction procedure, and the success/failure mood induction are effective.

One of the important questions in using the mood induction procedure is whether the induced mood state really resembles naturally occurring depression in terms of its effects on depression-associated variables. Two reviews questioned whether the results from the mood induction studies are similar to those from naturally occurring depression (Clark, 1983; Goodwin & Williams, 1982). The general conclusion from those reviews is positive; that is, findings from two areas show similar effects on the variables studied. Clark (1983) summarized that relatively similar effects of the VMIP and naturally occurring depression were found in these variables; counting times, writing speed, Digit symbol test, negative memory bias, and behaviour in social situations. Variables unaffected by the VMIP were as follows; skin conductance, time estimation, attributional styles. On the basis of this evidence, Clark (1983) concluded that the VMIP and naturally occurring depression are remarkably similar in their effects on depression related variables, and the induced depression resembles naturally occurring retarded depression.

Despite this comparability between induced and natural depression, some recent studies particularly in the memory area reported contradictory findings (Kwiatkowski & Parkinson, 1994; Hertel & Hardin, 1990; Hertel & Rude, 1991). These studies used a shortened form of the VMIP. The recall pattern of natural and induced depression is different in a similar/same cognitive task, compared to neutral controls. Particularly, the experiment 2 by Hertel and Rude (1991) directly compared naturally depressed, experimentally depressed, and neutral subjects in the recall test of target words from sentences. An induction of depression caused overall deficits in recall, while overall deficits in natural depression were not obtained. This lack of corresponding
results between natural and induced depression in relation to memory suggests that conclusion from employing experimental inductions of mood are confined to that domain.

Considering these results in view of Clark (1983), it may be argued that findings from experimentally induced depression employing simple tasks such as counting and writing are more generalisable to natural depression than those from more complex tasks such as a recall and recognition memory tests. At the moment, it is not clear why the VMIP produces discrepant effects on the different tasks. Considering that the subjects employed in those memory studies were only mildly depressed it is possible that the differences related to the strength of depression and so the results may be different if clinically depressed subjects are employed. Another possible reason for this difference in findings is that different studies developed differently modified and shortened VMIPs, leading to a relatively weak depressed mood in some studies; the reduced negative self-referent statements of the VMIP alleviate the intensity of depressed mood and thus duration may be shorter than that of the full-version of the VMIP. However, as the VMIP is still frequently used in other research, further study is required to explore other kinds of variation of the VMIP (e.g., the combination of the VMIP and MMIP) as well as the comparability of natural and the Velten-induced depression.

5.1.1 Velten Mood Induction Procedure (VMIP)

One of the most frequently used mood induction is the VMIP (Velten, 1968). The VMIP consists of 60 self-referent statements for each of two depressed and elated mood states. The neutral statements are not self-referent. The depression-inducing negative self-referent statements contain self-devaluation and somatic problems characteristic of depression. The statements progress from neutral tone to depressive tone. The procedure is to ask subjects to read each of statements silently and then aloud
at the rate of every 20 seconds while they are trying to feel the mood suggested by each statement. In effect, subjects are required to work hard to get into the mood.

The general experimental procedure of using the VMIP is to administer the mood induction procedure and then to check the successfulness of the procedure by using a self-report measure that assesses the mood in question (e.g., DACL; Depressive Adjective Checklist, Lubin, 1965). And then experimenters select subjects who changed the mood in the expected way and proceed to study behavioural or cognitive variables of central interest.

Reading negative self-referential statements from the VMIP resulted in lowered self-reported mood, slowed speech rate, retarded psychomotor functioning, reduced gaze behaviour, decreased use of hand illustrators, and decreased accessibility of positive/pleasant past memories (Aderman, 1972; Coleman, 1975; Gouaux & Gouaux, 1971; Natale, 1977; Natale & Bolan, 1980; Teasdale & Fogarty, 1979).

However, several problems with the VMIP were raised by investigators. First of all, not all subjects respond to the VMIP and so do not reach the criteria set up by the experimenter (Polivy & Doyle, 1980; Sutherland, et al, 1982). So the loss of subjects in selection causes a biased subject group, thus raising questions about the generability of results obtained using the VMIP to naturally occurring depression. Secondly, the VMIP can interact with individual differences such as personality factors. For example, Scheier and Carver (1977) reported that subject who score high on the private self-consciousness scale tended to respond to the VMIP more strongly than subject who scored low on the scale. This result indicates that more self-conscious subjects who focus more attention on themselves are more susceptible to the VMIP than less self-conscious subjects. Also Cash, Rimm, & Mackinnon (1986) examined the susceptibility to the VMIP among people classified by the Irrational Beliefs Test (Jones, 1968) measuring dysfunctional beliefs. Irrationals people were susceptible to the depressed self-referent statements of the VMIP, while rational people were not.
Another issue raised by many investigators is demand characteristics of the VMIP, i.e., subjects responding in the way expected by the experimenter rather than according to their true feelings (Buchwald, Strack, and Coyne, 1981). However, Berkowitz and Troccoli (1986) argued that many of reactions by the VMIP are too subtle to be deliberately faked. Also many studies using a mood induction procedure have attempted to circumvent the problems of possible demand characteristics in such ways as instructing subjects to report their true feeling. However, both Clark (1983) and Berkowitz and Troccoli (1986) conceded that demand characteristics are partially responsible for the mood effects on depression-associated variables.

Finally, another issue is whether the VMIP gives rise to a particular discrete mood state. In effect, the VMIP produces multiple mood states, resulting in a significant increase in anxiety and hostility (Polivy, 1981, study 2). These multiple effects in the VMIP are similar to naturally occurring blended emotions in depression.

The problem of the VMIP, related to the current experiment, is that the duration of induced mood by the VMIP may not be long enough for some investigators to complete the task (cf. Ellis, Seibert, & Herbert, 1990; Polivy, 1981, study 2). For this reason, null findings from an experiment are difficult to interpret because the initially induced mood tends to dissipate over time. Several studies measured the duration of the initial mood state by the VMIP.

Frost and Green (1982) directly examined how long the initially induced depression by the VMIP last using several questionnaires such as MAACL (Multiple Affective Adjective Check List (Zuckerman, & Lubin, 1985), BDI and PFS (Personal Feeling Scale; Frost, Graf, & Becker, 1979). The measurement of mood states took place three times: prior to, upon completion of the VMIP, and after 10 minutes waiting period after the VMIP. During the 10 minutes, there was no distracting task. The comparison of scores in the PFS immediately after the VMIP with those after the 10 minute waiting period revealed a significant improvement in depressed mood. However,
the depressed group was still more depressed than neutral controls. These results indicated that induced depression dissipate over time and lives up to at least 10 minutes.

Isen and Gorgoglione (1983) compared the VMIP with other three mood induction procedures in two times-of-measurement conditions. The first measurement was taken immediately after the VMIP and the second one was taken after 4 minutes intervening task of categorizing words. All mood checks were made through a set of five seven-point mood rating scales. The time of measurement was a between-groups variable. The results showed that immediately after the VMIP, subjects in the depression induction felt more negative, less amused, and less alert than those in the no manipulation condition. Such a difference in rating disappeared in the delayed condition. These results suggested that even though the VMIP initially created a powerful depressed mood state, the intensity of depression dissipate very rapidly, particularly when subjects interact with other external tasks.

Chartier and Ranieri (1989) compared two mood induction procedures (VMIP and success and failure manipulation) on the intensity and duration of the induced mood over 30 minutes after the induction. Mood was checked prior to, immediately after, and at five 6 minutes intervals after the mood induction treatment. To manipulate success and failure experiences, 50 multiple-choice word analogy problems were used. During the 30 minute waiting period, subjects were allow to think about whatever they liked. The mood was measured on the 7 alternative forms of the DACL (Lubin, 1965). The results showed that compared to the failure manipulation, VMIP depressed subjects showed a more intense depressed mood when it was measured immediately after induction. However, the initially induced depressed mood by the VMIP only lasts about 6 minutes and after that time, the comparisons with the mood prior to induction did not show any significant difference. These results suggest that the VMIP-depression produces an initially strong depressed mood state, which dissipates very rapidly, despite no
intervening task. In general, these results are consistent with Isen and Gorgoglione (1983).

Even though such a short-lived depression is induced by the VMIP as measured on the DACL, it is still unclear whether the lack of difference in mood is paralleled in behavioural and cognitive tasks. This is because the VMIP can affect cognition independently of induced mood (Riskind, 1989; Rholes, Riskind, & Lane, 1987). Riskind (1989) proposed a cognitive priming effect of the mood induction procedure, maintaining that the VMIP can prime a cognitive structure independent of its' effects on mood. This claim was substantiated by the finding that even when the self-devaluative statements of the VMIP failed to lower mood, they enhanced accessibility of negative memories (Rholes et al., 1987).

Another issue with the VMIP is about how the VMIP can achieve the desired mood states. Frost et al. (1979) split the VMIP statement into two, representing a self-devaluative component (29 statements) and a somatic component (21 statements). The aim of the study was to investigate whether somatic statements are as good as self-devaluative statements at inducing depression. The self-report mood state was evaluated on the PFS and MAACL and BDI. The PFS is a 10-point self rating scale on eight adjectives (eg., extremely optimistic-extremely pessimistic). The results showed that on the PFS, subjects in the somatic condition differed from the neutral controls, but subjects in the self-devaluative condition did not. On the MAACL-depression subscale, there was no such difference. On the BDI, the somatic condition induced more depressed mood than neutral and self-devaluative conditions, which did not differ. These results led the authors to conclude that the depressed mood states induced by the VMIP is primarily due to the somatic suggestion rather than the self-devaluative suggestion.

On the contrary, Riskind, Rholes and Eggers (1982) found conflicting results to the study (Frost et al., 1979). Riskind et al. (1982) examined effects of induced mood states by the VMIP on recall latences of negative and positive life events. The Velten
statements were divided into self-devaluation and somatic-related ones (cf. Frost, Graf, & Becker, 1979). Four type of statements (self-devaluative, somatic, combined, elated statements) were used separately to induce depression with elated statements as a control. The results showed that only self-devaluative statements made a difference in recall latency between positive and negative events, compared to the elated statements as a control condition. These results are contrasted with those in Frost, Graf, and Becker (1979) in which only the somatic statements lowered the mood significantly. According to Frost et al. (1979), negative memory bias should have been also obtained in the somatic condition. Furthermore, changes in recall latencies from pretest to posttest were not correlated with changes in mood between pre- and posttest-mood induction. On the basis of these results, they suggested that the VIP self-devaluative statements may have a direct cognitive priming effect on the accessibility of memories not via mood.

Other supportive data for the cognitive priming effect were obtained when the relative effectiveness of instruction alone condition in which subjects were asked to work hard to get into a designated mood and of the MMIP were compared for inducing elation and depression (Lenton & Martin, 1991). Self-reported mood measurements (VAS), psychomotor function (speech rate), and incentive ratings were employed as dependent measurements. The analysis of pre- and post- induction difference scores showed that the presence of the instruction was a sufficient factor to affect the dependent measurements regardless of the presence or absence of the MMIP. This result suggest that the instruction condition of getting into a certain mood by any means is enough to experience the mood. When subjects in the instruction condition were asked to report strategies they used to get into a mood, more than 50 % of subjects achieved the mood by recollecting past events or imaging future events. This great reliance of past memories seems to suggest that the way of mood induction procedures achieving their aim seems to be through the cognitive priming on past events.
5.1.2 Musical Mood Induction Procedure (MMIP)

The MMIP was developed to rectify some drawbacks with the VMIP. Kenealy (1988) used the MMIP to test if induced mood states (elated, depressed, and neutral) by the MMIP have similar effects on the behaviour and self-reported mood, which had been studied by the VMIP. The measurements were as follows; for self-reported mood, MAACL and VAS, for psychomotor retardation, distance approximation, writing speed task, decision task, and word association speed task. One of aims of the study is to investigate whether without obvious instruction to get into the desired mood, the intended mood state can be achieved. Clark (1983) suggested that without such a instruction, it would be difficult to achieve the desired mood states. On the post-induction tests, comparison of happy and sad groups revealed significant difference on two self-report mood measures and four behavioural measurements in the predicted direction. However, compared to a no induction group, the results were not consistent. In the case of the depressed group, they showed a significant difference in the VAS-sad and-despondent scales, but not in the MAACL-depression on the post-induction. On the behavioural measurements, depressed and control groups were different in the word association and decision time tasks. In general these results were interpreted as that the MMIP works without the suggestion of mood states desired by the experimenter.

Pignatiello, Camp, and Rasar (1986) also examined the effectiveness of the MMIP (elation, depression, neutral control) on the self-report (DACL) and psychomotor function (writing speed). Several pieces of music for each mood induction was compiled and each procedure started with the same music. In their first study, elated group was different from the depressed group on the DACL and no difference in the writing speed was found between groups. Their second study with an additional measurement of pretest on the writing test to be used as a covariate, found that only the elated group was different from neutral and depressed groups. On the writing speed task, the depressed
group wrote fewer numbers than elated and neutral groups. The MMIPs used, did not include any suggestion about changing mood states. These results suggest that the use of a neutral or an elated group as a control group can affect the results on the DACL.

Slyker and McNally (1991) tested relative effectiveness of instructions, instructions plus MMIP, instructions plus the VIMP, instructions plus the VMIP plus MMIP inducing anxious and depressed mood states. The instruction only condition asked subjects to work hard to get into the expected mood state by using whatever methods they could including memories, and imagery. The effectiveness of mood induction procedures were evaluated in self-reported moods (MAACL; Visual Analogue Mood Scale), psychomotor speed (speech rate) and Digit Span forward and backward. The results showed that neither VMIP, MMIP, nor the combination enhanced the effectiveness of the instruction alone condition. The argument that the MMIP is better than the VMIP inducing mood, was not supported (Clark, 1983).

Albersnagel (1988) compared the relative effectiveness of the VMIP and MMIP on self-report mood (VAS) and cognition (thought association). In the thought association task, subjects were presented with neutral words and instructed to write down the first thought evoked. Afterward the affective tones of associated words were evaluated. To induce the depressed mood by the MMIP, Sibelius’s ‘Swan of Tuonela’ was selected. Each of the MMIP and VMIP included four conditions; anxious, depressing, elating, and neutral conditions. The results showed no systematic difference between the VMIP and MMIP on the VAS. The predicted differential accessibility of negative and positive thoughts pertinent to the induced mood states was confirmed across the VMIP and MMIP.

**Experiment 2A**

The VMIP has been frequently employed to induce depressed mood states and hence to study the effects of mood on cognitive and behavioural performance (e.g.,
Clark, 1983; Goodwin & Williams, 1982; Ellis & Ashbrook, 1986). The effect of the VMIP on mood state, when measured by self-reported instruments has been relatively consistent across studies, whereas its effects on cognitive and behavioural variables has not (for a review, see Kenealy, 1986). Clark (1983) explained these inconsistent findings by claiming that the effects of the Velten procedure would not last long enough to affect performance measures on extended tasks. Several comparative studies of mood induction procedures have suggested that depressed mood induced by the VMIP is short-lived (e.g., Frost & Green, 1982; Isen & Gorgoglione, 1983; Chartier & Ranieri, 1989).

Some of these studies describe the time course of the VMIP when subjects are not engaged in a task. These estimates of duration may not always be appropriate since the purpose of mood induction is often to influence performance on some task, so it is necessary to determine if the task itself has an effect in changing mood. Hence it would be better to measure the duration of mood induction effects in a situation where subjects perform some task.

In line with this argument, Isen and Gorgoglione (1983) measured mood induction before and after a four minute neutral intervening task of word categorisation. They found that the Velten procedure created a very strong depressed mood state immediately after induction but this was removed by only four minutes filled delay after which there was no difference in mood between depression-induced subjects and neutral controls. This suggests that the duration of Velten-induced depressed mood may be shortened when a task is performed after mood induction. If so, then the failure to find an effect of mood induction on performance measures may be explained by the rapid dissipation of the induced mood (Clark, 1983).

Because Velten-induced mood is ephemeral, the music mood induction procedure was developed as an alternative (Sutherland et al., 1982; Pignatiello et al., 1986). The similarity of music mood induction to the Velten procedure has been examined (Kenealy, 1988; Slyker & McNally, 1991; Pignatiello et al., 1986). On the whole the results of the
The purpose of this study was to evaluate the relative effectiveness of three mood induction procedures in terms of the durability and strength of the induced mood. Four mood induction procedures were compared: (i) the reduced Velten induction procedure, (ii) the Music induction procedure, (iii) the Velten-plus-Music induction procedure, and (iv) Neutral music which served as a control. In the Music, Velten-plus-Music, and Neutral music conditions, music was played through the whole session to determine if it could keep the induced depression relatively stable. The dissipation rate of induced depression was measured over a period of 18 minutes after the initial mood induction, with mood states being checked at six minute intervals over that period. Although the
target mood was depression, anxiety levels were also measured after mood induction because studies of both naturally occurring depression (Greenberg & Alloy, 1989; Ingram, Kendall, Smith, Donnell, & Ronan, 1987; Watson & Kendall, 1989) and depression induction (Slyker & McNally, 1991; Teasdale & Forgarty, 1979) show a high correlation between depression and anxiety. Previous studies of depressed mood induction procedure have shown that anxiety levels increase as a result of the induction procedure (Clark, 1983; Slyker & McNally, 1991).

Three questions were asked. First, is the combination of the Velten-plus-Music more effective than either the Velten procedure or Music induction alone? Second, does continuous music throughout an experimental session help sustain an induced mood? Third, how does each mood induction procedure influence anxiety level?

Method

Subjects

Forty-four subjects who were recruited from a first year psychology subject pool were randomly allocated to four conditions. Twelve subjects participated in the Velten-plus-Music, ten in the Velten, eleven each in the Music and Neutral control. In return for their participation, subjects received course credits. In the assessment of depression using the Beck Depression Inventory (BDI) prior to mood induction, the Velten-plus-music (M = 5.42), the Velten (M = 6.50), the Music (M = 4.45), and Neutral control (M = 7.45) were not different, F(3,40)=.73, p >1.

Materials

(1) Velten Statements.

The reduced form of the Velten procedure was used, as in previous studies (Slyker & McNally, 1991; Teasdale & Forgarty, 1979). This consists of 30 negative self-referent statements, each of which was typewritten on a separate card. The intensity of
depression in the statements gradually increased from mildly depressing tones to severely depressing ones.

(2) Music Stimuli.

To select a piece of music for the induction of depression, a pilot study comparing several pieces of music was conducted for 25 students. The five pieces of music were as follows: Sibelius' The Swan of Tuonela, Prokoviev's Russia under the Mongolian Yoke, Greig's Aases Tod (Death of Aase), Satie's Description of automatiques (Sur un Vaisseau), and the finale of Tchaikowsky's Symphony No. 6. The five pieces of music were presented in counterbalanced order. Groups of five subjects listened to each piece of music and each subject then rated the emotional qualities of the music using visual analogue scales. The scales represented "depressed" "anxious" "sad" and "happy" and ranged from "very" to "not at all". The Swan of Tuonela was judged as the most depressing piece of music. The neutral music was that by Pignatiello et al. (1989).

(3) Visual Analogue Scale (VAS).

The VAS has been frequently used in mood induction studies (Teasdale & Fogarty, 1979; Williams, 1980; Albersnagel, 1988). It consisted of 10cm horizontal lines, one for each of three moods: 'anxious', 'sad', and 'happy'. Above each line 'At this moment' was written. For example, 'I do not feel at all anxious' was put at the one end of the line and 'I feel extremely anxious' at the other end. Subjects were asked to put a mark on the line to indicate their feelings at this moment. Measurements of depression and anxiety were taken in millimetres.

(4) Depression Adjective Check List (DACL).

This instrument consists of 32 or 34 positive and negative adjectives, which are selected by subjects to describe their present mood. An advantage of the DACL is that it exists in seven alternative forms, allowing repeated measurement of mood.

Procedure
Each subject was told that this experiment aimed to explore the relationship between feeling and thinking and was then randomly allocated to one of the four groups. Then all subjects were given the DACL, the VAS and the BDI before the induction started. In the Velten procedure, subjects were asked to read each statement aloud first and think about the message suggested by the statement for 20 seconds. At 20 second intervals subjects moved to the next statement when a tone sounded. It took 10 minutes to complete a set of 30 statements. In the Music and Neutral control procedures, subjects were asked to listen to music carefully to try to feel the mood suggested by the music. Music continued throughout the experiment. In the Velten-plus-music condition, while subjects completed the Velten procedure, music was played as background and then continued throughout the experiment. They were told to try to feel the mood suggested by music as much as possible while they were reading cards. Subjects in the control group were given the same instruction as in the music procedure except that neutral music was played through the experiment. In each of 3 six minute period, subjects completed 2 questionnaires (a form of the DACL and the VAS) and then a sentence completion task for the remainder of the time. In the sentence completion task, subjects were asked to continue sentence with a short phrase. Different sentences were used in each of the intervals. The experimenter left the room while subjects answered the questionnaire and worked on the sentence completion task. At the end of the experiment, all subjects in the depression induction groups went through a mood elating procedure. This included reading elating statements while elating music was played for 4 minutes. Subjects were then debriefed about the experiment; none of them showed any evidence of negative mood on completion of the experiment.

Results

(1) DACL

As there were unequal numbers of items in the different versions of the DACLs, raw scores were transformed to proportions. As shown in Figure 5.1, the Velten-plus-
music and Velten groups produced an initially stronger depressed mood than Music induction. But the rate of the dissipation is much faster for the Velten than the Velten-plus-Music procedure. At the final testing of mood after 18 minutes, the mood induced by the Velten-plus-Music group was higher than in any other group. To test these observations, the transformed scores were submitted to a 4 (Induction Procedures) x 4 (Time) split-plot analysis of covariance with DACL score in the preinduction as a covariate and time as the repeated measure. Main effects of induction procedure, $F(3,39)=3.07, p < .05$ and time of measurement $F(3,120)=3.07, p < .05$ were found. Also there was a significant interaction between time of measurement and induction procedure, $F(9,120)=3.18, p < .01$. This interaction confirms that the dissipation rate is different across procedures. To clarify this interaction effect, the simple main effect of time was examined for each induction procedure, using a Bonferroni correction. This analysis confirmed that only the Velten group's performance varied significantly over time, $F(3,120)=7.47, p < .001$.

![Graph showing DACL Mean Ratio Scores for the Three Induction procedures and Neutral Controls at Preinduction (Time1), Postinduction (Time 2), and Three 6 minutes Intervals.](image)

(2) VAS-Depression

As shown in Figure 5.2, the results obtained with the VAS-depression are quite similar to those with the DACL. Compared to the other groups, it is apparent that the Velten group showed a rapid dissipation over time. Also the Velten-plus-Music and Velten initially appear to raise the level of induced depression higher than the Music
procedure. But by the end of testing only the Velten-plus-Music shows depression levels higher than controls. When the same analysis was applied to the VAS-depression, both time and the interaction between time and induction procedures were significant, \( F(3,120)=3.20, p<.05, F(9,120)=2.39, p<.05, \) respectively.

The effect of induction procedure was only marginally significant, \( F(3,39)=2.40, p<.09. \)

To explore the nature of the interaction effect, the simple main effect of time was analysed for each induction procedure. Again only Velten-induced mood significantly decreased over time, \( F(3,120)=7.93, p<.001. \)

![Graph showing VAS-depression Mean Scores for the Three Induction Procedures and Neutral Controls at Preinduction (Time1), Postinduction (Time2), and Three 6 minutes Intervals.](image)

(3) VAS-Anxiety

As Figure 5.3 shows, all induction procedures appear to increase the initial level of anxiety immediately after mood induction. Paired t-tests on pre- and post-induction measures for each induction procedure showed that the Velten-plus-music procedure, the Velten procedure, and Music induction all increased the level of anxiety significantly, \( t(11)=3.57, p<.01, t(9)=4.36, p<.01, t(10)=2.36, p<.05 \) respectively. Another analysis using the score difference between pre- and post-induction measurements was conducted. The result showed that there was a marginally significant difference among
induction procedures, $F(3,40)=2.69, p < .058$. This suggests that the procedures differ in terms of their effects on induced anxiety, with the Velten procedure having the greatest effect. In the 4 (Induction Procedures) X 4 (Times) split-plot analysis of covariance with time of previous anxiety level as a covariate, the only result of significance was the effect of time, $F(3,120)=3.48, p < .05$. This result shows that the initially increased level of anxiety immediately after mood induction decreased over time. Thus the use of music throughout the session did not sustain the increase in anxiety scores.

### Discussion

This study examined the effects of three mood induction procedures (Velten-plus-music, Velten, and music procedures), and neutral music controls on the strength and duration of induced depressed mood while undertaking a sentence completion task. The main purpose of this experiment was to test whether the Velten-plus-Music was more efficient in producing a strong and stable mood change than either the Velten procedure or Music alone. In regard to the strength of the induced mood, the Velten and the Velten-plus-Music both elevated depressed mood to the same extent, but the Velten-induced mood dissipated rapidly over time. Such a transient effect of the Velten procedure on mood was shown on the both measures of DACL and VAS-depression,
and is consistent with previous findings (Frost & Green, 1982; Chartier & Ranieri, 1989; Isen & Gorgoglione, 1983). It is possible that the failure of previous studies to show an effect of induced depression on behavioural measures and cognitive performance could be attributed to the rapid dissipation of Velten induced mood (Coleman, 1975; Natale, 1977; Hale & Strickland, 1976).

In contrast, the Velten-plus-Music and Music procedures kept induced mood relatively stable over time. Mood induced by the Velten-plus-Music procedure was still elevated 18 minutes after induction. Compared to previous findings that the durations of the induced depression by the Velten procedure lasted approximately 10 minutes with a significant decrease in its strength (Frost & Green, 1982), the Velten-plus-Music procedure increased the duration up to 18 minutes or more. These results suggest that the transient effect of the Velten procedure on mood could be overcome by playing music throughout an experimental session. So the relatively long duration of the induced mood could make the Velten-plus-Music most appropriate for studies of induced mood on cognition, provided the music does not interfere with the cognitive task studied.

Even though the Music procedure was developed as an alternative to the Velten procedure, in this study its initial effect on mood is weaker than either the Velten-plus-Music or the Velten procedure, but its effect on mood lasted longer than the Velten procedure. Hence rather than using the Music procedure alone, it is desirable to use music with the Velten procedure to sustain the initially induced mood. This argument is contrasted with the Clark (1983) study, which compared two independent studies using the Music and Velten procedures respectively (Teasdale & Russell, 1982; Clark & Teasdale, 1982). The results showed that the Music procedure induced a more severe depressed mood than the Velten procedure. This difference from current results could be due to different musical characteristics used in both studies.

All the depression induction procedures used here increased the level of anxiety immediately after mood induction. As with induced depression, this effect decreased over
time. These results are consistent with previous findings (Slyker & McNally, 1991) but also imitate naturally occurring depression (cf. Watson & Kendall, 1989)
CHAPTER 6

Serial Recall in Verbal Short-Term Memory in Naturally Occurring and Induced Depression

The effect of depression on verbal short-term memory (STM) has been extensively explored in several studies, but the findings have been inconsistent. Part of the reason for this is that a variety of tasks have been used to assess STM including the Brown-Peterson paradigm, serial list learning, immediate recall of supraspan lists and conventional memory span (e.g., Berndt & Berndt, 1980; Colby & Gotlib, 1988; Dannenbaum, Parkinson & Inman, 1988; Friedman, 1964; Gass & Russell, 1986; Henry, Weingartner, & Murphy, 1973; Krames & MacDonald, 1985; Kuhl & Helle, 1986; Richards & Ruff, 1989; Slife, Miura, Thompson, & Shapiro, 1984). Another possible reason is that different kinds of depressive populations have been used in these studies, ranging in severity from hospitalised depressed patients, through depressed outpatients and the depressed elderly to dysphoric college students. The issue of whether dysphoric populations can be regarded as analogues of clinical depression has recently been reviewed by Vrendenburg, Flett and Krames (1993), who concluded that similar effects of depressed mood were observed in dysphorics and clinical patients.

The following studies employing serial recall will be addressed under the assumption that memory span is dependent upon rehearsal process (Baddeley, Thomson, & Buchanan, 1975; Baddeley, 1986). Krames and MacDonald (1985) used a free recall test for words while varying a concurrent digit load. Their results showed that for the primacy component of free recall, depressed patients recalled fewer words than controls if there was no concurrent load. As the digit load increased, recall in depressives improved relative to the controls, and with a six-digit load the two groups performed at about the same level. They concluded that depressives have difficulty in maintaining information, perhaps arising through rehearsal difficulty. One problem with this
interpretation is the extent to which free recall performance as a whole reflects STM. Much evidence suggests that free recall recency is a separable component of free recall, perhaps reflecting STM. However, this component is itself dissociable from STM as measured by memory span (Baddeley & Hitch, 1974; Richardson & Baddeley, 1975). The primacy component of free recall is considered to be a measure of long-term memory, since it is resistant to post-list interference, although it may reflect rehearsal processes during the early part of list presentation. Krames and MacDonald proposed that the deficit in free recall primacy arose through depressive thoughts which competed for STM capacity at the beginning of the list. As memory task demands increased, these depressive thoughts were displaced from STM and so the difference between groups disappeared. However, no attempt was made to measure the extent of these depressive thoughts during the task.

Colby and Gotlib (1988) employed a modified digit span task to assess short-term memory functioning with dysphoric college students. This procedure involved simultaneous presentation of supraspan lists of 8 or 10 digits, which were visible for 8 or 10 seconds respectively. They found that dysphoric students performed as well as controls on a test of immediate recall, but showed deficits if recall took place after a 20 or 30 second unfilled retention interval. They interpreted their results as a failure of rehearsal. While this interpretation is quite plausible, it is not clear to what extent this task involves the same cognitive processes as traditional memory span. Neither this study nor that of Krames and MacDonald (1988) investigated rehearsal processes directly.

Slife et al. (1984), used simultaneous presentation of 16 CVC trigrams presented for 30 seconds followed by immediate free recall over three successive learning and recall trials. Part of their aim was to investigate memory bias, but their results also showed that elderly depressed subjects recalled fewer trigrams than matched controls. This could be interpreted as a short-term memory deficit. However, no difference
between groups appeared on the first trial, suggesting that the difficulty arose in long-
term learning.

Henry et al. (1973) investigated serial recall of 8-word lists over six successive 
trials in bipolar and unipolar depressives, comparing each individual's performance at 
different times when the severity of depression varied. They reported no effect of 
severity of depression on serial recall for the first trial, but a significant difference was 
found for later trials. They claimed that depressed patients had difficulties in transferring 
information from short-term to long-term memory.

Berndt and Berndt (1980) used the Brown-Peterson paradigm with a ten second 
filled retention interval and did not find any differences between dysphoric students and 
nondysphoric controls. This memory task uses interference to prevent rehearsal, and 
measures the decline in recall across retention intervals. Certain anomalies in this task, 
particularly performance on the first trial, question the extent to which it assesses STM 
(Keppel & Underwood, 1962). Thus the fact that there is no difference between 
dysphorics and normals may be due to the control of rehearsal opportunities, or to the 
fact that once again LTM is being assessed here.

A number of studies have compared depressed subjects and normals using digit 
span to assess STM. Although Friedman (1964) suggested STM deficits in clinical 
depression based on a wide variety of measures, he found no evidence of any STM 
deficit using digit span. Similarly, both Richards and Ruff (1989) and Gass and Russell 
(1986) failed to detect deficits in the digit span tasks of the WAIS (Wechsler, 1981) in 
clinically depressed populations. Similarly, in Kule and Helle's (1986) study, no deficits 
of word span were found in clinically depressed patients under normal conditions, 
although differences were found when intentions were manipulated.

However, some studies have reported deficits in memory span with depression. 
Rappaport (1968) reported that poor performance on digit span was commonly observed 
in depressed patients. Breslow, Kocsis and Belkin (1980) showed impairments on the
digit span subtest of the Wechsler Memory Scale in hospitalised depressed patients compared with a matched control group. A recent study by Dannenbaum, Parkinson, and Inman (1988) investigated delayed recall of letters, using list lengths which were adjusted in relation to individual subjects' letter spans. Short-term forgetting was examined by asking for recall immediately or after a filled retention interval of 6.3 seconds. They reported no difference in short-term forgetting rates between depressed and normal elderly subjects when this adjustment was made. However, in assessing letter span, they found that the depressives had lower spans than controls. These results were interpreted as showing encoding and storage deficits in depressives. In sum, serial recall in depression was explored using diverse tasks and met with inconsistent findings. Furthermore, most of studies were conducted without a clear theoretical framework. In contrast with those studies mentioned earlier, Channon, et al. (1993b) extensively studied short-memory functioning in terms of working model (Baddeley & Hitch, 1974) on range of tasks exploring the articulatory loop, visuospatial sketch pad, and central executive. They concluded that both articulatory loop and visuospatial sketch pad remain intact in clinical depression and rather central executive functioning appears impaired.

The framework adopted here for exploring STM in depression is the working memory model proposed by Baddeley and his colleagues (e.g., Baddeley, 1986; Baddeley & Hitch, 1974; Baddeley, Thomson & Buchanan, 1975). According to this model, performance in serial recall tasks such as memory span, is determined by a dedicated component of working memory called the articulatory loop. Extensive experimental work has shown that immediate serial recall is sensitive to the phonological similarity of list items (Conrad & Hull, 1964), the length of words estimated by their spoken duration (Baddeley et al., 1975; Cowan, Day, Soultis, Keller, Johnson, & Flores, 1992; Schweickert & Boruff, 1986), and by unattended speech or particular kinds of nonspeech noise (Jones & Macken, 1993; Salame & Baddeley, 1982). With auditory presentation, the effects of phonological similarity are resistant to the effects of
articulatory suppression (rapid articulation of a short sequence of words such as "one..two..three"), whereas the effect of speech rate can be blocked by this manipulation under some circumstances (Baddeley, Lewis & Vallar, 1984). Hence the articulatory loop is believed to consist of at least two components: an auditory store and a rehearsal mechanism. In serial recall tasks, rehearsal of the items is used to preserve their order, by recycling items through the store. The capacity of the loop is thus determined by the duration of information in the store multiplied by the rehearsal rate. Since rehearsal is assumed to be internal speech operating at something like overt speech rates (Landauer, 1962), there should be a close relationship between speech rates and memory span. This relationship has been found to exist across normal adults (e.g., Baddeley et al., 1975), across children of different ages (e.g., Nicolson, 1981) and across languages where familiar terms differ in spoken duration (e.g., Ellis & Hennelly, 1980).

The articulatory loop is a dedicated component or slave system of the working memory model, and one which is particularly adapted to serial recall tasks. Another important component is the central executive, which is believed to allocate tasks to slave systems and to regulate control processes. The properties of this component are poorly understood, but it seems to be called upon in tasks requiring a high mental load, in circumstances where two tasks are performed concurrently, and in tasks where strategy decisions have to be made.

As explained previously, attempts to find STM deficits in depressed or dysphoric subjects have met with inconsistent results, which can be attributed to the use of diverse and non-standard tasks which may draw on different components of cognition. The current experiments address the issue of whether dysphoric mood affects performance in standard serial recall tasks, thereby exploring the effect of dysphoria on the articulatory loop component of working memory. An effect of dysphoria on serial recall could take place by inefficient encoding, disordered or slow rehearsal, or by reduced central capacity. As reviewed earlier, a number of theories have been put forward to explain
cognitive deficits occurring with depressed mood. Their possible implications for deficits in serial recall are discussed.

First, Brewin (1988), on the basis of negative schemata theory (Beck, 1967) argued that negative automatic thoughts generated by negative schemata intrude into depressed people's minds either with or without awareness. According to this account such thoughts may impair STM performance by reducing central capacity, or by interrupting articulatory rehearsal.

Hasher and Zacks (1979) proposed that depressed mood imposes limits on central capacity, and hence suggested that memory deficits would be found in difficult tasks requiring effortful processing, such as rehearsal and elaboration, rather than in automatic processing. Unfortunately, their theory did not address the question of how depression reduces attentional capacity. More recently, Hasher and Zacks (1988) have produced a revised theory of mental performance deficits, originally applied to ageing, but also claimed to apply to depression (p. 194). According to this model, depressive memory deficits may arise from an inefficient inhibition mechanism, which plays the important role of preventing personal memories or other unwanted thoughts from entering working memory space. Hence depressive memory deficits can be explained by the intrusion of task-irrelevant thoughts. Hasher and Zacks (1988) provide examples such as: irrelevant environmental details, personalistic memories or concerns, and off goal-path interpretations. Ellis and Ashbrook (1988) also proposed that under depression attentional capacity is taken up by task-irrelevant processing. Memory deficits arise from competition between tasks demands and these irrelevant thoughts.

A recent review by Hartlage, Alloy, Vazquez & Dykman (1993) concluded that depression causes deficits in tasks which require effortful processing, but not in tasks which require only automatic processing. They proposed that the deficit was due to a combination of two factors: a reduction in the total available cognitive capacity and a focussing of attention on task-irrelevant thoughts. All these theories are very similar in
that they emphasise the role of thought intrusions and argue that such intrusions should reduce central attentional capacity.

Another aspect of depression which may affect STM performance is that depressives show retarded psychomotor functioning (Friedman, 1964; for a review see Williams, Watts, MacLeod and Mathews, 1988). If psychomotor retardation in depression also slows speech rate, then according to the working memory model, rehearsal efficiency and memory span will decrease. Moreover, a measure of speech rate has been used as an index of psychomotor retardation. For example, Teasdale, Fogarty, & Williams (1980) asked subjects to count from 1 to 10 under elated conditions or under negative mood induction. They found that mean pause time was correlated with the increase in dysphoria occurring on mood induction.

The current experiment explores the effects of mild dysphoria on performance in memory span tasks. The purpose of the first experiment was to investigate the effectiveness of maintenance rehearsal over prolonged retention intervals in dysphoric students and normal controls, using a serial recall task. If dysphorics have difficulties in sustaining rehearsal, then performance should decline more rapidly in dysphorics compared to normals. This might occur for example if task-irrelevant or other intrusive thoughts disrupted the rehearsal process. On the other hand if rehearsal rate was slowed by depression, then this should affect initial encoding, leading to a deficit in immediate serial recall. Measures were also taken of speech rate, the frequency of negative automatic thoughts (ATQ-N; Hollon & Kendall, 1980), and the frequency of task-irrelevant thoughts (Sarason, 1980) occurring throughout the experiment, to determine the relationship, if any, between these measures and STM performance.

Experiment 3A

Method

Subjects
Two hundred and thirty-six first-year Psychology undergraduates at the University of Wollongong were screened for dysphoric mood. Sixteen nondysphorics and fifteen dysphorics served as subjects. In the screening procedure, subjects were tested in groups of 10 - 20 and were administered the Beck Depression Inventory (BDI; Beck, 1967) together with other measures such as the State-trait Anxiety Scale and the Style of Thinking Questionnaire, which are not relevant to the purpose of this study. The BDI is a self-report questionnaire of 21 items used to measure the severity of depression, with scores ranging from a possible 0 to 63. Subjects who scored less than 5 or more than 10 on the BDI were classified as nondysphorics and dysphorics respectively, and were individually contacted to participate in the experiment. At the time of the experiment, 2 - 4 weeks after the initial contact, another administration of the BDI was given. Subjects who met the same criterion on this retest were admitted to the experiment, following the procedure recommended by Kendall, Hollon, Beck, Hammen & Ingram (1987). At retest, the mean BDI score for the nondysphoric group was 1.38 (SD = 1.26), and for the dysphorics the mean BDI was 18.2 (SD = 5.52).

Materials

The digit span task was presented using a President AT-compatible computer driving a Philips colour monitor using VGA graphics. Each digit was displayed in white on a black ground and measured 230 mm high by 130 mm wide. Each series of digits used consisted of six numbers randomly drawn from the range 1 - 9 without replacement. Responses were made using the computer keyboard. To measure negative and task-irrelevant thoughts occurring at the time of the experiment (cf., subjects were tested on the negative version of the Automatic Thought Questionnaire (ATQ) and the Cognitive Interference Questionnaire (CIQ). The ATQ lists 30 negative self-statements and then asks subjects to rate on a 5-point Likert scale how frequently each self-statement occurred to them during the current experiment (e.g., I wish I were somewhere else). The CIQ consists of 12 items inquiring about the frequency of any task-irrelevant
thoughts which occurred during the experiment (e.g., "I thought about the purpose of the experiment").

**Procedure**

Upon arriving at the experimental room, subjects were given the second administration of the BDI. Subjects who responded differently from their first BDI test were dismissed. In the digit span task, the subject initiated each trial by a key press. A series of six digits was displayed sequentially at rate of 1.5 seconds per item. The series was followed by a blank retention interval of 1, 8, or 15 seconds in length, after which three hash symbols (###) were displayed. Subjects then typed in the numbers on the keypad on the right side of keyboard. There were 30 trials, ten trials at each of the three retention intervals, presented in a random order.

Upon the completion of the span task, the ATQ and CIQ were administered. A measure of speech rate was then taken. To measure speech rate, subjects were asked to read aloud a set of three digits repeatedly as fast as they could. Their speech was recorded on a cassette recorder, from which measurements were made of the time taken to articulate ten repetitions of the set. The procedure was repeated five times, each time using a different set of digits, and the average of these five attempts was used as the mean speech rate.

**Results and Discussion**

**Digit span**

The digit span data were scored in two ways: first as the percentage of digits output in the correct serial position and secondly as the percentage of series which were completely correct. Both measures yield similar results, so here only the first measure is reported. The mean percentage of digits correct are provided in Table 6.1, and show that overall performance was high and at about the same level for both nondysphoric and
dysphoric groups. In both groups performance remained high across all retention intervals.

Table 6.1 Percentages of items recalled correctly in three retention intervals

<table>
<thead>
<tr>
<th>Retention interval (sec)</th>
<th>1</th>
<th>8</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nondysphoric subjects (n=16)</td>
<td>91.46</td>
<td>91.15</td>
<td>91.25</td>
</tr>
<tr>
<td></td>
<td>(9.93)</td>
<td>(11.62)</td>
<td>(11.70)</td>
</tr>
<tr>
<td>Dysphoric subjects (n=15)</td>
<td>93.33</td>
<td>91.78</td>
<td>91.44</td>
</tr>
<tr>
<td></td>
<td>(6.30)</td>
<td>(9.73)</td>
<td>(8.99)</td>
</tr>
</tbody>
</table>

( ) indicates standard deviations.

The absence of any effect of mood or of retention interval was confirmed by analysis of variance with mood as the between-subjects factor and retention interval as the within factor. Using percentage of items correct as the dependent measure, there was no evidence of any effect of mood, $F(1,29) < 1.0$, or of retention interval, $F(2,58) < 1.0$. Nor was there any evidence of an interaction, $F(2,58) < 1.0$.

Speech rate

The mean speech rate for the nondysphoric group was 4.35 digits/sec (SD = 0.82), and the mean speech rate for the dysphoric subjects was 4.38 digits/sec (SD = 0.74). There was no significant difference between groups, $t(29) = .31$, nonsig.

ATQ

The mean number of automatic negative thoughts reported by the dysphoric group was 45.07 (SD = 15.28), and the corresponding values for the nondysphoric group was 33.56 (SD = 5.69). The difference in frequency of reported thoughts was significant, $t(29) = 2.74$, $p < .01$. Thus dysphoric subjects reported more negative thoughts during the course of the experiment. This would be expected given the negative memory bias associated with dyshoric mood (Teasdale & Fogarty, 1979). However, the
increased frequency of negative thoughts did not seem to have a deleterious effect on STM performance.

CIQ

Using the CIQ, dysphoric subjects reported more task-irrelevant thoughts during the task performance (mean = 30.73; SD = 8.36), compared to nondysphoric subjects (mean = 22.69; SD = 7.29). The difference in reported frequency of irrelevant thoughts was again significant, t(29)=2.86, p<01.

The results of this experiment showed no difference between dysphoric and nondysphoric subjects on immediate serial recall or on speech rate measures. Together these findings suggest that the functioning of the articulatory loop is not affected by dysphoric mood states. Moreover, there was no evidence of any decline in performance across retention intervals for either group. Thus subjects in both groups were able to maintain rehearsal throughout these unfilled retention intervals. However, there was a significant difference in the frequency of negative automatic thoughts and task-irrelevant thoughts reported by the two groups. If it is true that dysphoric subjects experience more task-irrelevant thoughts, then these results suggest that such thoughts do not interfere with the functioning of the articulatory loop, or act to disrupt extended periods of maintenance rehearsal.

This experiment measured serial recall using six-digit sequences, which although it is believed to engage most of the capacity of the articulatory loop, is regarded as a relatively easy task. Performance in both subject groups was high, and it is possible that any difference in performance is partly obscured by ceiling effects. Another experiment with longer sequences of 7 digits was repeated. Colby and Gotlib (1988), using a nonstandard STM task, reported a decline in performance over long retention intervals (20 - 30 seconds). Since the retention intervals used here were shorter, this experiment would not have detected either a very slow decay, or late-onset decay occurring after 15 seconds. Thus the second experiment increased the retention intervals.
Experiment 3B

This experiment was similar to Experiment 3A except that the digit load and the duration of retention intervals were increased. According to Hasher and Zacks (1979), Hartlage et al. (1993) and Ellis and Ashbrook (1988), memory deficits in depression will only occur when processing is effortful. If so, then increasing the demands of the task should result in reduced performance in dysphoric subjects.

Method

Subjects

18 nondysphoric and 17 dysphoric subjects were drawn from the same pool of students, using the same selection criteria as in Experiment 1. In this case, the second BDI test was administered 4 - 5 months after initial screening. Mean BDI was 15.83 (SD = 7.13) for the dysphoric group and 2.06 (SD = 1.70) for the non-dysphoric group. None of the subjects had participated in Experiment 3A.

Materials

Sequences of 7 digits were presented visually at a rate of 1.5 sec per digit, with retention intervals of 1, 20 and 30 seconds. Otherwise the materials were as for Experiment 3A.

Procedure

Subjects completed the serial recall task, speech rate measures, and the questionnaires in the same order as in Experiment 3A. In measuring speech rate, subjects read sequences of 6 digits, rather than 3 digits. Otherwise the procedure was the same as for Experiment 3A.

Results and discussion

Serial recall
Serial recall was measured using two indices of performance, as for Experiment 3A. Table 6.2 shows the percentage of items recalled in the correct serial position. The results show that scores were lower with the increased memory load, and clearly avoided ceiling levels. Performance was slightly higher in the nondysphoric group and decreased in the longest retention interval.

<table>
<thead>
<tr>
<th>Group</th>
<th>Retention intervals (sec)</th>
<th>1</th>
<th>20</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nondysphoric</td>
<td></td>
<td>84.05</td>
<td>84.84</td>
<td>81.43</td>
</tr>
<tr>
<td>subjects (n=18)</td>
<td>(12.88)</td>
<td>(14.84)</td>
<td>(16.51)</td>
<td></td>
</tr>
<tr>
<td>Dysphoric</td>
<td></td>
<td>83.70</td>
<td>80.42</td>
<td>76.22</td>
</tr>
<tr>
<td>subjects (n=17)</td>
<td>(10.77)</td>
<td>(11.42)</td>
<td>(10.90)</td>
<td></td>
</tr>
</tbody>
</table>

( ) indicates standard deviations.

A two-way ANOVA (2 groups x 3 retention intervals) was carried out using retention interval as the within-subject factor and using the percentage of items recalled as the dependent measure. In terms of the number of items correctly reported, there was no difference between nondysphoric and dysphoric subjects, $F(1,33) < 1.0$. However, there was an effect of retention interval, $F(2,66) = 3.32; p < .05$, but again no interaction of group and retention interval, $F(2,66) < 1.0$. The results show that there was some loss of information over time over the longer retention intervals of this experiment, but the rate of loss did not differ between groups. When the percentage of series correct was used as the dependent measure, no significant effects were found.

Speech rate
Speech rate measures were not obtained for one dysphoric and two nondysphoric subjects due to recording failures. For the remaining subjects the mean speech rate was 4.23 digits/sec (SD = 0.65) for the dysphoric group and 4.24(SD = 1.39) for the nondysphoric group. Again, there was no significant difference between groups, t(30) = .04, nonsig.

ATQ and CIQ measures

For the ATQ the mean score for nondysphorics was 38.17 (SD = 8.78), and for dysphorics the mean was 48.18 (SD = 15.1). The corresponding values for the CIQ were 24.39 (SD = 7.86) for non-dysphorics and 30.47 (SD = 7.52) for the dysphorics. Both measures showed a significant difference between groups: for the ATQ, t(33)=2.38, p < .05 and for the CIQ, t(33)=2.34, p < .05.

Increasing the memory load in this experiment led to lower scores and removed the possibility of any ceiling effects. Nevertheless, as for Experiment 3A, no difference between groups was observed. Thus no evidence was found here to suggest that mild dysphoria has any effect on serial recall. However, in this experiment there was an effect of retention interval, indicating that subjects in both groups found it difficult to maintain the items over the longer retention intervals used here. Let us assume that articulatory rehearsal is responsible for maintaining a series of items under these conditions. If rehearsal was impaired in dysphorics, perhaps by the increased incidence of task-irrelevant thoughts, we would expect to find a faster loss of information over extended retention intervals. No such evidence was found. Moreover, in terms of articulation rate, dysphorics performed at a similar level to normal controls. A strong correlation was found between serial recall and speech rate across subjects, r(32) = 0.53, p < .002, supporting the view that the articulatory loop was functioning normally in this task.

These first two experiments indicate firstly that the articulatory loop seems to operate normally in dysphoric subjects, and secondly, that despite the increased incidence
of irrelevant thoughts, maintenance rehearsal can operate over prolonged retention intervals. Thus task-irrelevant thoughts do not interfere at the level of the articulatory loop, for example, by disrupting rehearsal. Experiment 3C investigated this question further by examining the word length effect of serial recall. Once again, naturally-occurring dysphorics were included, and we also included a sample of mood-induced dysphorics. Previous studies have shown that after dysphoric mood induction, subjects' counting rates are slowed and show longer pause times between successive numbers (e.g., Teasdale, & Taylor, 1981). Thus we might expect to find reduced memory span in induced dysphorics which is attributable to reduced speech rate.

**Experiment 3C**

The previous experiments have shown no significant depressive memory deficits in immediate serial recall with list lengths approximating the memory span limit. More specifically, there was no evidence of any impairment in rehearsal, either in terms of speech rate measures or in terms of the maintenance of information over prolonged retention intervals. In terms of the working memory model, these results suggest that the articulatory loop functions normally in naturally occurring dysphorics. A more direct test was made in the current experiment, in which word span was measured for lists of short and long words. In normal subjects, the span length is related to the articulation rates of the words, so that span for long words is less than for short words. This word length effect is believed to arise from articulatory rehearsal. Hence if normal rehearsal processes operate in dysphorics, it is expected to find clear word length effects of similar magnitude as for nondysphorics.

In previous studies of dysphoria using mood induction techniques, Teasdale and colleagues (Teasdale & Fogarty, 1979; Teasdale & Taylor, 1981) used speech rate to assess the extent to which mood induction had been successful. Their procedure for assessing speech rate was to ask subjects to count from 1 to 10 in their own time. With
this measure, they reported slower speech rates with induced dysphoria compared to induced elation. However, these studies did not include neutral controls, so it is not clear whether the differences in speech rate was due to either slowed speech rate in induced dysphoria, or faster speech due to induced elation, as Goodwin and Williams (1982) pointed out. In these studies, speech rate was not related to STM performance. In working memory studies (e.g., Baddeley et al., 1975), speech rate is usually measured by asking subjects to repeat a series of stimuli as fast as possible. Experiments 3A and 3B show that, using this measurement, there is no difference between naturally occurring mild dysphorics and controls. In this experiment, mood induction of dysphoric and elated moods was used to determine the effect, if any, of these induced mood states on speech rates estimated by rapid repetition of words.

Method

Subjects

Fourteen naturally occurring dysphorics were selected from a different population of psychology undergraduates, using a similar procedure to Experiment 3A. The naturally depressed subjects were those who scored 9 or more on the BDI during initial screening (the criterion used by Greenberg & Alloy, 1989) and again at the time of the experiment, which took place 2 - 3 months later. Subjects with BDI scores below 9 during the initial screening procedure were contacted and randomly assigned to the neutral, induced depression or induced elation conditions. The number of subjects was 48; 18 neutral controls, 16 induced dysphorics, and 12 elated subjects. All subjects received course credits or a small sum of money in return for their services.

Materials

Two pools of ten words were adapted from those used in Experiment VI of Baddeley, et al., (1975). One set consisted of monosyllabic words, the other of words of five syllables. Each set consists of one word from each of the original 10 semantic categories, except that here English place names were replaced by Australian place
names. From each word pool, a set of 20 five-word lists was made by sampling at random without replacement. Words were displayed in uppercase on an IBM-AT compatible computer at a rate of one word every 1.5 seconds.

The VMIP (Velten, 1968) was administered using only the last 30 statements of the original 60 statements. For the dysphoric and elated mood induction conditions, the statements are self-referent in nature and gradually increase in intensity. Neutral mood induction is accomplished using non self-referent statements. Music was also used to supplement the VMIP. Pilot work from experiment 2A indicated that Sibelius' tone poem, The Swan of Tuonela, was the most depressing piece of music, and the contrasting pieces of neutral and elating music were those used by Pignatiello, Camp, and Rasar (1986).

Procedure
Upon arrival at the experimental room, subjects completed the BDI and the version A of the Depressive Adjective Check List (DACL; Lubin, 1965). The DACL has been often used to assess a transient depression induced by mood induction procedures (e.g., Pignatiello et al., 1986; Chartier & Ranieri, 1989). Naturally dysphoric subjects were given the neutral mood induction procedure. All other subjects were then given a neutral, dysphoric or elated mood induction procedure, consisting of administration of the Velten sentences plus accompanying music of the appropriate mood. In each case, subjects read the 30 Velten statements of the appropriate kind and were instructed to try to experience the mood suggested by the statements. At the same time, music of the appropriate kind (depressing, elating or neutral) was played through headphones. The music continued for the duration of the experiment, and subjects were instructed to feel the mood suggested by the music. After mood induction, all subjects answered the DACL version B to check whether mood induction was successful.

The experiment began with four practice trials. On each trial a row of asterisks was briefly displayed as a warning signal. Each word was then shown for 1 second, with
0.5 seconds between each word. At the end of the list there was a five-second delay, after which a question mark was displayed. This was the signal to begin oral recall, for which ten seconds were allowed. Subjects were instructed to say the words aloud in the order presented, and to say "blank" if they could not remember a word in a particular serial position.

Speech rate was measured at the end of the experiment. Subjects were asked to read aloud as fast as possible a series of three words from the one of the pools. They were timed by stop-watch for 10 repetitions of the series. This measurement was made four times for each word pool, each time with a different series of words. To measure negative and positive automatic thoughts, both the positive (Ingram & Wisnicki, 1988) and negative forms of the ATQ were administered with all items mixed randomly.

Results and Discussion

Mood indices and Mood manipulation check

As shown in Table 6.3, the DACL-A and BDI administered prior to mood induction showed that the naturally occurring dysphoric students had lower scores on both tests than the other groups.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Neutral ( (n=18) )</th>
<th>Natural Dys. ( (n=14) )</th>
<th>Induced Dys. ( (n=16) )</th>
<th>Elated ( (n=12) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDI</td>
<td>3.22 (2.76)</td>
<td>13.79 (4.34)</td>
<td>2.94 (2.82)</td>
<td>2.92 (2.81)</td>
</tr>
<tr>
<td>DACL-A</td>
<td>6.00 (3.93)</td>
<td>12.93 (3.63)</td>
<td>7.06 (3.75)</td>
<td>6.25 (2.22)</td>
</tr>
<tr>
<td>DACL-B</td>
<td>7.39 (5.66)</td>
<td>13.00 (4.84)</td>
<td>13.63 (4.50)</td>
<td>3.00 (2.00)</td>
</tr>
</tbody>
</table>

Note. ( ) indicate standard deviations. BDI = Beck Depression Inventory; DACL = Depression Adjective Check List. DACL-A and DACL-B administered prior to and after mood induction.
Analysis of variance showed that these pretest differences in mood between natural dysphorics and the other groups were significant: for the BDI scores, $F(3,56)=39.94, p < .001$ and for the DACL-A, $F(3,56)=12.37, p < .001$. Further analysis of the BDI and the DACL-A scores using the Neuman-Keuls test showed that the naturally depressed subjects were more dysphoric than the other three groups which did not differ.

For the mood manipulation effect, the DACL-B showed that the manipulation was successful and that after induction there was a significant effect of group, $F(3,56) = 16.09, p < .001$. Comparison of groups using the Neuman-Keuls test showed that both the natural dysphorics and experimentally depressed groups were significantly more depressed than the other groups.

The elated group was also significantly different from the neutral group. Thus mood induction, as measured by the DACL-B test was highly successful.

**Serial recall**

**Table 6.4** The percentages of items recalled for short and long words.

<table>
<thead>
<tr>
<th>Group</th>
<th>Short</th>
<th>Long</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral group (n=18)</td>
<td>87.44 (11.93)</td>
<td>49.17 (15.18)</td>
</tr>
<tr>
<td>Natural dys. (n=14)</td>
<td>84.29 (17.34)</td>
<td>52.57 (14.44)</td>
</tr>
<tr>
<td>Induced dys. (n=16)</td>
<td>77.25 (17.75)</td>
<td>45.56 (19.14)</td>
</tr>
<tr>
<td>Elated group (n=12)</td>
<td>84.67 (15.35)</td>
<td>45.25 (19.75)</td>
</tr>
</tbody>
</table>

( ) indicates standard deviations.

The data reported here are the percentage of words correctly recalled. The data were analysed by a two-way ANOVA with one between subject factor (mood state) and
one within-subject factor (word length). The scores are provided in Table 6.4 and show a large word length effect, whereby recall of short words was superior to that for long words, $F(1,56)=331.19$, $p < .001$. However, there was no difference between mood states, $F(3, 56) < 1.0$, and neither was there any interaction between mood state and word length, $F(3,56) = 1.0$. These findings indicate clearly that there was no difference either in overall memory span or in the size of the word length effect across groups.

As shown in Table 6.5, there was no difference between groups in speech rate for one-syllable words, $F(3,56)=1.83$, $p > .05$, nor for five-syllable words, $F(3.56)=1.61$, $p > .05$.

Table 6.5  Speech rate for short and long words

<table>
<thead>
<tr>
<th>Measure</th>
<th>Neutral (n=18)</th>
<th>Natural Dys. (n=14)</th>
<th>Induced Dys. (n=16)</th>
<th>Elated (n=12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short words</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1 syllable words)</td>
<td>1.84 (0.63)</td>
<td>2.15 (0.78)</td>
<td>2.17 (0.59)</td>
<td>2.42 (0.73)</td>
</tr>
<tr>
<td>Long words</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5 syllable words)</td>
<td>1.05 (0.24)</td>
<td>1.12 (0.24)</td>
<td>1.19 (0.24)</td>
<td>1.22 (0.26)</td>
</tr>
</tbody>
</table>

( ) indicates standard deviations

These findings indicate that natural or induced emotional mood states have little if any effect on repetition measures of speech rate.

Negative automatic and task-irrelevant thoughts

One subject in the neutral group failed to complete the ATQ, and one subject in the induced depression group failed to complete both the ATQ and the CIQ. The mean number of negative and positive automatic thoughts measured on the ATQ and task-irrelevant thoughts measured on the CIQ are provided in Table 6.6, along with the ratio
depressives, there was an increase in the number of negative thoughts, relative to the other groups, although this was not true of the induced depressives. The elated mood induced group showed an increase in the frequency of positive thoughts. When analysed in terms of the total number of positive and negative thoughts on the ATQ, there was no difference between groups, $F(3, 54)=1.78, p > .05$.

Table 6.6 The frequencies of irrelevant thoughts as measured by the ATQ and the CIQ

<table>
<thead>
<tr>
<th>Group</th>
<th>Measure</th>
<th>Neutral (n=18)</th>
<th>Natural Dys. (n=14)</th>
<th>Induced Dys. (n=16)</th>
<th>Elated (n=12)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ATQ-P</td>
<td>47.82 (19.51)</td>
<td>42.57 (12.79)</td>
<td>44.73 (15.43)</td>
<td>63.75 (29.60)</td>
</tr>
<tr>
<td></td>
<td>ATQ-N</td>
<td>37.24 (8.33)</td>
<td>49.71 (21.56)</td>
<td>35.20 (7.61)</td>
<td>39.58 (12.85)</td>
</tr>
<tr>
<td></td>
<td>ATQ-P/ATQ-N</td>
<td>0.85 (0.24)</td>
<td>1.15 (0.22)</td>
<td>0.86 (0.29)</td>
<td>0.73 (0.30)</td>
</tr>
<tr>
<td></td>
<td>CIQ</td>
<td>28.56 (5.80)</td>
<td>31.43 (7.63)</td>
<td>29.13 (5.97)</td>
<td>28.17 (7.30)</td>
</tr>
</tbody>
</table>

Note. ( ) indicates standard deviations. ATQ-P = Positive Automatic Thoughts Questionnaire; ATQ-N = Negative Automatic Thoughts Questionnaire; CIQ = Cognitive Interference Questionnaire. N=17 in ATQ-P and ATQ-N for Neutral controls, N=15 in ATQ-P, ATQ-N, and CIQ for Induced Dys.

These results suggest that approximately the same number of thought intrusions occurred in each group. However, the ratio of negative thoughts to positive thoughts did vary across groups, $F(3,54) = 6.41; p < .001$, and post-hoc analysis using the Neuman Keuls test showed that the naturally dysphoric group differed from all the other groups, but there were no other significant differences. Thus the natural dysphorics experienced a higher proportion of negative thoughts compared to the other groups. The natural dysphorics experienced more negative thoughts than positive ones as reported on the ATQ: for negative thoughts, mean=49.71 (SD=21.56), and for positive thoughts
mean=42.57, (SD=12.79). This difference was marginally significant, t(13)=2.12, p = .054. In contrast, the reverse is true of the neutral control group: for negative thoughts, mean=37.24 (SD=8.33), and for positive, mean=47.82 (SD=19.51), which was significant, t(16)=2.28, p < .05. On the CIQ measure, groups did not differ in their reported frequencies of task-irrelevant thoughts, F(3, 55)=.68, p > .05.

The present experiment clearly showed that depressive mood states do not affect the size or nature of the word length effect in serial recall. The results also confirm those of Experiments 3A and 3B that speech rate measures do not vary with either natural or induced mood. If speech rate can be considered as an indirect measure of rehearsal rate, then there is no evidence of any effect of mood state on rehearsal.

These results contrast with the rehearsal difficulty hypothesis argued by Hasher and Zacks (1979) and Colby and Gotlib (1988). In their view, rehearsal is an effortful process, of the type which is sensitive to depressed mood. Also in their recent review of depressive memory deficits, Hartlage et al. (1993) argued that tasks requiring conscious effort are likely to show depressive deficits. These results suggest that serial recall tasks requiring rehearsal do not appear sensitive to depressed mood. Either rehearsal itself is not effortful, in the sense used by these authors, or effortful processing alone is not enough to reveal cognitive deficits in depression. The results cannot be explained simply by saying that STM deficits occur only in difficult tasks. Performance levels on the long word lists was much lower than those on the short words. Nevertheless, there was no evidence that the depressed groups were particularly affected by the more difficult task using long words. Together with Experiments 3A and 3B there is no evidence that dysphoric subjects differ from normal subjects in terms of memory span performance or rehearsal capabilities.

In terms of the working memory model, these findings suggest that the articulatory loop system, responsible for rehearsal mechanism is not affected by emotional mood states. The articulatory loop is believed to hold speech-like
representations and to be limited to the number of words subjects can speak within about 2 seconds (Baddeley et al., 1975; Schweickert & Boruff, 1986). The current data is consistent with these estimates. The mean number of one-syllable words recalled was 4.2 and the mean number of five-syllable words recalled was 2.4. Mean speech rates for one and five syllable words were 2.12 and 1.14 words/sec. Based on these averaged measures, the function relating memory span to speech rate is given by:

\[ \text{memory span} = 0.6 + 1.88 \times \text{speech rate} \]

The total number of positive and negative automatic thoughts reported did not vary across groups. However, the ratio of negative to positive thoughts did differ significantly, in that naturally dysphoric students reported a higher proportion of negative thoughts. Despite this preponderance of negative thoughts, the natural dysphorics did not show any decrease in recall. Once again there is no evidence of a specific impairment on STM brought about by negative automatic thoughts. However, since the total number of task-irrelevant thoughts remains constant across groups, it is possible that task-irrelevant thoughts in general use up STM capacity.

The results of these three experiments suggest that performance in traditional serial recall STM tasks is preserved in dysphoric mood states, and that the articulatory loop component of working memory appears to function normally. The final experiment adapted the paradigm developed by Morris and Jones (1990) to determine if dysphoric mood states have an effect on the operation of the central executive.

**Experiment 3D**

The capacity model of cognitive impairments in depression (Hasher & Zacks, 1988; Hartlage et al., 1993; Ellis & Ashbrook, 1988), proposes that depressed mood states reduce the attentional resources available for the current task. The reason given for
this is that negative automatic thoughts and task-irrelevant thoughts compete with task-relevant thoughts for the limited central capacity. The previous experiments have shown that if this reduced capacity occurs, it does not impair performance on standard serial recall tasks. This would not be unexpected if the articulatory loop acts autonomously in such tasks. The reduced capacity should however affect performance on tasks which depend on the central executive. This was tested directly in the present experiment by using the running memory span task developed by Morris and Jones (1990). This task requires the subject to observe a series of items of unknown length and to report back the six most recent items in serial order. It thus involves memory for serial order plus an updating component which operates when the list length exceeds six items. The task is more complex than traditional memory span, since the strategies used must change during the presentation of the list. As a supervisory attentional system, the central executive should play a role in regulating these strategies (Morris & Jones 1990). The task is considered as consisting of serial recall and updating components, tapping the articulatory loop and central executive respectively. Hence, if dysphorics experience reduced capacity in the central executive, the performance of dysphorics should decrease relative to nondysphorics in conditions where updating is required.

Method

Subjects

Seventeen nondysphoric and seventeen dysphoric subjects were drawn from the same subject pool used for Experiment 3C. Three subjects in each condition had also participated in Experiment 3C. The criterion for inclusion in the dysphoric group was a BDI score of 9 or above, and for the nondysphoric group a score of 5 or less. Otherwise, the selection procedure was the same as for Experiment 1. The second administration of the BDI was given 4 - 5 months after initial screening.

Materials
A total of 40 lists of consonants were constructed, ten lists at each of four list lengths, 6, 8, 10 and 12 items. No consonant appeared twice in the same list and any obviously meaningful acronyms were deleted. Two lists of each length were used for practice. Four sets of 8 lists were used in each condition. Lists were presented in a randomized order with the constraint that no two lists with the same length should be presented consecutively. Lists were presented on an IBM-compatible computer, as in Experiment 3A.

Procedure

Upon arrival, subjects filled out the BDI. If dysphoric subjects failed to reach the criterion on this second administration of the BDI, they were dismissed. Subjects were presented with the consonants displayed in the central location of the computer screen at a rate of one per second. At the end of the list three question marks were displayed, which was the signal for recall of the consonants. Unlimited time was allowed for recall. Subjects wrote the last six consonants in six separate boxes on response sheets in the correct (forwards) serial order.

Subjects were told that the length of a given list might be 6, 8, 10, or 12 items long, and were instructed to recall the last six consonants. They were instructed to guess if they could not remember one of these items. It was emphasized that some lists were only six items long so they could not afford to ignore any items.

Results and discussion

Recall performance was scored by the percentage of correct items in each serial position. The mean percentage of correct items are plotted for each group in Figure 6.1. It can be seen that for a list length of six items (no updates) the dysphoric and nondysphoric subjects performed at about the same level. However, for longer series, where updating was required, the dysphoric group had lower scores. A two way ANOVA (2 groups vs. 4 updating condition) was carried out with updating conditions as
a repeated measure. Main effects of group and updating factors were significant, $F(1, 32) = 5.28; p < .05$, $F(3, 96) = 23.46; p < .0001$, respectively, suggesting an overall reduction in performance of depressed subjects. The expected interaction between groups and updating conditions failed to reach significance, $F(3, 96) = 1.97; p = .12$. This interaction may be weakened by the fact that the difference between dysphorics and controls was constant across the three longest list lengths. A more powerful analysis used contrasts between scores for a list length of six and the combined scores on all other list lengths. When transformed in this way the main contrast effect was very highly significant, $F(1,32)=50.27, p < .0001$, and there was a significant interaction between group and list length contrast, $F(1,32)=4.27, p < .05$\(^1\). These results suggest that the updating process itself leads to memory impairment in depression.

![Diagram](image)

**Fig. 6.1 Running Memory Span among nondysphorics and dysphorics**

\(^1\) Morris & Jones' (1990) study 2 used three updating conditions (2, 4, 6) and three treatment conditions (quite treatment, articulatory suppression, and irrelevant speech). Subjects had to recall the last six items. Three main effects including updating, treatment, and serial position were significant, $F(3,33)=7.50, p < .001$, $F(2,22)=24.97, p < .001$, and $F(5,55)=44.19, p < .0001$ respectively. However, the interaction between updating and treatment was not significant, $F(6,66) < 1$. 
Morris and Jones (1990) reported that this updating memory task relies on two functions; one is rehearsal, mainly operated by the articulatory loop, and the other an updating component involving the central executive. In this experiment a memory deficit was revealed in dysphorics only with longer list lengths that require updating. It is not clear whether this reflects a general impairment in the central executive in dysphorics, or whether this task which makes demands on the central executive has properties (for example effortfulness) which makes it sensitive to depression. However, the absence of any such deficit when no updating is required confirms the results of Experiments 3A - 3C in showing that serial recall operates normally in dysphorics.

General Discussion

These experiments suggest that when a standard memory span task is used, there appears to be no deficit in STM in dysphorics, either for immediate or delayed recall, compared to controls. The dysphorics seem to show normal memory span performance in terms of capacity, maintenance over unfilled retention intervals, the presence and size of word-length effects and speech rates. These results contrast with the finding of Colby and Gotlib (1988), who reported that dysphorics performed worse than controls at a task involving delayed serial recall of simultaneously presented digits. However, dysphorics showed no deficits on immediate recall, or any evidence of abnormal forgetting for short lists. Both these results are consistent with normal articulatory loop functioning. However, for longer lists, other components would be required to augment performance and to preserve information throughout the extended retention intervals, and it is these conditions which led to a deficit in performance in dysphorics. Colby and Gotlib (1988) suggested that rehearsal processes might be impaired in dysphorics, but articulatory rehearsal alone could not be used to maintain supraspan performance over extended intervals, and hence could not explain the level of performance achieved by their control subjects. One possibility is that the nondysphoric subjects adopted an elaborative strategy.
which increased LTM performance, whereas dysphoric subjects failed to do so. This interpretation is related to the cognitive initiative deficit hypothesis proposing that depression inhibits the spontaneous use of beneficial strategies for good performance in memory tasks unless they are required to do so (Hertel & Hardin, 1991; Hasher & Zacks, 1988; Abramson, et al., 1981).

As this argument that dysphorics did not show memory deficits in the serial recall of digits and words is based on the acceptance of null findings, power analyses on group differences in the total recall performance were conducted with a \( \alpha \) level as .05 to support the argument. Unfortunately, except for experiment 3D the level of power for these experiments was relatively low, suggesting that the current experiments are relatively insensitive to the difference between dysphorics and nondysphorics. The results showed that the power of experiments 3A-3C ranged from .20 to .40, but the power of experiment 3D was about .90. However, across the series of similar independent experimental conditions across various dependent measures such as a speech rate, consistent findings suggests that the lack of group differences can not be solely attributed to the lowered power. In the case of the experiment 3D with a high power of about 90, there was still no depressive performance deficits in the serial component supposed to be responsible for STM when the running memory task was divided into the serial and updating components. This conclusion was also consistent with one drawn by Channon et al. (1993b) study exploring the serial recall in terms of working memory model. Finally to avoid the lack of power and draw a strong conclusion, a further work is required with the increased number of subjects in each group.

The role of negative automatic and task-irrelevant thoughts

In this study, two measures were used to assess the extent to which dysphorics experienced intrusive thoughts during a serial recall task. In agreement with previous investigations, the results of Experiments 3A, 3B, and 3C have shown that naturally
occurring dysphorics report more negative automatic thoughts than controls. There was no evidence of any increase in reported rates of negative thoughts in induced dysphoria. The results for the CIQ, which measures task-irrelevant thoughts, were slightly different, showing an increase in dysphorics in Experiments 3A and 3B, but not Experiment 3C. The number of positive automatic thoughts was also measured using the ATQ in Experiment 3C, and this showed that although naturally occurring dysphorics experienced more negative thoughts during the experiment, they experienced fewer positive thoughts. Thus the interpretation with respect to the number of disruptive thoughts experienced in different mood states, depends to some extent on the measure used.

The main finding here is that the increased frequency of reported irrelevant thoughts in dysphorics does not produce any deficit in memory span. However, several theories of cognitive deficits in depression (e.g. Ellis & Ashbrook, 1988; Hasher & Zacks, 1988) have proposed that depression-related thoughts (a general category which probably includes both negative self-referent and task-irrelevant thoughts), interfere with effortful processing, by competing for limited capacity resources. There are two possible resolutions to this problem. One is that articulatory rehearsal, which is a commonly used STM strategy, may not be an effortful process. This is consistent with a working memory account whereby memory span is carried out by the quasi-autonomous articulatory loop slave system, thus freeing the central executive. By this account, negative thoughts may be severely disruptive to the central executive, but memory span performance is sustained by an unimpaired articulatory loop. Part of the problem here is that the nature of the thoughts themselves is unspecified. If they are auditory-verbal in nature, for example internal speech, it would be expected that they utilise the articulatory loop and possibly interfere with rehearsal. On the other hand, if the thoughts take the form of visual imagery, then no direct competition with the articulatory loop should occur.
The second possible resolution is that whereas negative automatic thoughts were more common in dysphorics, the total frequency of intrusive thoughts, both positive and negative, may not differ between normals and controls. If we assume that positive and negative automatic thoughts are equally disruptive, then no difference in performance between dysphorics and controls would be expected. Strictly, there is no evidence in these experiments to support a particularly disruptive role for negative thoughts on serial recall, since in Experiments 3A and 3B the frequency of positive automatic thoughts was not recorded. But the dysphorics also reported a higher incidence of task-irrelevant thoughts, using the CIQ in Experiments 3A and 3B, but not Experiment 3C. Any conclusion from these findings must be tentative, since the two self-report measures are partially inconsistent. However, if we adopt the CIQ as a true measure of the frequency of task-irrelevant thoughts, then dysphorics (i) do seem to experience more frequent intrusive thoughts than controls but (ii) the occurrence of these thoughts does not impair serial recall.

The effect of dysphoria on articulation rate

Teasdale and Fogarty (1979) measured speech rate as an index of psychomotor retardation in dysphoric mood states. They found that dysphoric mood slowed down speech rate, as measured by an average pause time when subjects were asked to count 1 to 10 in their own time. If this were generally true, then we would expect dysphorics to show impaired memory span, as there is a strong positive relationship between span and speech rate (Baddeley et al., 1975). However our results provide no evidence whatsoever for any speech rate retardation in either naturally occurring dysphorics (Experiments 3A - 3C) or induced dysphorics (Experiment 3C). When subjects are asked to repeat short lists of items as rapidly as possible, dysphorics perform as well as controls. These results support the conclusion that the articulatory loop functions normally in dysphorics. The same conclusion was drawn from the study exploring
phonological similarity and word length effect among clinical depression, which are assumed to tap the articulatory loop component in working memory model (Channon, et al., 1993b).

Dysphoria and central executive functioning

In this study, dysphoria produced a memory deficit only in the running memory span task (Experiment 3D). In this task subjects reported the last six digits of a series in which 6, 8, 10 or 12 digits were shown. There was no effect of mood state when only six digits were presented. In this case the task is equivalent to simple serial recall of a six item list, and the absence of any effect of mood confirms Experiments 3A - 3C. However, a clear difference between dysphorics and controls emerged when rehearsal updates were required. In this task, the component responsible for updating is independent of the articulatory loop, since updating does not interact with the effects of articulatory suppression or unattended speech. Morris and Jones (1990) argue that this component is the central executive. Hence one interpretation of these results is that dysphorics have a deficit in the central executive, an interpretation which is close in spirit to the reduced attentional capacity theories outlined by Hasher & Zacks (1979) or Ellis and Ashbrook (1988). Similarly, Channon et al. (1993b) suggest the possibility of an impairment of central executive in depression because depressed patients showed impairment on backward digit span task, and paced and unpaced auditory serial addition test (PASAT; Gronwell & Sampson, 1974), both of which are assumed to involve central executive capacity.

There is one problem with this interpretation. If the central executive impairment increased the probability of making an error on each update (perhaps by competition from task-irrelevant thoughts), then we should expect the two curves to diverge as the number of updates increased. This does not happen and, as with Morris and Jones' (1990) original data, performance does not decline after the first update. This pattern of results
suggests that the main source of difficulty lies in making the first update. Once this is made, subsequent updates are added without further error. Thus one interpretation of these results is that dysphorics have difficulty in making the appropriate change from a simple rehearsal strategy to an updating strategy.

(4) Automatic and Effortful Processing

A number of studies have drawn the distinction between automatic and effortful processing and have argued that only effortful processing is affected by dysphoria (Hartlage, et al., 1993; Hasher & Zacks, 1979; Colby & Gotlib, 1988). Within this framework, rehearsal is considered by some (e.g., Hasher & Zacks, 1979) to be an effortful process. However the reduced capacity model by Hasher and Zacks (1979) did not clearly distinguish between maintenance rehearsal and elaborative rehearsal (cf. Craik & Lockhart, 1972, Craik & Watkins, 1973; for a review, see Greene, 1987). The maintenance rehearsal is rote, repetitive and prolongs an items' accessibility without leading to permanent memory trace, thus using a minimal cognitive capacity. In contrast, elaborative rehearsal functions to enrich and elaborate the memory trace by adopting process such as chunking, forming images, or recoding material in various way. With this distinction, maintenance rehearsal can be seen as automatic, while elaborative rehearsal as effortful. So the current data suggests that depression do not interfere with maintenance rehearsal, since standard memory span tasks are assumed to rely upon rote rehearsal, which is close to automatic processing. It could be argued that the updating process in the running memory span task is effortful. To avoid circularity, we need to have an independent criterion for establishing whether a task is effortful. The position is currently unsatisfactory, but the results suggest that effortfulness is not identical to task difficulty. When simple memory span was made more difficult by increasing the memory load or word length, no differences were found between dysphorics and controls. It was only when a need for making strategic decisions was added to the task that the effect of
mood became apparent; that is when elaborative rehearsal is required by the task. So with this distinction of types of rehearsal, a more accurate prediction can be made on whether the rehearsal process would be interfered by depression.
CHAPTER 7

Visual Recognition Memory in Naturally Occurring Depression

According to the continuum of automatic vs. effortful processing, the judgement of frequency and the encoding of spatial information was categorised as an automatic process (Hasher & Zacks, 1979). In the judgement of frequency, depressed people could perform as well as nondepressed people (Hasher & Zacks, 1984; Hasher & Zacks, 1979, study 3). However, whether the encoding of spatial location information is made automatically even in the normal population is not clear (cf. Naveh-Benjamin, 1987, 1988, Ellis, 1990). In terms of criteria of automatic processing by defined by Hartlage et al. (1993), and Hasher and Zacks (1979), automatic processing should not be affected by the intentional vs. incidental learning, concurrent memory loads, and individual difference such as depression. Nevertheless, these variables affected memory for spatial location (Naveh-Benjamin, 1988), but not in the Ellis’ (1990) study.

In relation to depression, Cooper and Marshall (1987) could not find any difference between experimentally induced depression and normal controls in the recall of the spatial location geometric figures. On the other hand, using the Block span task based on Corsi’s block sequence span, Richards and Ruff (1989) found that depressed patients performed worse than normal controls in the delayed condition but not in the immediate condition. Similarly, Channon et al. (1993b) did not find a disruptive effect of depression on the block span-immediate measure. Thus current evidence of automatic processing of spatial information has been mixed in both normal and depressed populations.

Little research has been done in the visual STM functioning under depressed mood states, compared to verbal STM. The logic behind the verbal STM in the previous experiments on verbal STM was extended to visual STM functioning in depressives in the following experiments. It is assumed that visual STM is similarly based on rehearsal
processes as in the verbal STM and the question is asked whether depression interferes with delayed recognition of visual matrix patterns, which relies on maintenance rehearsal. If depressives have rehearsal difficulty with visual STM, their recognition of visual stimuli should deteriorate more rapidly over a delay period, relative to the nondepressives.

Experiment 4A

Method

Subjects

The same subjects participated as in experiment 3A with one nondysphoric subject missing resulting in 15 subjects in each group.

Materials

An IBM compatible 286 computer was used to present visual stimuli. 4 x 4 novel abstract patterns were displayed, consisting of a rectangular matrix with cells which could be either filled or unfilled. In each pattern, half of the cells were filled at random, and the patterns were displayed for 2 seconds.

Procedure

Subject were screened out by administering the BDI twice, 2-4 weeks apart. On the initial test, subjects who scores more than 10 or less than 5 on the BDI were selected. The second test was administered on the day of the experiment and subjects who met the same category criteria were included. Half of subjects in each group received the verbal test first and the other half received the reversed order. There was no order effect on total visual recall, t(28) = 1.60, nonsig. The presentation of matrix patterns employed three delayed recognition tests (1, 8, 15 seconds). Each retention interval was tested in 10 trials, totalling 30 trials for each subject. The order of retention intervals was
randomly generated by the computer in each subject. After the retention interval, the same matrix pattern was displayed with one illuminated cell missing. The location of the missing cell was randomly generated by the computer. Subjects were instructed to point to the missing cell. After pointing, the correct cell was displayed on the screen by the experimenter. The number of correct trials, recognising the missing cell, were scored by the experimenter.

Results and discussion

The number of correct trials were transformed into the percentage of total trials and were subject to a two-way ANOVA (2 groups x 3 retention intervals: 1, 8, 15 seconds) with the repeated measure on delays. The percentage of correct trials is shown in the table 7.1 below.

<table>
<thead>
<tr>
<th>Group</th>
<th>Retention intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 second delay</td>
</tr>
<tr>
<td>Nondysphorics</td>
<td>83.33 (14.48)</td>
</tr>
<tr>
<td>(n=15)</td>
<td></td>
</tr>
<tr>
<td>Dysphorics</td>
<td>76.00 (15.95)</td>
</tr>
<tr>
<td>(n=15)</td>
<td></td>
</tr>
</tbody>
</table>

( ) indicates the standard deviations.

In overall performance across retention intervals, nondysphorics appear to recognise more than dysphorics, but it was not statistically confirmed, $F(1,28)= 2.55$ nonsig. No significant effect of group was found, and only a marginally significant effect of retention interval, $F(2,56)=2.63$, $p=.08$, was found.
These results suggest that dysphorics are not different from nondysphorics in their ability to rehearse visual stimuli once they encode it. This argument is based on the finding that recognition performance of dysphorics did not deteriorate over retention intervals more rapidly, relative to nondysphorics. Also a lack of group difference in overall recognition performance implies no encoding difficulties with dysphorics. However, these conclusions seem tentative because the figures in the table show that dysphorics perform consistently worse than nondysphorics across retention intervals. Another possible reason for this null finding in relation to group may be related to the level of complexity of matrix patterns (4 x 4 matrix patterns; 16 cells), which is lower than the average visual memory span (Wilson, Scott, & Power, 1987). The average visual memory span in adults is about 14.3 cells illuminated (about 4 x 7 matrix; 28 cells), which means that the current matrix pattern is relatively easy. With these possible problems considered, the following experiment was designed.

**Experiment 4B**

This experiment is similar to the experiment 4A except that task complexity of the visual matrix patterns and the duration of the retention intervals are increased. A 5 x 5 matrix pattern was used and the increased retention intervals were 1, 15, 30 seconds. Similarly, the purpose of this experiment is to test whether depression interferes with the process of rehearsal of visual stimuli, which underlies visual STM. The number of subjects in dysphoric and nondysphoric groups was 17. All subjects had participated in experiment 3b on the same day. The order between verbal and visual tests was counterbalanced across groups and subjects, and there was no significant effect of order on total visual recall, *t*(32) = .80, nonsig. Other than these changes, all the other procedural details are the same as in the previous experiment.

Results and discussion
The proportion of correct trials is shown in the table 7.2 below. A two way ANOVA (2 groups x 3 retention intervals) was carried out on subjects' percentage of correct trials. As expected, a significant interaction between groups and retention intervals was found, $F(2,64)=3.16, p<.05$. However, as shown in the table, performance of dysphorics does not seem to deteriorate at longer retention intervals, relative to nondysphorics. Similar to the previous experiment, the effect of retention interval was significant, $F(2,64)=6.42, p < .01$, suggesting that overall recognition performance does decrease at longer retention intervals.

Table 7.2 The correct trials (%) in the recognition test of 5 x 5 matrix patterns among dysphoric and nondysphoric groups over three retention intervals

<table>
<thead>
<tr>
<th>Retention intervals</th>
<th>1 second delay</th>
<th>15 seconds delay</th>
<th>30 seconds delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nondysphorics (n=17)</td>
<td>60.59</td>
<td>52.94</td>
<td>46.47</td>
</tr>
<tr>
<td>(16.76)</td>
<td>(22.57)</td>
<td>(24.73)</td>
<td></td>
</tr>
<tr>
<td>Dysphorics (n=17)</td>
<td>50.00</td>
<td>60.00</td>
<td>43.53</td>
</tr>
<tr>
<td>(22.91)</td>
<td>(20.92)</td>
<td>(19.02)</td>
<td></td>
</tr>
</tbody>
</table>

( ) indicates the standard deviations

The simple main effect analysis of the interaction, comparing averaged delayed retention conditions vs. immediate condition, showed that the interaction was attributed to poor performance of dysphorics in the immediate recognition test (1 second delay), suggesting that their poor performance appears to be more associated with encoding difficulty than with the maintenance rehearsal of stimuli, $F(1,32)=4.08, p=.052$. A similar result was found in Sprock, Saccuzzo, and Alkinson's (1983) study. They found that depressed people took longer to form a representation of the stimulus when backward masking was used. These results are contradictory to the rehearsal difficulty hypothesis claiming that the rehearsal process, as an effortful cognitive process, will be impaired in depression.
(Hasher & Zacks, 1979; Colby & Gotlib, 1988). In contrast, Richards and Ruff (1989) did find visual memory deficits as measured by a 20 second interference delayed block span test in depressed outpatients but not in an immediate block span test. The block span test requires subjects to serial recall the locations of blocks, which parallels the digit memory span test. Similarly, Channon et al. (1993b) did not find group difference on immediate block span tests (forward and backward) among depressed patients. These findings suggest that clinical depressives may suffer from impaired maintenance rehearsal, not from encoding difficulty. The lack of group difference in the immediate block span (Channon, et al., 1993b; Richards & Ruff, 1989) contrast with the current result, suggesting an encoding difficulty of visual matrix patterns. This discrepant finding to the current study appears to lie in procedural differences; the current study employed mildly dysphoric students with a recognition test, while they used clinical depression with a recall test. In detail, the visual matrix pattern (12 cells illuminated) used in the current study was fixed in its task complexity, which is close to the average adult visual span (14.3 cells, Wilson, et al., 1987). The block span test increases its complexity when subjects are successful in the same level.

In addition, Richards and Ruff (1989) found depressive impairment in visuospatial learning (Ruff-Light Trail Learning Test) but only minimal verbal learning difficulties (Selective Reminding Test). Nor did they find memory span deficits in the forward digit span test. On the basis of these results they claimed differential effects of depression on visuospatial and verbal functioning. This differential effect of depression on visual and verbal memory seems consistent with the current experiments provided that the task difficulty across verbal and visual memory tasks used in the current experiments is comparable. In effect, both 7 digit memory span and 5 x 5 matrix pattern tests appear comparable in terms of task difficulty because both of them are close to the average memory span of adults. Tentatively, it can be concluded that visuospatial memory
functioning seems to be more impaired by depression than verbal memory span as long as both visual and verbal memory span are underlied by maintenance rehearsal.

These results can be explained in terms of the working memory paradigm. In the normal population, Morris (1987) explored the relationship among the central executive, the visuo-scratch pad, and articulatory loop using visual patterns. He contends that the maintenance rehearsal of visual patterns requires minimal resources of the central executive, on the basis of the finding that once the encoding of visual pattern is accomplished, delaying recall (20 seconds) did not cause a dramatic decline in performance. In contrast, he claimed that encoding of visual patterns requires some portion of the central executive resources. According to this argument, the current lack of an effect of retention interval suggests that the visuo-spatial scratch pad remains intact, accounting for the maintenance of rehearsal in dysphoric mood states. Rather, these results suggest inefficient functioning of the central executive because difficulties of dysphorics appear to lie in the encoding of visual stimuli. A possible reason for this encoding difficulty is that dysphoric students do not pay full attention to the visual stimuli due to their narrowing of attention due to depressive thoughts. This assumption was supported from the results from the ATQ-N and the CIQ.

Dysphorics reported more frequent negative automatic and task-irrelevant thoughts, relative to nondysphorics, $t(32)=2.31, p < .05$, $t(31)=3.39, p < .01$ respectively. However, correlation of these measures with performance was not significant, $r=.07$, $r=-.04$ on the ATQ and CIQ respectively. The only significant correlation was found on a separate question of “how much your mind wanders while you were doing the experiment” on the CIQ, $r=-.33$ (one-tailed).

Finally, as a cautionary note, the power analysis was conducted on their total recognition performance in experiment 4A and 4B because no difference between groups could be found due to the lack of statistical power. Both analysis showed that the levels of power at $\alpha=.05$ was .55 and .31 in experiment 4A and 4B respectively. These
relatively low power values suggest that the lack of difference in between groups may be partly attributable to a insufficient statistical power. Therefore, whether rehearsal process is impaired by depression, requires a further work with a more powerful experimental design.
CHAPTER 8

Summary and Discussion

Several reviews showed that depression is characterized by memory deficits, but did not discuss the distinction between short-term and long-term memory and any differential predictions that might be made (Hasher & Zacks, 1979; Hartlage, et al., 1993; Burt, Zembar, & Niederehe, 1995; Ellis & Ashbrook, 1988). They put depressive memory deficits on an automatic vs. effortful processing continuum (e.g., Hartlage, et al., 1993) but such a cognitive effort approach was criticized by the lack of independent measures of effort expended. Mitchell and Hunt (1989) claimed the concept of cognitive effort as a cause-effect explanatory framework was inadequate for memory performance. The cognitive effort account for depressive memory deficits was challenged by the reduced initiative hypothesis, which restricted the cognitive effort account and can lead to a more specific prediction of depressive memory deficits (e.g., Hertel & Hardin, 1991; Channon et al., 1993a).

There are several reasons why it is important to investigate depressive memory deficits, particularly on neutral materials, without implication of emotional contents. According to Williams et al. (1988), some studies related to “mood and memory” included only positive and negative materials without neutral materials, which provide a baseline performance against which effects on emotional materials may be judged. Another reason is that the neuropsychological tests for diagnosis rely on neutral materials. As depression occurs concomitant with other mental disorders, it can be a confounding factor affecting their performance (cf. Richards & Ruff, 1989; Gibson, 1981). In this regard, it is important to determine whether depression interferes with performance on neutral materials.

The thesis aimed to explore depressive memory deficits in terms of long-term memory and short-term memory. The long-term memory process was investigated
employing an elaboration precision manipulation in a subject-generated task condition, and short-term memory was examined using memory span, including both verbal and visual tasks. In addition, due to some drawbacks with current mood induction procedures (Clark, 1983), and some difficulties recruiting naturally occurring depressives, the combined method of VMIP and MMIP (Music Mood Induction Procedure) was developed and its effectiveness in terms of duration and intensity of induced depression was evaluated compared to the VMIP and MMIP over time.

Another focus of the thesis was to explore the role of negative/positive automatic thoughts, and task-irrelevant thoughts in task performance. It is generally accepted that such thoughts, particularly negative cognitions, have disruptive effects on task performance for one reason or another, depending on the theoretical framework (e.g., Hasher & Zacks, 1988; Kuhl & Helle, 1986; Ellis & Ashbrook, 1988). However, most studies of memory performance did not measure the frequency of depressive thoughts even if they attribute memory deficits to depressive thoughts (e.g., Krames & McDonald, 1985). Moreover, it is not clear which attribute of depressive thoughts are responsible for memory deficits; for example, frequency, controllability, individual meaningfulness, or content of the thoughts (positive vs. negative). Contrary to such impairing effects of depressive thoughts on memory performance predicted by the major theoretical frameworks, Williams et al. (1988, chap. 2) suggested that it is not clear whether such depressive thoughts are negatively correlated with performance.

8.1 Duration and Intensity of Induced Depression by the Combined VMIP and MMIP

As an alternative approach to natural depression, the VMIP has been widely employed to study depression-associated variables such as negative memory bias, and psychomotor retardation in the context of experimentally induced depression. Despite its convenience, several problems using the VMIP were raised (e.g., Polivy & Doyle, 1980;
Sutherland, et al., 1982); for example, demand characteristics, suggestibility of subjects, and multiple affects induced. The problem of the VMIP, related to the current studies is that the duration of induced depression by the VMIP may not be long enough for some investigators to complete the task (cf. Clark, 1983; Ellis & Seibert, & Herbert, 1990; Polivy, 1981, study 2). Thus, inconsistent findings in cognitive and behavioural variables may be attributed to a short-lived induced depression (Clark, 1983). The current study investigated the relative effectiveness of the combined procedure of the VMIP and MMIP in terms of duration and intensity over time. Four mood induction procedures were compared, while subjects undertook a sentence completion task: (i) the reduced VMIP, (ii) the MMIP (iii) the VMIP plus MMIP, and (iv) Neutral music procedure. As predicted, the VMIP plus MMIP showed a more stable and strong mood change than either the VMIP or MMIP as measured by the DACL and VAS-depression. Compared to the VMIP plus MMIP, the VMIP alone elevated depressed mood to the same extent in the beginning, but it dissipated rapidly over time. The effects of MMIP on mood were weaker than either the VMIP plus MMIP or the VMIP, but lasted longer than the VMIP. In sum, these results suggest that the transience of depression induced by the VMIP could be overcome by playing music throughout an experimental session, provided that the music does not interfere with the cognitive task studied. The level of anxiety was elevated by all depression mood induction procedures, but dissipated over time. This coexistence of depressed and anxious mood states imitates naturally occurring depression (cf. Watson & Kendall, 1989). Taken together, these results suggest that the VMIP plus MMIP is a better method than either MMIP or VMIP alone.

8.2 Long-term Memory and Precise Elaboration.

Several studies suggest that depressive memory deficits will be found in tasks requiring elaborative processing (Hasher & Zacks, 1979, 1988; Williams, et al., 1988; Ellis & Ashbrook, 1988; Hartlage, et al., 1993; Weingartner, et al., 1981). This
prediction is based on the idea that shallow and weak elaborative processing occurs due
to the reduced capacity and/or inadequate allocation of processing resources to neutral
materials, relative to depressive thoughts. This prediction of poor/shallow elaboration in
depression was tested in terms of the precise elaboration hypothesis (experiment 1A, 1B,
and 1C). This precision of elaboration hypothesis maintains that in a relatively novel and
new situation, the extent of learning and recall is determined by the quality of elaboration
(precision) rather than the amount of elaboration (Stein & Bransford, 1979; Stein, et al.,
1982; Stein, et al., 1984). That is, information (elaboration) clarifying the seemingly
arbitrary relationship often encountered in a new situation can facilitate the acquisition of
the knowledge. In a relatively arbitrary situation, the questions subjects ask to lessen the
arbitrary relationship play an important role.

This precise elaboration hypothesis was applied to depression to explore how
shallow elaborative processing is reflected in the subject-generated elaboration paradigm
used by the Stein and Bransford (1979), and whether the extent of precise elaboration is
differentially affected by the types of task instruction for sentence continuation.

In experiment 1A with an ambiguous task instruction, subjects were allowed to
continue a base sentence with either a precise or an imprecise elaboration at their will.
The results showed overall recall deficits in dysphoric subjects, but that the extent of
precise elaboration was comparable in both groups. Considering precision of elaboration,
contingent upon recall accuracy (recalled or not recalled), nondysphoric subjects recalled
more target adjectives from more precisely elaborated contexts, while dysphorics did not
show such a difference. However, such overall recall deficits were not supported by the
extent of precise elaboration because both groups did not differ in terms of the extent of
precise elaboration. Rather, these results suggested that dysphoric subjects may have
difficulties retrieving such precise elaborations as they could elaborate the base sentence
as precisely as nondysphoric students.
From the perspective of the reduced capacity and resource allocation models, overall recall deficits support the reduced capacity model, but on the other hand, the same extent of precise elaboration contradicts the suggestion of poor elaborative processing in depression (e.g., Weingartner, et al., 1981; Hasher & Zacks, 1988). One possible reason for the same precision of elaboration seems related to the uncontrolled/ambiguous task instruction, possibly letting subjects speak the first thought which pops into their mind. In regard to the precision of elaboration contingent upon the recall accuracy, the reduced initiative hypothesis and lowered self-initiative proposal appear to be more adequate in explaining such a group difference. That is, lowered self-initiative prevented depressed subjects from accessing the memory trace of their own precise elaboration at the retrieval phase. Furthermore, in a situation like an incidental recall, self-initiated activities for accessing their own elaborations seem more necessary for good performance. In the case of Hertel and Hardin’s (1991) study depressive memory deficits were found in a context requiring initiative from subjects.

Alternatively, such a group difference in the relationship between recall accuracy and the extent of precision of elaboration could be explained in terms of a response bias (e.g., Miller & Lewis, 1977; Larner, 1977; Dunbar & Lishman, 1984). Depressed subjects are less willing to access the memory trace during later recall or produce the recalled item as a response even though their elaborations are as precise as nondysphorics. However, to exclude the possibility of response bias, subjects were instructed to guess if they did not know the answer. These results led to two subsequent experiments, examining the retrieval phase and task instruction (encoding phase) respectively.

Some changes were made in experiment 1B; subjects were administered the BDI twice, and only subjects who did not change their group category on two occasions were included for the experiment according to the suggestion from Kendall et al. (1987), and they were given a more specific task instruction (“continue each sentence in a
Experiment 1B aimed to test whether the availability of their own elaboration differentially affected nondysphoric and dysphoric subjects. The results showed that the elaborated retrieval condition enhanced recall, compared to the nonelaborated retrieval condition, but the retrieval condition did not interact with group. Thus, it does not seem that dysphoric subjects' access to their own elaborations at the retrieval phase is impaired due to lowered self-initiative.

In experiment 1C, task instruction was manipulated; specific instruction vs. nonspecific instruction conditions. In recall performance, dysphoria interacted with task instruction. Nondysphoric subjects enhanced their recall in the specific instruction condition, while dysphoric subjects did not. Nondysphoric subjects recalled more target adjectives in the specific instruction condition than did dysphoric subjects, while in the nonspecific instruction, there was no difference between the groups. This enhanced recall of nondysphoric subjects in the specific instruction condition replicated the previous studies in the normal population (e.g., Stein & Bransford, 1979; Stein, et al., 1982). In relation to the precision of elaboration rating scores, nondysphoric subjects elaborated base sentences in a more precise way than dysphoric subjects. However, the nonspecific instruction condition received a more precise elaboration rating, than the specific instruction condition. The extent of precision of elaboration was positively associated with the recall of target adjectives, whereas the severity of depression measured on the BDI was negatively correlated with the extent of precise elaboration. These results suggest that the more precisely elaborated target adjectives have a higher chance of being recalled and that depression interferes with precise elaboration. Regarding recall accuracy contingent upon the extent of precise elaboration, both groups recall more target adjectives from more precisely elaborated contexts. One unexpected finding in the precise elaboration rating that the superiority of the nonspecific instruction condition to the specific instruction condition seemed to be attributed to the process of the rating procedure. Raters judged each short phrase generated by subjects in terms of its
relevance to its target adjective, which could give rise to more precise elaborating scores to the nonspecific task instruction. To exclude this possibility, a new rating was conducted with a different rating instruction in which raters attempted to evaluate sentences in a manner close to the specific task instruction - how well does the completion explain why the action described was performed by that particular person. However, this new rating procedure yielded very low intercorrelations among three raters; none of the correlations among the three raters was significant. The failure to obtain a significant correlation among raters suggests that it is very difficult to evaluate sentences consistently in the "why-question" context. Examination of the subjects' responses revealed that very few of the sentences were elaborated in the way the instructions requested. It may be that the elaboration task was too difficult for the subjects in this experiment. This argument was also evidenced by low average elaboration scores by the three raters (2.25 (SD=.66), 2.46 (SD=.72), and 2.99 (SD=.85), on the 5 point scale), suggesting that in general they elaborated less precisely than the average (3 on the scale). So easier sentences are required for subjects to elaborate in a more precise way, whose precision of elaboration can be evaluated in a more systematically by raters.

In conclusion, from the perspective of the long-term memory functioning in the area of subject-generated precise elaboration, the elaboration activity of dysphoric subjects depends upon the task instruction about how to continue base sentences with short phrases, showing elaboration deficits (experiment 1C). In contrast, nondysphoric subjects appear to elaborate base sentences in a precise way spontaneously regardless of task instruction and then take advantage of them for later recall. In terms of recall performance, dysphorics show performance deficits in a more uncontrolled task instruction (experiment 1A), probably allowing their attention to wander from the task. When a more specific task instruction is given (experiment 1C; Why-question) with its aim to reduce the arbitrary relationship to the base sentence, they did not make good use
of it, showing recall deficits, compared to nondysphoric subjects. In general, these results lend more support to the reduced initiative hypothesis (Hertel & Hardin, 1991; Hertel, 1994) and to lowered self-initiated activity hypothesis (Hasher & Zacks, 1988; Abramson, et al., 1981) than to the capacity-reduced hypothesis. However, it is not clear that the lack of cognitive initiative of elaboration activity in depression originated from motivational or cognitive deficits (Hertel & Hardin, 1990). As the reduced initiative was later called reduced cognitive control (Hertel, 1994), it seems related to cognitive deficits due to reduced capacity. If so, the reduced initiative hypothesis become very similar to lowered self-initiated activity attributed to the reduced processing resources (Hasher & Zacks, 1988). However, from overall recall performance of three experiments, it is difficult to claim that total available capacity is reduced in depression. Rather, their allocation of resources is inadequately directed to self-relevant/other task-irrelevant environments as measured by the ATQ-N/P and CIQ by narrowing attentional focus. Despite this theoretical ambiguity with reduced initiative hypothesis, more researches on the cognitive strategies can be conducted owing to the specific prediction the model can offer, compared to the reduced capacity model. As Ellis (1990) claimed, contribution of reduced initiative hypothesis might lie in the locus of depressive effect. Further work is required to examine whether total capacity is reduced in an absolute term.

8.3 Short-term Memory.

Many of the published studies on short-term memory in depression are sketchy and did not use a standard method. Furthermore they have some methodological problems such as statistical regression because depressed subjects serve as their own controls (cf. Colby & Gotlib, 1988). Channon et al. (1993b) also pointed out that studies of STM in depression have been conducted without a clear-cut theoretical framework. As with Channon et al.'s (1993b) study, the current studies were conducted in terms of the working memory model. One of the aims of the experiments was to test the rehearsal
difficulty hypothesis proposed by Colby & Gotlib (1988). Hasher and Zacks (1979) classified rehearsal as an effortful process, suggesting depressive memory deficits will be found in tasks requiring a rehearsal process. Similarly, Krames and McDonald (1985) also suggest that depression will interfere with the maintenance of information in STM due to depressive thoughts. Several other studies also suggest STM deficits (e.g., Friedman, 1964; Rappaport, 1968, Henry, et al., 1973). This rehearsal difficulty hypothesis was tested using several different paradigms including both verbal and visual STM; experiment 3A and 3B employed standard verbal memory span for digits with varying retention intervals, experiment 3C examined the word length effect, experiment 3D running memory span, and experiment 4A and 4B visual matrix patterns with varying retention intervals.

8.3.1 Digit Span Memory and Word Length Effect in Depression

Contrary to the prediction of short-term memory deficits, experiment 3A employing 6 digits, showed that dysphoric subjects did not show overall memory deficits and also depression did not interact with retention interval. According to the rehearsal difficulty hypothesis, dysphoric subjects should have shown more loss of information over longer retention intervals. This result was replicated in experiment 3B using 7 digits with longer retention intervals, relative to experiment 3A. These results suggest that depressed people can encode as effectively as nondepressed people and maintain information in STM as well as nondepressed people, in spite of the more frequent depressive thoughts reported by dysphoric subjects during an experiment. In terms of automatic vs. effortful processing, these results suggest that maintenance rehearsal may not be seen as an effortful process. According to the working memory model, these results can be explained as that the articulatory loop responsible for rehearsal remains intact in depression. To examine the articulatory loop in depression, the word length effect was investigated in experiment 3C with short and long words. If dysphoric
students have a problem with articulatory functioning, they should show a smaller word length effect, compared to nondysphoric students. However, dysphoric subject showed the same word length effect as nondysphoric subjects, confirming the earlier results that articulatory rehearsal in depression remains intact. This argument was further supported by the lack of difference in speech rate between nondysphoric and dysphoric subjects. These results are consistent with the Channon et al. (1993b) study testing the articulatory loop using the phonological similarity effect, forward digit span, and word length effect.

One problem with this interpretation is based on the fact that power in these verbal short-term memory experiments was low, suggesting relative insensitivity of experiments. However, considering these experiments (3A, 3B, 3C), close to independent replications, leading to consistent data, these null findings do not necessarily seem to be related to insensitivity of experiments. In the following experiment 3D, where power is high, serial component did not differ between groups. In addition, a series of experiments by Channon et al. (1993b) drew a same conclusion; articulatory loop responsible for serial recall remain intact.

8.3.2 Running Memory Span in Depression

Considering these results, depression may interfere with the operation of the central executive, which regulates and coordinates attentional resources among its subcomponents and appears to be called in on tasks involving a high mental load such as cognitive strategy selection and decision making. To test this assumption, the running memory span task was employed in experiment 3D. The task is considered as consisting of serial recall and updating components, tapping the articulatory loop and central executive respectively (Morris & Jones, 1990). Thus, if depression reduced capacity in the central executive, dysphoric subjects should show memory deficits in the updating component rather than in the serial recall component. Consistent with this assumption, the updating process leads to memory impairment in depression, while the serial
component remains intact, confirming the results of experiment 3A-3C. These results suggest that depressive STM deficits do not come from a deficit in simple maintenance rehearsal, but from a deficit in elaborative rehearsal requiring cognitive strategy such as in the updating component, suggesting an impairment of central executive functioning. The possibility of impairment in the central executive was also suggested by the Channon and Robertson (1993b), and Channon and Baker (1994) studies employing different tasks such as backward digit span, which are assumed to involve central executive capacity.

8.3.3 Maintenance vs. Elaborative Rehearsal

Several studies mentioned earlier suggest rehearsal difficulty or STM deficits in depression, but they did not clearly distinguish between maintenance and elaborative rehearsal. Several studies with nondysphorics made a distinction between these two types of rehearsal (cf. Craik & Lockhart, 1972, Craik & Watkins, 1973; for a review, see Greene, 1987). Maintenance rehearsal is rote, repetitive and prolongs an items' accessibility without leading to permanent memory storage, thus using minimal cognitive capacity. In contrast, elaborative rehearsal functions to enrich and elaborate the memory trace by adopting processes such as chunking, forming images, or recoding material in various ways. With this distinction, maintenance rehearsal such as in experiment 3A-3C appears to underly the articulatory loop, while elaborative rehearsal such as in the updating processing involves central executive resources. So the current data (experiment 3A-3C) suggests that depression does not interfere with the articulatory loop functioning, and that depression impairs central executive functioning. A similar interpretation is feasible when automatic vs. effortful processing is equated with maintenance vs. elaborative rehearsal respectively. However, to avoid circularity, we need to have an independent criterion for establishing whether a task is effortful. The position is currently unsatisfactory, but the results suggest that effortfulness is not
identical to task difficulty. When simple memory span was made more difficult by increasing the memory load or word length, no differences were found between dysphorics and controls. It was only when a need for making strategic decisions was added to the task that the effect of mood became apparent; that is when elaborative rehearsal is required by the task. So with this distinction between types of rehearsal, a more accurate prediction can be made on whether the rehearsal process would be interfered with by depression.

8.3.4 Visuo-spatial Memory of Matrix Patterns

Hasher and Zacks (1979) claimed that spatial information is automatically processed, hence is not impaired by depression. However, there is controversy as to whether visuo-spatial memory is an automatic process even in the normal population (cf. Naveh-Benjamin, 1988; Ellis, 1990). In the case of the depressed population, when the Corsi block span task was used, an immediate recall did not show any difference between a depressed group and normal controls (Channon, et al., 1993b; Richards & Ruff, 1989), but the delayed condition showed memory deficits (Richards & Ruff, 1989), suggesting a rehearsal difficulty. The current thesis was interested in whether depression impairs the rehearsal process underlying visual STM (visuo-spatial sketch pad) in the visual recognition memory of matrix patterns with varying retention intervals. Assuming that the rehearsal difficulty hypothesis is extended to the visual STM, it was expected that dysphoric subjects would show a more dramatic decrement at longer retention intervals, compared to nondysphoric subjects. Contrary to this prediction, experiment 4A (4 x 4 matrix patterns) showed no interaction between group and retention intervals. Once dysphoric subjects encoded visual stimuli, they could maintain the stimuli as well as nondysphoric subjects. However, when the complexity of the matrix patterns increased to 5 x 5 patterns, an interaction between group and retention interval was found (experiment 4B). The source of this interaction lies in immediate recognition rather than
delayed recognition, suggesting encoding difficulty rather than difficulty in rehearsal of visual patterns. As with experiment 4A, once dyphoric subjects encode visual stimuli, they could maintain the stimuli as well as nondysphoric subjects. In terms of the working memory model, these results were interpreted as that the visuo-spatial sketch pad remain intact, but central executive function is impaired. This interpretation is made on the basis of Morris' (1987) study, which he argued showed that encoding of visual patterns requires some portion of the central executive resources, while maintenance rehearsal of visual patterns requires minimal resources of the central executive. Taken together with verbal short-term memory, these results suggest that i) regardless of verbal and visual stimuli, tasks requiring maintenance rehearsal are impervious to depression, ii) both the articulatory loop and the visuo-spatial scratch pad remain intact in depression and iii) central executive functioning appears to be impaired.

8.4 Depressive Thoughts and Memory Performance

Negative self-referent cognitions were considered as an etiological factor in the maintenance and exacerbation of depression, and their impairing effects on performance were also examined. In effect, throughout LTM and STM tasks, dysphoric students reported having experienced negative self-referent thoughts as measured by the ATQ-N. This result means that depression is characterized by a preponderance of negative thoughts and supports the idea that this negative tendency plays an important role in the maintenance of depressed mood. The opposite pattern is true of nondysphoric subjects; they reported more positive automatic thoughts, relative to negative automatic thoughts. These results suggest that depression regulates the accessibility of negative/positive automatic thoughts; depression increases the accessibility of negative thoughts, while reducing positive automatic thoughts. However this heightened accessibility of negative automatic thoughts was not replicated in the depression induced by the VMIP, suggesting that an enduring characteristic, such as a negative self-schema is responsible
for negative thoughts rather than temporarily induced depression (experiment 3C). On the other hand, elated mood states increase the accessibility of positive automatic thoughts. These asymmetric effects of depressed and elated mood induction seem to lend more support to "cognitive priming" rather than mood effects itself (Riskind, et al. 1985). In the case of nondysphoric subjects, positive information congruent to their schema in the elation condition easily primed self-schema, leading to an increased accessibility of positive automatic thoughts, while noncongruent information to their schema such as in the depression induction did not.

However, when the frequency of negative thoughts is correlated with task performance, the expected negative correlation is not obtained, which is contradictory to the disruptive role of negative thoughts assumed by several theoretical frameworks (Beck, 1967; Brown, 1988; Hasher & Zacks, 1988; Ellis & Ashbrook, 1988). Several reasons for this can be suggested. First, negative automatic thoughts generated consciously or unconsciously require minimal attentional resources, thus do not impair performance on the criterial task (Bargh & Tota, 1988). Second, when frequencies of negative and positive automatic thoughts within each individual are combined, their total frequency did not differ in nondysphoric and dysphoric groups. As with negative thoughts, if positive thoughts are assumed to be disruptive to performance, there should not be any between-group difference in performance (cf. Seibert & Ellis, 1991). Third, what matters in relation to performance may not be the frequency dimension of negative thoughts, but some other dimensions such as controllability, personal meaningfulness, and intensity. Unless negative thoughts are directly manipulated or investigated, the role of negative thoughts regarding performance is tentative. Rather than negative automatic thoughts, in general task-irrelevant thoughts/mind-wandering as measured by the CIQ, seem to be a better predictor of performance. This is because the CIQ includes both negative self-referent and task-irrelevant thoughts. Particularly the indice of mind-wandering was the best predictor of performance compared to other measures such as
the BDI, ATQ-N/-P, and CIQ in experiment 3C. Dysphoric subjects let their mind wander more frequently than nondysphoric subjects do, suggesting a concentration difficulty.

8.5 Conclusion

Elaborative activity plays an important role in acquiring new information. Sometimes, elaborative information is provided by the experimenter, but to learn effectively, subjects themselves have to generate their elaborations by utilizing prior knowledge to acquire new, seemingly arbitrary information. By doing so, more durable and distinctive memory traces could be laid down and subsequently could be utilized to facilitate recall. However, just adding semantically congruous information to the current context does not seem to be sufficient to facilitate learning and recall, rather, regardless of the amount of information added, the quality (precision) of information added is more important in a novel situation; that is, lessening the arbitrariness characterising new information by being associated with prior knowledge and thus laying down a more distinctive memory trace. This assumption was tested through the processing of arbitrary sentences, an analogue to a novel situation, among nondysphoric and dysphoric subjects. Dysphoric subjects appear to have some difficulty utilizing prior knowledge to generate more precise elaborations, particularly when they are prompted to do so by the task instruction. However, once they produce a precise elaboration, they can make use of their own elaborations as effectively as nondysphoric people (experiment 1C). These results suggest some difficulties of dysphorics in learning in a new situation by initiating precise elaboration, i.e., utilizing prior knowledge or experiences to make the context more meaningful. Furthermore, as depression gets severe, it seems that depressed people find it more difficult to use prior knowledge for precise elaboration. In general these results appear to be consistent with the reduced initiative hypothesis focusing on the initiation of effortful processing. Other supporting evidence to the reduced initiative
hypothesis is that nondysphoric subjects make good use of their own elaborations consistently regardless of task instruction (more or less controlled) for later performance, while dysphoric students are sensitive to the task instruction in both elaboration and recall. In a broad sense, these results put constraints on a general elaboration deficit hypothesis. This is because elaboration activity can be affected by the task instruction.

The short-term memory functioning in dysphoric people can be accommodated by the working memory model. Contrary to the rehearsal difficulty hypothesis, the articulatory and visuo-scratch pad seem to be intact (experiment 3A-3C). Rather, they have difficulty using cognitive strategies involving the central executive, as shown in the running memory span task. Consistent with these results, in the recognition test of visual matrix patterns, dysphoric subjects showed problems with encoding, involving the central executive rather than maintenance rehearsal of visual patterns over the retention interval. In sum, dysphoric people have difficulties using elaborative rehearsal rather than maintenance rehearsal. The simple rehearsal difficulty hypothesis should be refined to accommodate such differential effects of depression on maintenance vs. elaborative rehearsal. As with the long-term memory findings, these results lend support to the reduced initiative hypothesis because dysphoric subjects have difficulties in employing/initiating cognitive strategies.

For an analogue study of depression, the combined method of the VMIP and MMIP looks desirable particularly if researchers are interested in the measurement of cognitive and behavioural variables. The combined method is more effective than either the VMIP or MMIP alone in terms of duration and intensity of initially induced depression.

Finally, performance correlates of negative self-referent thoughts as measured by the ATQ-N are not apparent across long term and short-term memory tasks. These results hold even though dysphoric subjects show dysfunctional thinking in terms of a higher proportion of negative automatic thoughts. These findings suggest that negative
automatic thoughts can be processed unconsciously or consciously without placing a high mental load on attentional resources. Or assuming that positive automatic thoughts play a similar role to negative automatic thoughts during the task as intrusive thoughts, the equal number of automatic thoughts in both nondysphoric and dysphoric subjects can suggest no difference in performance. A better predictor of performance in both long-term and short-term memory was mind-wandering, suggesting that dysphoric students lose their concentration more frequently than nondysphoric subjects. In future studies, other than the number of automatic thoughts, other dimensions such as personal meaningfulness and intensity should be taken into account in explaining performance deficits. These results hold for naturally occurring dysphorics, but not for experimentally depressed people, suggesting that the heightened accessibility of negative self-referent thoughts as measured by the ATQ-N appears to be associated with more enduring attributes of naturally occurring depressed people rather than temporarily induced depression.

8.6 Qualifications of the Present Thesis and Suggestions for Future Research

First of all, all experiments reported here were based on a mildly/moderately depressed student population. Even if results from analogue studies using a student population are claimed to be applicable to a clinical population, a direct investigation of the precise elaboration hypothesis and running memory span task in clinical population seems worthwhile.

In detail, in regard to the selection of dysphoric students, a simple two stage selection method using the self-reported measure of depression does not appear to be sufficient to guarantee a stable depressed group. In addition, using a diagnostic criteria for depression is more desirable to obtain a clear-cut result. Particularly, this issue is related to experiment 1A using a median split method upon completion of an experimental task. In general, most studies on depression excluded subjects scoring from
6 to 9 on the BDI. However, experiment 1A included such subjects, causing some problems in comparing its results to the other two experiments (experiment 1B and 1C).

In future studies exploring negative/positive automatic thoughts in memory performance, rather than the correlational method used in the current experiments, more direct investigation on negative self-referent thoughts is required. After selecting a depressed population, a further screening procedure may be conducted to single out people who experience certain types of negative automatic thoughts frequently and a further experiment carried out to investigate the effects of such thoughts on memory performance. One study (Sutherland, et al., 1982) employed a similar procedure but they did not examine the effects of such thoughts on memory performance.

In relation to the visual recognition test of matrix patterns, the current two experiments only employed a fixed level of complexity of matrix patterns with varying retention intervals. The development of a corresponding visual running memory span task to the verbal running memory is required to investigate whether differential effects of depression on serial vs. updating components found in the verbal running memory span task, can be replicated with visual stimul. Also the current suggestion of the impairment of central executive functioning should be further explored using different types of task assumed to involving central executive capacity. If depressives suffer from impaired use of cognitive strategy in the running memory span task, the provision of a helpful cognitive strategy performing a running memory span should remove depressive memory deficits. In regard to the rehearsal difficulty hypothesis in both short-term and long-term memory aspects, further study is required to investigate whether maintenance vs. elaborative rehearsal is differentially affected by depression.

Finally, as discussed in the relevant sections, the insufficient power shown in both verbal and visual experiments requires the replication and extension of previous experiments with a sufficient power to confirm the argument that rehearsal process remains intact in depressed mood states.
References


APPENDICES
Appendix A

Base sentences used in Experiment 1A.

1. The funny man bought the cake.
2. The tall man purchased the crackers.
3. The rich man bought the paint.
4. The grey-haired man carried the bottle.
5. The bold man used the telephone.
6. The angry man watched the T.V.
7. The rude man climbed up the ladder.
8. The happy man used the charcoal.
9. The short man put up the tent.
10. The greedy man kicked the ball.
11. The slow man went to the library.
12. The handsome man listened to music.
13. The quite man got a hair-cut.
14. The brave man went into the house.
15. The lucky man cleaned the floor.

Appendix B

Base sentences used in Experiment 1B.

1. The hungry man bought a tie.
2. The short man put up the tent.
3. The funny man bought the cake.
4. The rich man bought the paint.
5. The clumsy man cut the paper.
6. The tall man purchased the biscuits.
7. The thin man found the scissors.
8. The polite man used the telephone.
9. The rude man climbed up the ladder.
10. The slow man went to the library.
11. The handsome man listened to music.
12. The grey-haired man opened the fridge.
13. The brave man went into the house.
14. The lucky man cleaned the floor.
15. The strong man read the book.
16. The fat man went to the station.
17. The quite man got a hair-cut.
18. The young man drove the car.
19. The friendly man ate the dinner.
20. The outgoing man looked at his picture.

Appendix C

Base sentences used in Experiment 1C.

1. The angry man watched the TV.
2. The kind man ate dinner.
3. The fat man wore the shoes.
4. The strong man read the book.
5. The frightened man walked up the steps.
6. The brave man gave money to the robber.
7. The old man bought the paint.
8. The funny man bought the ring.
9. The smart man went to work.
10. The short man put up the tent.
11. The lucky man walked home.
12. The greedy man kicked the ball.
13. The tall man purchased the biscuits.

14. The slow man went to the library.

15. The thin man found the scissors.

Appendix D

List of words used in Experiment 3C.

Zinc/Deer/Perth/Maths/Stove
Aluminium/University/Refrigerator/Louisiana/Periodical
Coonabarabran/Periodical/Tuberculosis/Aluminium/University
Scroll/Deer/Greece/Mumps/Perth
Greece/School/Deer/Maine/Mumps
Maine/Zinc/School/Perth/Maths
Aluminium/Coonabarabran/Physiology/Yugoslavia/Tuberculosis
Mumps/Stove/Greece/Zinc/Maine
School/Mumps/Maine/Greece/Scroll
Perth/Maths/Deer/Scroll/Stove
Zinc/Scroll/Maths/Deer/Perth
Louisiana/Yugoslavia/Tuberculosis/Physiology/Periodical
Deer/School/Maine/Perth/Zinc
Physiology/Tuberculosis/Aluminium/Coonabarabran/Louisiana
Deer/Perth/Maths/School/Zinc
Louisiana/Refrigerator/Periodical/University/Hippopotamus
Perth/Maine/Scroll/Deer/School
Mumps/Zinc/Scroll/Stove/Maths
Tuberculosis/Physiology/Yugoslavia/Hippopotamus/Coonabarabran
Refrigerator/Hippopotamus/Yugoslavia/University/Tuberculosis
Greece/Stove/School/Maine/Scroll
Hippopotamus/Louisiana/Aluminium/Refrigerator/Coonabarabran
Maths/Maine/Stove/Greece/Mumps
Yugoslavia/Coonabarabran/University/Tuberculosis/Aluminium
Periodical/Refrigerator/Louisiana/Aluminium/University
Scroll/Greece/Mumps/Stove/School
Coonabarabran/Periodical/Refrigerator/Louisiana/Aluminium
Yugoslavia/Louisiana/Physiology/Coonabarabran/Hippopotamus
Periodical/Aluminium/Hippopotamus/Refrigerator/Physiology
Stove/Maths/Perth/Scroll/Greece
University/Tuberculosis/Coonabarabran/Physiology/Yugoslavia
University/Aluminium/Coonabarabran/Tuberculosis/Physiology
School/Greece/Mumps/Zinc/Maine
Tuberculosis/University/Hippopotamus/Yugoslavia/Refrigerator
Maine/Perth/Zinc/Maths/Deer
Refrigerator/Physiology/Periodical/Hippopotamus/Louisiana
Stove/Mumps/Zinc/School/Greece
Physiology/Hippopotamus/University/Periodical/Yugoslavia
Maths/Scroll/Stove/Mumps/Deer
Hippopotamus/Yugoslavia/Louisiana/Periodical/Refrigerator
Appendix E

Table 4.2 Analysis of Variance on Mean Recall Scores in Experiment 1B

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Table 4.3 Analysis of Variance on Mean Recall Scores in Experiment 1C

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Table 4.4 Analysis of Variance on Mean Elaboration Rating Scores in Experiment 1C

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Table 4.5 Analysis of Variance on Ratios of ATQ-P/-N in Experiment 1C.

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Table 4.5 Analysis of Variance on the CIQ in Experiment 1C.

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Table 4.5 Analysis of Variance on "Controlability" in Experiment 1C.

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<td>1</td>
<td>.019</td>
<td>.010</td>
<td>.921</td>
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<tr>
<td>Error</td>
<td>55</td>
<td>1.901</td>
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</tbody>
</table>
Table 4.5 Analysis of Variance on ATQ-P.

<table>
<thead>
<tr>
<th>Sources</th>
<th>D. F.</th>
<th>M. S.</th>
<th>F</th>
<th>Pr</th>
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</thead>
<tbody>
<tr>
<td>Group (G)</td>
<td>1</td>
<td>779.162</td>
<td>.955</td>
<td>.333</td>
</tr>
<tr>
<td>Task Inst (I)</td>
<td>1</td>
<td>735.421</td>
<td>.902</td>
<td>.347</td>
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<td>G*I</td>
<td>1</td>
<td>719.161</td>
<td>.882</td>
<td>.352</td>
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<td>Error</td>
<td>55</td>
<td>815.667</td>
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</table>

Table 4.5 Analysis of Variance on ATQ-N in Experiment 1C.

<table>
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<tr>
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<th>D. F.</th>
<th>M. S.</th>
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</thead>
<tbody>
<tr>
<td>Group (G)</td>
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<td>5150.722</td>
<td>38.882</td>
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<td>Task Inst (I)</td>
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<td>4.861</td>
<td>.037</td>
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<td>G*I</td>
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<td>.010</td>
<td>.000</td>
<td>.993</td>
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<td>Error</td>
<td>55</td>
<td>132.472</td>
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</tbody>
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Figure 5.1 Analysis of Covariance on the DACL in Experiment 2

<table>
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<tr>
<th>Sources</th>
<th>D. F.</th>
<th>M. S.</th>
<th>F</th>
<th>Pr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction Procedures (I)</td>
<td>3</td>
<td>.21</td>
<td>3.07</td>
<td>.039</td>
</tr>
<tr>
<td>Error (I)</td>
<td>39</td>
<td>.07</td>
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<td></td>
</tr>
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<td>Time (T)</td>
<td>3</td>
<td>.02</td>
<td>3.07</td>
<td>.031</td>
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<tr>
<td>I*T</td>
<td>9</td>
<td>.02</td>
<td>3.18</td>
<td>.002</td>
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<tr>
<td>Error (I*T)</td>
<td>120</td>
<td>.01</td>
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<td></td>
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</tbody>
</table>
Figure 5.2 Analysis of Covariance on VAS-D in Experiment 2

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<th>M. S.</th>
<th>F</th>
<th>Pr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Induction Procedures (I)</td>
<td>3</td>
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<td>2.40</td>
<td>.082</td>
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<tr>
<td>Errors (I)</td>
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<td>2435.82</td>
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<tr>
<td>Time (T)</td>
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<td>799.04</td>
<td>3.20</td>
<td>.026</td>
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<td>M * T</td>
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<td>596.21</td>
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<td>.016</td>
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<td>Error (I * T)</td>
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<td>249.67</td>
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</table>

Figure 5.3 Analysis of Covariance on VAS-A (anxiety) in Experiment 2.

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<th>Pr</th>
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<tr>
<td>Induction Procedures (I)</td>
<td>3</td>
<td>1902.52</td>
<td>1.61</td>
<td>.204</td>
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<tr>
<td>Errors (I)</td>
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<td>1184.77</td>
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<td>Time (T)</td>
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<td>459.56</td>
<td>3.48</td>
<td>.018</td>
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<td>I * T</td>
<td>9</td>
<td>212.39</td>
<td>1.61</td>
<td>.121</td>
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<td>Error (I * T)</td>
<td>120</td>
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Table 6.1 Analysis of Variance on Percentages of Items Recalled Correctly in Experiment 3A

<table>
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<tr>
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<th>F</th>
<th>Pr</th>
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</thead>
<tbody>
<tr>
<td>Group (G)</td>
<td>1</td>
<td>18.83</td>
<td>.08</td>
<td>.779</td>
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<tr>
<td>Error (G)</td>
<td>29</td>
<td>234.49</td>
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<td></td>
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<tr>
<td>Retention Interval (R)</td>
<td>2</td>
<td>10.25</td>
<td>.34</td>
<td>.712</td>
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<tr>
<td>G * R</td>
<td>2</td>
<td>5.88</td>
<td>.20</td>
<td>.823</td>
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<td>Error (G * R)</td>
<td>58</td>
<td>30.02</td>
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</table>
Table 6.2 Analysis of Variance on Percentages of Items Recalled Correctly in Experiment 3B.

<table>
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</thead>
<tbody>
<tr>
<td>Group (G)</td>
<td>1</td>
<td>290.34</td>
<td>.78</td>
<td>.382</td>
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<td>Error (G)</td>
<td>33</td>
<td>370.40</td>
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<td>Retention Interval (R)</td>
<td>2</td>
<td>242.06</td>
<td>3.32</td>
<td>.042</td>
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<td>G * R</td>
<td>2</td>
<td>59.47</td>
<td>.81</td>
<td>.447</td>
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<td>Error</td>
<td>66</td>
<td>73</td>
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Table 6.4 Analysis of Variance on Proportions of Words Recalled in Experiment 3C.

<table>
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<tr>
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<th>Pr</th>
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</thead>
<tbody>
<tr>
<td>Group (G)</td>
<td>3</td>
<td>351.38</td>
<td>.82</td>
<td>.486</td>
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<td>Error (G)</td>
<td>56</td>
<td>426.57</td>
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<td>Syllable (S)</td>
<td>1</td>
<td>36486.20</td>
<td>331.19</td>
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<td>G * S</td>
<td>3</td>
<td>125.23</td>
<td>1.14</td>
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<td>Error (G * S)</td>
<td>56</td>
<td>110.17</td>
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Table 6.5 Analysis of Variance on Speech Rate (One Syllable words) in Experiment 3C

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<th>F</th>
<th>Pr</th>
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<tbody>
<tr>
<td>Group (G)</td>
<td>3</td>
<td>.8417</td>
<td>1.8279</td>
<td>.1526</td>
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<td>Error</td>
<td>56</td>
<td>.4605</td>
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### Table 6.5 Analysis of Variance on Speech Rate (Five Syllable Words) in Experiment 3C

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<th>F</th>
<th>Pr</th>
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<tbody>
<tr>
<td>Group (G)</td>
<td>3</td>
<td>.0949</td>
<td>1.6069</td>
<td>.1980</td>
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<td>Error</td>
<td>56</td>
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### Table 6.6 Analysis of Variance on the ATQ-N in Experiment 3C

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<th>Pr</th>
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<tr>
<td>Group (G)</td>
<td>3</td>
<td>1369.9075</td>
<td>1.7827</td>
<td>.1614</td>
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<td>Error</td>
<td>54</td>
<td>768.4333</td>
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### Table 6.6 Analysis of Variance on Ratios (ATQ-N/ATQ-P) in Experiment 3C

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<th>F</th>
<th>Pr</th>
</tr>
</thead>
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<tr>
<td>Group (G)</td>
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<td>.4313</td>
<td>6.4054</td>
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### Table 6.6 Analysis of Variance on CIQ in Experiment 3C

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<th>F</th>
<th>Pr</th>
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</thead>
<tbody>
<tr>
<td>Group (G)</td>
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<td>29.7452</td>
<td>6773</td>
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<td>Error</td>
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<td>43.9141</td>
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### Figure 6.1 Analysis of Variance on Running Memory Span in Experiment 3D

<table>
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<th>F</th>
<th>Pr</th>
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</thead>
<tbody>
<tr>
<td>Group (G)</td>
<td>1</td>
<td>4182.11</td>
<td>5.28</td>
<td>.028</td>
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<td>Error (G)</td>
<td>32</td>
<td>792.67</td>
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<tr>
<td>Updating (U)</td>
<td>3</td>
<td>4371.47</td>
<td>23.46</td>
<td>.000</td>
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<tr>
<td>G * U</td>
<td>3</td>
<td>367.18</td>
<td>1.97</td>
<td>.124</td>
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<tr>
<td>Error (G * U)</td>
<td>96</td>
<td>186.37</td>
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### Figure 6.2 Analysis of Variance on the Combined Scores (Serial vs. Updating) in Experiment 3D

<table>
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<th>M. S.</th>
<th>F</th>
<th>Pr</th>
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</thead>
<tbody>
<tr>
<td>Group (G)</td>
<td>1</td>
<td>1056.67</td>
<td>2.31</td>
<td>.138</td>
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<td>Error (G)</td>
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<td>Updating (U)</td>
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<td>G * U</td>
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<td>699.24</td>
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### Table 7.1 Analysis of Variance on the correct trials in the recognition test (4 x 4 matrix patterns) in Experiment 4A.

<table>
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<th>F</th>
<th>Pr</th>
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</thead>
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<tr>
<td>Group (G)</td>
<td>1</td>
<td>810.00</td>
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<td>Error (G)</td>
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<td>341.11</td>
<td>2.63</td>
<td>.081</td>
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<td>.18</td>
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Table 7.2 Analysis of Variance on the correct trials in the recognition test (5 x 5 matrix patterns) in Experiment 4B.

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<th>Mean Square</th>
<th>F</th>
<th>p</th>
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</thead>
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<tr>
<td>Group (G)</td>
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<td>.725</td>
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<td>Retention Interval (R)</td>
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