INTENTIONAL FORGETTING IN DEPRESSED STATES

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ABSTRACT

The aim of this thesis was to extend previous research on intentional forgetting in depressed states. The **first experiment** used the think/no-think paradigm, and found that although dysphoric individuals were significantly worse at suppressing emotional (positive and negative) words than non-dysphoric individuals, both groups were unsuccessful at direct thought suppression. However, there was no effect of rumination on dysphoric individuals' ability to intentionally forget material. Furthermore, there was also no group differences in attentional measures of Stroop and IDED. The **second experiment** involved modifying the TNT task, by including the use of substitute words in the suppression phase, in order to determine whether recalling substitute words during suppression would increase the level of forgetting. The findings from the study revealed that both dysphoric and non-dysphoric individuals were successful at intentionally forgetting neutral words using a thought substitution strategy. However, both groups were impaired at suppressing words in the direct thought substitution condition. The **third experiment** investigated the influence of thought substitution on intentional forgetting of emotional words in dysphoria. The study replicated experiment two, but used emotional (i.e. positive and depression-relevant) words instead of neutral words. The study found that dysphoric individuals were still impaired in their ability to suppress emotional material. Furthermore, dysphoric individuals were recalling significantly more depression-relevant respond and previously-suppressed words. The **fourth experiment** examined the role of executive control in intentional forgetting. In the study, dysphoric and non-dysphoric participants were categorised as having good or poor executive control based on their scores on the operation span with words task (OSPAN). The study found that non-dysphoric individuals with good control demonstrated successful suppression. However, dysphoric individuals with good control were unsuccessful at suppression. The **fifth experiment** investigated whether experimentally induced changes in mood state would alter an individuals' ability to intentionally forget emotional material. Non-dysphoric healthy participants were given a positive or negative autobiographical memory and music mood induction. They completed two modified think/no-think tasks, one prior to the mood induction and one after the mood induction. The study found that transient negative mood state impaired intentional forgetting of depression-relevant material. **Summary:** Taken together, the findings suggest that individuals in a depressed mood are impaired in their ability to intentionally forget emotional material, even with the use of a thought substitution strategy. Furthermore, the findings implicate poor executive control and negative mood state in impaired intentional forgetting. An important theme emerging from the findings was the role of an inhibitory mechanism in intentional forgetting. The findings reported in this thesis suggest that thought substitution involves engaging an inhibitory control mechanism that contributes to successful intentional forgetting. The findings have clear implications on depressed individuals everyday functioning, and suggest that even with the presence of effective distraction, dysphoric individuals are impaired in their ability to suppress emotional material. Furthermore, it is suggested that impaired intentional forgetting of emotional material may contribute to the maintenance of depressed mood, and could potentially worsen ongoing depression.

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CHAPTER THREE

Hertel and Gerstle (2003) used the think/no-think paradigm to investigate intentional forgetting in dysphoria and found that dysphoric individuals were significantly worse than non-dysphoric individuals at suppressing emotional material. They also found significant correlations between self-reported rumination and overall deficits in forgetting, with individuals reporting more real life rumination having greater difficulty forgetting to-be-suppressed information, than individuals reporting less real life rumination. Study 1 extended these findings by utilising a rumination manipulation, in order to determine whether manipulating rumination influences intentional forgetting in a depressed state. Furthermore, Study 1 investigated whether the observed deficits in intentional forgetting in dysphoric individuals were the result of impaired attentional control (indexed by the Stroop and Intradimensional-Extradimensional (IDED) Tasks). In the study dysphoric and non-dysphoric participants learnt a series of paired associates (neutral nouns paired with positive or negative adjectives). Learning of the paired associates was assessed using a cued-recall test. Once learning had been established, participants practiced responding to some targets and suppressing responses to others (think/no-think phase). At final memory testing, participants were told to disregard previous instructions and to recall targets associated with every cue. In order to investigate whether increased rumination in dysphoria leads to greater deficits in intentional forgetting, within each BDI group (dysphoric vs. non-dysphoric) half of the participants undertook a rumination manipulation and half a distraction manipulation. Furthermore, in order to investigate whether any observed deficits in intentional forgetting were related to poor attentional control, all participants completed a computerised version of the Stroop task and the IDED task. The study found that dysphoric participants were significantly worse at suppressing words than were the non-dysphoric participants, regardless of word valence. However, both dysphoric and non-dysphonic participants were unsuccessful at intentionally forgetting emotional words. Furthermore, no significant group differences were found for the rumination-distraction manipulation, the Stroop task or the IDED task. Moreover, performance on the Stroop task and IDED task did not correlate with the number of previously-suppressed words recalled.

CHAPTER FOUR

An important finding emerging from Study 1 was that both dysphoric and non-dysphoric individuals were impaired at intentionally forgetting emotional material. However, recent research (e.g. Hotta & Kawaguchi, 2009) has demonstrated that suppression in the think/no-think paradigm can be strengthened when a strategy, such as thought substitution is used to constrain the focus of attention. For example, Hertel and Calcaterra (2005) employed the think/no-think paradigm and demonstrated that when healthy non-dysphoric participants were provided with substitute words to recall in the suppression condition, the level of forgetting was higher than in the direct suppression condition. Study 2 extended this work by investigating whether using a thought substitution strategy would aid forgetting in dysphoric individuals. Furthermore, Study 2 investigated the underlying mechanism responsible for successful forgetting. Given the fact that previous research (Anderson & Green, 2001; Levy & Anderson, 2008) suggests that using an independent recall test is essential to determine whether forgetting is due to inhibition, as opposed to associative interference (Camp, 2006), Study two included an independent recall test. Dysphoric and non-dysphoric participants learnt a series of neutral (non-emotional) noun pairs. Learning of the paired associates was assessed using a cued-recall test. Once learning had been established, participants were instructed to either recall or suppress the associated target word, when presented with the cue word. Within each BDI group (dysphoric vs. non-dysphoric), half of the participants were pseudo randomly allocated to the aided (thought substitution) suppression condition and half were allocated to the unaided suppression condition. The aided suppression condition involved participants being told to think about experimentally provided nouns in order to avoid the original associated response word, and the unaided suppression condition involved participants being instructed to avoid saying or thinking about the associated response word. Final memory testing was assessed using cued recall and independent recall tests. In the cued recall test participants were told to disregard previous instructions and to recall the response associated with every cue and in the independent recall test participants were presented with the semantic category and the first letter of the target word and were subsequently asked to recall the response word. The study found that both the dysphoric group and the non-dysphoric group were successful at suppressing in the aided condition. This pattern of findings was also observed in the independent recall test, suggesting that participants had successfully inhibited the previously-suppressed words. However, both groups were impaired at intentional forgetting in the unaided suppression condition.

CHAPTER FIVE

The aim of Study 3 was to establish whether dysphoric participants were successful at suppressing emotional material using a thought substitution strategy. In particular, the aim was to determine whether dysphoric individuals would demonstrate impaired forgetting of previously-suppressed depression-relevant words. The study followed an identical protocol used in Study 2, but with two notable exceptions. The first was that the nouns were paired with emotional and not neutral adjectives (half were positive and half were depression-relevant adjectives, for e.g. *'loving baby'*, *'helpless baby'*). The valence of the cues was counterbalanced, such that participants were told to suppress, either positive words associated with neutral cues, or depression-relevant words associated with neutral cues. The second exception was that a word-fragment completion was used as an independent recall test. Given the fact that the inhibitory account (Anderson & Green, 2001) suggests that the unwanted memory itself is inhibited, it therefore follows that retrieval of the unwanted memory should be impaired on any test that is used to access that memory. The study found that non-dysphoric participants were successful at suppressing with the use of a thought substitution strategy. This pattern of findings was also observed in the independent recall test, suggesting that non-dysphoric participants had successfully inhibited the previously-suppressed words. The study found that dysphoric participants were unsuccessful at suppressing, even with the use of a thought substitution strategy. However, impaired forgetting was not limited to depression-relevant material. Rather, dysphoric participants demonstrated enhanced recall of depression-relevant respond (think condition) and previously-suppressed (no-think condition) words. Taken together, these findings suggest that group differences in suppression may only be observed when the material used is emotional. Furthermore, the presence of between-group valence differences between dysphoric and non-dysphoric individuals may be explained by the degree to which the words represented the concerns/thinking of the groups.

CHAPTER SIX

Previous research has demonstrated that individuals with poor executive control demonstrate impaired memory suppression. For example, Brewin and Beaton (2002) used the standard ‘white bear’ paradigm to look at thought suppression, and also included the operation span with words task (OSPAN; Turner & Engle, 1989) to measure executive control in healthy non-depressed individuals. The study found that better performance on OSPAN was related to having fewer intrusions in the thought suppression condition, suggesting a specific association between individual differences in executive control and attempts to inhibit unwanted thoughts. Given that individuals with depression and dysphoria display impairments in executive function (Degl'Innocenti, Agren & Backman, 1998; Landro, Stiles & Sletvold, 2001; Rogers et al, 2004), it would seem plausible that the suppression deficits observed in dysphoric participants in Studies 1 and 3 might be the result of poor executive control on the part of these individuals. Therefore, the purpose of Study 4 was to establish if changes in intentional forgetting observed in dysphoria are a consequence of impaired executive function. In the study dysphoric and non-dysphoric participants completed the operation span with words task (OSPAN; Turner & Engle, 1989). They were subsequently given the think/no-think task from Study 3. The study found that non-dysphoric participants with good executive control were the only group to show successful suppression. These findings suggest that individual differences in the ability to suppress unwanted memories can to some degree, be explained by differences in executive control. However, a key finding that emerged from the study was that the dysphoric group with good executive control showed equivalent recall of previously-suppressed words in comparison to baseline, whilst dysphoric participants with poor control demonstrated enhanced recall of previously-suppressed words. Taken together, these findings suggest that factors, other than executive control, may also contribute to memory suppression.

CHAPTER SEVEN

The previous study findings that dysphoric individuals with good executive control were also unsuccessful at suppression suggest that the presence of dysphoric mood state may undermine the effectiveness of thought suppression efforts. This notion is in line with research which has found that an increased number of intrusions during thought suppression are associated with greater negative affect (Freeston, Ladouceur, Thibodeau & Gagnon, 1992; Purdon & Clark, 1993), with negative mood making it more difficult for participants to suppress unwanted thoughts. For example, Minnema and Knowlton (2008) looked at forgetting of emotional material in healthy non-depressed individuals, and found that participants with higher negative mood ratings on the Positive Affect/Negative Affect Scale (PANAS) exhibited less directed forgetting of negative than of positive or neutral words. Therefore, the purpose of this study was to investigate whether changes in mood state would alter an individual's ability to intentionally forget emotionally valenced material. The study involved a group of 50 non-dysphoric, non-anxious and never depressed participants taking part in the study. In order to ensure that there were no group differences on the forgetting task prior to the mood induction (MI) procedure, all participants underwent the forgetting task from Study 4. Half the participants then underwent a positive mood induction and the remaining half underwent a negative mood induction, using autobiographical memory focus reinforced with happy or sad music. Following a mood check to confirm the effectiveness of the mood induction procedure, participants were again given the forgetting task. The protocol for the forgetting task remained the same as above, but differed only in terms of the words that were presented. The study found that the impairment in intentional forgetting that has been reported in dysphoric participants can be instated in never-depressed participants by inducing a sad mood. There were no differences between the positive and negative groups on the forgetting task prior to the mood induction. After the mood induction procedure, the study found that only the positive group were successful at suppressing material. The negative group however, were significantly impaired in their ability to suppress emotional material. Mood congruent effects were also obtained, with the negative group recalling more depression-relevant than positive previously-suppressed words. These findings are consistent with previous research and suggest that transient negative mood has a detrimental effect on cognitive processing and impairs an individual's ability to intentionally forget emotional material.

CHAPTER ONE

General Introduction

1.1. Background

According to the Diagnostic & Statistical Manual of Mental Disorders (1994), depression is defined as a heterogeneous disorder that is characterised by persistent sad mood and a loss of pleasure. It is one of the most common psychological problems in the UK, with two-thirds of adults at some time in their lives experiencing depressed mood of sufficient severity to interfere with normal activities (NICE, 2004). Furthermore, it is predicted that by the year 2020, depressive disorders will be the second most important cause of disability in the world (Murray & Lopez, 1997). Currently between 5 and 10% of the UK population consulting their GP meet the criteria for clinical depression, with these figures increasing 3 times as much for people high in depressive symptomatology, also referred to as dysphoric (NHS CRD, 2002; Butler, Carney & Cipriani, 2004).

Dysphoria is considered less severe, more transient, and less affectively specific than clinical depression (Ingram & Wisnicki, 1999). Dysphoria is problematic and has been shown to interfere with normal functioning (Segrin, 1990). Results from a growing number of studies have found that dysphoric individuals demonstrate poor social interaction skills (Jones & Asen, 1999), inappropriate social responses (Kendall, Hollon, Beck, Hammen & Ingram, 1987; Nolen-Hoeksema, Girgus & Seligman, 1992) and report their social exchanges as being less enjoyable and rewarding than non-dysphoric individuals (Nezlek, Hampton & Shean, 2000).

Furthermore, findings also indicate that dysphoric individual's perceptions of other people's attitudes and responses toward them contribute to the etiology and persistence of depressive mood, and may lead to long-term distortions in memory (McCann & Lalonde, 1993). It is also thought that dysphoria may serve as a vulnerability or risk factor for more severe disorders, which may also persist for a considerable time (e.g. months or years) (Haaga & Solomon, 1993). The emotionally problematic, disruptive, and common nature of dysphoria suggests that it is worthy of research attention in its own right and thus justifies this body of work.

1.2. Cognitive deficits in depression

Cognitive deficits have been frequently implicated in depressed states (Weingartner & Siberman, 1982) and research has found that depressed individuals display deficits in the following cognitive domains: executive functioning (Austin, Mitchell, Wilhelm et al, 1999; Elliott, Baker, Rodgers et al, 1997; Porter, Bourke & Gallagher, 2007), attention (Purcell, Maruff, Kyrios & Pantelis, 1997; Ravnkilde, Videbech, Clemmensen et al, 2002), memory (Austin, Ross, Murray et al, 1992; Harmer, Clark, Grayson & Goodwin, 2002), visuo-spatial processing and psychomotor function (Mondal, Sharma, Das, Goswami & Gandhi, 2007).

Research has also found that depressed individuals display impaired cognitive functioning long after the remission of a depressive episode (Airaksinen, Larsson, Lundberg & Forsell, 2004). These findings suggest that there may be pervasive and long-lasting effects of depression on cognitive functioning. Furthermore, these effects may impact the ability for some individuals with depression to functionally recover (Jaeger, Berns, Uzelac & Davis-Conway, 2006).

1.2.1. Cognitive biases in depression

It has been well established that depression is associated with biases in attention, memory and judgement. For example, depressed individuals have been shown to attend more strongly to negative material (Gilboa & Gotlib, 1997), demonstrate enhanced recall of negative material (Neshat-Doost et al, 1998; Watkins et al, 1996) and make more negative judgements concerning hypothetical events (Anderson, Spielman, & Bargh, 1992; Constans & Mathews, 1993) than non-depressed individuals.

There is also evidence of similar biases with dysphoric individuals (Clarke & Teasdale, 1982; Ridout, Noreen & Johal, 2009) with studies finding that changes in mood are associated with corresponding changes in the magnitude of recall for valenced information (Clarke & Teasdale, 1982). For example, Reynolds & Salkovskis (1992) found that individuals with high depression scores (measured by the Beck Depression Inventory II (BDI II; Beck, Steer & Brown, 1996)) demonstrate superior negative memory relative to non-dysphoric individuals. Furthermore, Gilboa-Schechtman, Ben-Artzi, Jeczemien et al, (2004) found that dysphoric individuals were impaired in their ability to ignore emotional aspects of facial expressions on a selective attention task. Taken together, these findings suggest that depressed and dysphoric individuals are impaired in their processing of emotional material, in comparison to healthy non-depressed controls (Matt, Vazquez, & Campbell, 1992).

Much of the research in depression and dysphoria has focused primarily on cognitive processes, such as attention and memory, which may underlie and enhance the negative thoughts that characterise depressive disorders (Matt, Vazquez & Campbell, 1992). Recently research has begun investigating intentional forgetting. It is important to look at intentional forgetting in depressed states, as it may be possible that impaired forgetting of unwanted memories may also be related to enhanced negative thoughts that characterise depressive disorders. Therefore, the aim of the current thesis is to investigate intentional forgetting in dysphoria.

1.3. Intentional forgetting

Intentional forgetting has been defined as a ‘motivated attempt to limit the future expression of specific memory content’ (Johnson, 1994 page 274). This is contrary to the common assumption that forgetting is a failure of memory and instead suggests that forgetting is a beneficial process (Sheard & MacLeod, 2005), that individuals require to keep their memories functioning effectively (Bjork & Bjork, 2003). It is evident that in order to remember relevant information without confusion we need to forget irrelevant information. For example, it is useful for a driver to remember where they parked their car that day, but it is just as useful to forget where the car was parked on the previous day to avoid confusion about where the car is currently parked (Bjork, 1989). This suggests that an efficient memory system can not only retain relevant information but can also suppress irrelevant information that is out of date and a possible source of error and interference.

Research suggests that one of the most debilitating symptoms of depression is the frequent occurrence of unintentional negative thoughts, which are implicated in both the onset and the maintenance of depressive episodes (Nolen-Hoeksema, 2000; Roberts, Gilboa & Gotlib, 1998). However, it has been found that with guidance and repeated attempts, depressed individuals could reduce processing and the subsequent accessibility of negative memories coming to mind, leading to the development of a valuable and effective cognitive skill (Joormann, Hertel, Brozovich & Gotlib, 2005). Therefore, work that increases our understanding of the specific factors that may decrease the occurrence of negative thoughts and memories in depressive states represents an extremely important avenue of research. Furthermore, delineating the cognitive mechanisms that underlie these negative cognitions potentially offers targets for successful methods of remediation.

1.4. Paradigms used to study intentional forgetting

1.4.1. Item and list method directed forgetting paradigms

One paradigm that has been used extensively for studying intentional forgetting is the directed forgetting paradigm (Araya, Akrami & Ekehammar, 2003; Sheard & MacLeod, 2005). The directed forgetting paradigm essentially involves participants complying with explicit instructions to disregard newly learned information, whilst being instructed to remember other information (Johnson, 1994; Sheard & MacLeod, 2005). The two most commonly used methods in the directed forgetting paradigm are the item method (Fawcett & Taylor, 2008; Goernert, Widner Jr & Otani, 2007; MacLeod, 1999; Wylie, Foxe & Taylor, 2007) and the list method (Benjamin, 2006; Basden, Basden & Gargano, 1993; Elmes, Adams, & Roediger, 1970; Gottlob & Golding, 2007) directed forgetting paradigms.

In the item method directed forgetting paradigm participants are presented with individual words, which are subsequently followed by an instruction to either remember or forget that particular word. Participants are then asked to disregard previous instructions and recall all the words presented to them at final testing. In the list method directed forgetting paradigm participants are presented with a list of words that they are instructed to remember. Immediately following the presentation of the list participants are instructed to forget those words and instead remember a new list of words. Following the presentation of the second list, participants are asked to disregard previous instructions and recall all words from both lists. Research has demonstrated that healthy participants recall significantly more to-be-remembered words than to-be-forgotten words using both item method (Basden, Basden & Gargano, 1993; Goernert, Widner Jr & Otani, 2007) and list method (Basden, Basden & Gargano, 1993; Elmes, Adams, & Roediger, 1970) directed forgetting paradigms.

Although both item and list method appear to be testing the same phenomenon, it has been argued that there are different processes that are responsible for the directed forgetting effect observed under these two paradigms (Basden, Basden & Gargano, 1993; Bjork, 1989). In the item method, each word is presented individually followed by an instruction to forget (F) or remember (R). As instructions are received on a trial by trial basis, participants rehearse each word in working memory until an R or F instruction is received. When an R instruction is received, participants engage in elaborative rehearsal.

Elaborative rehearsal refers to the creation of associations between a target word and existing material stored in memory, resulting in enhanced memory of the to-be-remembered item (Craik & Lockhart, 1972). For example, elaboration of the target word *'sad'* may include associations with other words, such as *'unhappiness'* and autobiographical memories that involve thinking of unhappy times in the past (e.g. a relationship breakup). When an F instruction is received participants do not include the word in their rehearsal set. Because F items are not as well rehearsed as R items this subsequently leads to better encoding of the R items than of the F items (DePrince & Freyd, 2004). According to Basden, Basden & Gargano (1993) selective rehearsal underlies item method and this is the commonly accepted explanation of item method directed forgetting (Johnson, 1994; MacLeod, 1999).

In the list method participants are instructed to initially remember the forget word list, therefore both F and R word lists should be elaborately rehearsed to encode F and R words to the same extent. The fact that a directed forgetting effect is found suggests that differences cannot be attributed to selective rehearsal, as participants can forget the words after they have been rehearsed and encoded. Instead this is explained by retrieval inhibition (Basden, Basden & Wright, 2003; Bjork, 1989; DePrince & Freyd, 2004; McNally, Ristuccia & Perlman, 2005). According to the retrieval inhibition account, as the forget words have already been encoded in memory, when participants are given the forget instructions they inhibit the F words, so that when they are asked to recall words F words retrieval is less probable than R words, which have not been inhibited. Support for the retrieval inhibition account comes from Geiselman, Bjork & Fishman (1983) who investigated list method directed forgetting using recall and recognition tests. Participants were given two categories of words in each list. One category of words had to be learned (intentional learning), and another category of words had to be judged based upon how pleasant they were (incidental learning). Geiselman, Bjork & Fishman (1983) predicted that if terminated rehearsal was responsible for forgetting of F words, than no directed forgetting of these words would be observed in the incidental learning condition as these words were not rehearsed. However, the study found that participants had successfully forgotten the F words in both the intentional and incidental learning conditions, suggesting that a cue to forget initiated a process that inhibited access to the F words, which was responsible for the directed forgetting effect observed. The inhibition account was further supported by the recognition test results. Geiselman, Bjork & Fishman (1983) found that participants in both the intentional and incidental learning conditions, given F or R instructions demonstrated equivalent recognition of words, suggesting that words were inhibited at retrieval only, so that when participants were presented with the F words they overcame this inhibition and no effect of the forget instruction was found. These findings are consistent with more recent studies which also provide strong evidence for the retrieval inhibition account in list method directed forgetting (Golding & Gottlob, 2005).

1.4.2. Think/no-think paradigm

Another paradigm that is used to study intentional forgetting is the 'think-no-think' (TNT) paradigm devised by Anderson and Green (2001). The 'think-no-think' task involves participants learning a list of unrelated word pairs to a specified criterion. They are subsequently presented with a cue word and are instructed to either respond with or suppress the associated target word. Cue words are presented on multiple occasions (0, 1, 8 or 16 times) to determine whether forgetting increases with the number of times the memory is suppressed. In the baseline (0) condition words are presented only in the learning phase and on the final test. On the final test participants are instructed to recall the correct response word for each cue. Using emotionally neutral material, Anderson and Green (2001) found that greater practice in suppression produced increased forgetting in healthy participants, thus demonstrating the importance of instructions to actively forget.

1.4.2.1 The inhibitory control account of intentional forgetting in the think/no-think paradigm

According to Anderson and Green (2001) findings demonstrating impaired memory for previously-suppressed words in the no-think condition may be due to inhibition. Inhibition involves engaging executive control mechanisms to prevent unwanted information from entering consciousness (Anderson & Bjork, 1994). Several researchers have proposed that impaired recall performance of previously-suppressed words requires an inhibitory mechanism, which acts upon the memory representation of the unwanted word, deliberately impairing retrieval and keeping it out of consciousness (Anderson, 2003; Anderson, Green & McCulloch, 2000; Anderson & Spellman, 1995; Levy & Anderson, 2002). According to Anderson and Green (2001) by repeatedly instructing participants to 'not think' about the target word, participants control and adapt their thinking patterns, using executive control processes to prevent the unwanted memory from entering consciousness, thus leading to poorer recall of previously-suppressed words at final testing.

1.4.2.2. The associative interference account of intentional forgetting in the think/no-think paradigm

However, it is also possible that impaired memory for previously-suppressed words is due to associative interference (Camp, 2009). Associative interference involves creating new associations with the cue word in order to 'not think' about the target word. According to Camp (2009) when two or more items are responses to the same memory cue, they compete with each other for retrieval. The outcome of this competition depends on the associative strength between the cue and the target word.

For example, in a traditional paired-associate experiment participants are asked to study a list of unrelated word pairs (e.g. '*table-mouse*'). Participants are subsequently presented with a second list of word pairs to study. In some instances the new word pairs contain the same cues presented in list one, but with different responses (e.g. '*table-rat*'). When memory for the first list is tested, targets for the cue from both the first and second lists compete with one another. Impaired recall may arise if access to the first list of target words is blocked by the targets from the subsequent list (i.e. competing words) (Blaxton & Neely, 1983; Brown, 1981; Brown, Whiteman, Cattoi, & Bradley, 1985; Roediger & Schmidt, 1980).

Because memory is fundamentally associative, with retrieval guided by cues to associated items in memory, it is possible that when participants in the Anderson and Green (2001) study were presented with the cue and the target word (e.g. '*table-mouse*') they created a new association with the cue word *('table-rat'*), so that both responses become associated with the original cue. This subsequently led to the target (e.g. *'rat'*) and the new associated response (e.g. *'mouse'*) competing for retrieval, thus resulting in impaired recall of the target word. Although Anderson and Green (2001) did not investigate the strategies that participants used to forget words during the think/no-think phase, a study by Hertel and Calcaterra (2005) found that the level of forgetting was higher when participants reported thinking of something else.

1.4.2.3. Distinguishing between inhibitory and associative accounts of intentional forgetting

In order to distinguish between inhibitory and associative accounts of intentional forgetting, and to determine the underlying mechanism responsible for successful forgetting, Anderson and Green (2001) used an independent probe test in the think/no-think task. The independent probe test involved participants being shown the semantic category of the target word, as well as the first letter (e.g. for the word pair *'ordeal-roach'* participants were shown *'insect-r____'*). According to the inhibitory account, if the decrement in recall in the no-think task is due to inhibition, then it follows that forgetting should be observed in both the final cued recall test and the independent probe test, since it is the memory of the target word itself that is inhibited rather than its association with the cue word. However, if associative interference is responsible for the suppression effects observed, then forgetting would be limited to the cue target association and participants would be unimpaired in the independent probe test (Anderson & Green, 2001). Using the independent probe test Anderson and Green (2001) found impaired recall of previously-suppressed words on the independent probe test, which became progressively worse with greater practice in suppression. These findings isolate inhibition as the underlying mechanism responsible for successful forgetting and rule out associative accounts.

It is important to note that Anderson and Green's (2001) study investigated intentional forgetting of neutral words. Recent research has extended these findings to emotional material. For example, Depue, Banich & Curran (2006) used the think/no-think task to examine whether cognitive control of memories differs depending on whether the information is negative or neutral. The study used face word pairs and found that whilst participants were successful at suppressing both negative and neutral material, inhibition effects were larger for negative than neutral stimuli.

One explanation to account for these findings may relate to the amount of cognitive control that is exerted over emotional than non-emotional information. Research suggests that because emotional information is better encoded (Rolls, 2000) and retrieved (Hamann, 2001) than non-emotional information, the memory representation of emotional material is stronger than non-emotional material. In addition, research also suggests that the increased strength of a representation may make the memory more accessible to cognitive control mechanisms (Norman, Newman, Detre & Polyn, 2004). Thus, because emotional memories have a stronger memory representation, they are more susceptible to mechanisms of cognitive control. Taken together, these findings provide support for the role of an inhibitory control mechanism and suggest that this mechanism is recruited when we deliberately engage in thought suppression. Furthermore, the findings suggest that cognitive control appears to be more effective for emotional than non-emotional memories.

However, a recent study by Bulevich, Roediger, Balota & Butler (2006) failed to find suppression effects in a group of healthy participants using the think/no-think task. Bulevich et al (2006) carried out a direct replication of Anderson and Green's (2001) procedure, and failed to find reliable suppression in both the final cued recall and independent probe tests. This failure to replicate Anderson and Green's (2001) findings could not be attributed to individual differences between the two population samples. The inconsistency in findings using the think/no-think paradigm suggests that, self controlled thought suppression may not necessarily lead to successful forgetting. Furthermore, the inconsistency in findings warrants further investigation, as it is important to establish why some individuals have been successful at suppressing, whilst other individuals have been unsuccessful. Moreover, it is also important to investigate the processes that mediate the effects found in the think/no-think task.

1.5. Investigating intentional forgetting in depression using item and list method directed forgetting paradigms

Few studies have examined intentional forgetting of emotional material in depressed individuals using item and list method directed forgetting paradigms. One such study by Power, Dalgleish, Claudio, Tata & Kentish (2000) used the list method paradigm, which involved depressed and non-depressed participants recalling positive and negative emotional words, that they had been instructed to forget. The study found that only depressed participants demonstrated enhanced memory for the to-be-forgotten negative over the to-be-forgotten positive words, therefore demonstrating that depressed individuals exhibit a specific impairment in their ability to intentionally forget negative material.

These findings also extend to neutral material. For example, Cottencin et al, (2008) used an item method directed forgetting paradigm to examine intentional forgetting of neutral material, and found that depressed individuals recalled significantly more to-be-forgotten words than did the non-depressed individuals. These findings suggest that impaired forgetting is not specific to emotional words. Rather, depression is related to a more general impairment in intentional forgetting.

Power et al's (2000) and Cottencin et al's (2008) findings suggest that depressed individuals are impaired in their ability to intentionally forget both neutral and emotional material. However, it is important to note that both Power et al's (2000) and Cottencin et al's (2008) studies used different directed forgetting paradigms. Given the fact that research suggests that there are different processes responsible for the directed forgetting effects observed by these two paradigms (Basden, Basden & Gargano, 1993), results need to be interpreted cautiously. Furthermore, although Power et al's (2000) findings suggest impaired inhibition for negative material in depressed individuals, it has been argued that the forgetting task used was arguably more passive than active (Sahakyan & Kelley, 2002), with instructions to forget occurring only once during the entire task.

1.6. Investigating intentional forgetting in dysphoria using the think/no-think paradigm

The think/no-think paradigm makes use of instructions to forget. Using this paradigm, Hertel and Gerstle (2003) examined intentional forgetting in dysphoric individuals. The study involved dysphoric (Beck Depression Inventory (BDI) 9+) and non-dysphoric (BDI 0-6) participants learning 40 unrelated word pairs, with which neutral words were paired with positive and negative cues (e.g. *'romantic cottage'* vs. *'gloomy cottage'*, *'esteemed paper'* vs. *'failing paper'*, *'delicious apple'* vs. *'poisoned apple'*). Participants were instructed to create a self-referential mental image for each word pair, and subsequently rate its meaningfulness. To determine the effects of practice on recall participants practiced responding and suppressing targets when presented with a cue word for a varied number of repetitions (0, 1, 8 and 16 times). In the baseline (0) condition words were presented only in the learning phase and on the final test. On the final test, participants were instructed to recall all targets, regardless of previous instructions. Hertel and Gerstle (2003) found that both dysphoric and non-dysphoric groups recalled more previously-suppressed words than never-suppressed baseline words. However, dysphoric participants recalled more previously-suppressed words than did non-dysphoric participants, regardless of word valence. Furthermore, the effect of responding increased with the number of cue presentations, with greater practice resulting in more recall of target words in the 'think' (non-suppressing) condition.

Findings demonstrating a non specific effect of valence on impaired intentional forgetting in dysphoric individuals are inconsistent with those obtained by Power et al (2000), who found that clinically depressed individuals were impaired in their ability to suppress negative material. However, the findings are consistent with previous research investigating mood-congruent memory in mildly depressed individuals, which has demonstrated equivalent recognition of positive and negative information (Gilboa & Gotlib, 1997). Indeed, a meta-analytical review by Matt, Vazquez, & Campbell (1992) found marked differences in processing biases between depressed and dysphoric individuals, with clinically depressed individuals recalling up to 10% more negative than positive words, whereas dysphoric individuals demonstrate even-handed processing for positive and negative stimuli.

These differences in processing patterns between depressed and dysphoric individuals indicate that a clinical level of depression operating with a variety of concurrently existing depressive symptoms may be required to observe the negative bias commonly perceived in depressed individuals, (Mathews & MacLeod, 1994). Therefore, it is possible that deficits in intentional forgetting are less specific in dysphoric individuals than depressed patients, and thus correspond with symptom severity.

1.7. Potential factors influencing impaired intentional forgetting in depression

1.7.1. The role of inhibition in intentional forgetting in depression

Hertel and Gerstle's (2003) findings of impaired intentional forgetting in dysphoric individuals may be the result of impaired inhibition in depression. Empirical support for this explanation comes from research looking at selective attention, which has demonstrated an inability to inhibit distracting stimuli in depression (Lemelin, Baruch, Vincent, Laplante, Everett & Vincent, 1996). Inhibition in depressed individuals has been studied using the negative priming paradigm. Negative priming refers to delayed response latency to a target, when the distractor from a previous trial becomes the target on the present trial. It has been found that depressed individuals do not demonstrate this negative priming effect (Linville, 1996). For example, McQueen, Tipper, Young et al (2000) used a negative priming paradigm (Milliken, Tipper & Weaver, 1994) to investigate the role of impaired distractor inhibition in depression and found that depressed participants had a lessened ability to inhibit features of a distractor, thereby demonstrating deficits in inhibition. Taken together, these findings suggest that dysphoric individual's inability to inhibit the associated target words in Hertel and Gerstle's (2003) study led to enhanced recall of previously-suppressed words.

While these findings provide support for an inhibitory dysfunction in depression, it is possible that this inhibition deficit may be more prevalent for emotionally valenced information. In order to examine this the negative affective priming task (NAP) has been developed to investigate inhibition in the processing of emotionally valenced information (Gotlib, Neubauer Yue & Joormann, 2005; Joormann, 2004; see also

Goeleven, DeRaedt, Baert & Koster, 2006). The NAP task involves participants evaluating the valence of a target word. Participants are subsequently presented with a target and a distractor word, with instructions to ignore the distractor and respond to the target. In the negative priming condition distractors and targets per trial are related by valence. However, in the control condition distractor and trial targets are unrelated. It has been found that depressed individuals demonstrate impaired inhibition for negative material. For example, using NAP Joormann (2004) found that dysphoric individuals demonstrate reduced inhibition of negative words. However, no group differences were observed for positive words. Furthermore, Goeleven, DeRaedt, Baert & Koster, (2006) found impaired inhibition in depressed individuals also extended to sad facial expressions. However, there were no significant differences between depressed and non-depressed individuals' ability to inhibit happy facial expressions. Taken together, these findings provide support for depression and dysphoria being related to inhibitory deficits in the processing of negative material.

1.7.2. Lack of processing resources

Hertel and Gerstle's (2003) findings of overall impaired intentional forgetting in dysphoric individuals, may relate to the amount of cognitive resources that were available to dysphoric participants for performing the task. According to the resource allocation model (Ellis & Ashbrook, 1988) an individual's emotional state regulates the amount of capacity that is allocated to a task. Individuals in a depressed mood state displace a portion of this total capacity available, which subsequently reduces the amount of task-relevant processing that can take place. Furthermore, greater attentional demands will produce a larger discrepancy in the performance between depressed and non-depressed individuals.

According to this account, difficulties in thought suppression occur in depressed and dysphoric individuals because the conscious and effortful process of forgetting is disturbed by depressed mood, which drains attentional resources that would otherwise be devoted to the task in hand (Ellis & Ashbrook, 1988). This therefore suggests that in Hertel and Gerstle's (2003) study, when participants were instructed to focus on suppressing target words, because dysphoric participants were able to allocate less cognitive resources to the task, they were not as successful as non-dysphoric participants at suppressing.

Furthermore, according to Ellis & Ashbrook (1988), effects are mediated by the allocation of attention to irrelevant features of the task, which subsequently reduces the capacity to allocate attention to the relevant aspects of the task that would benefit later recall. Support for the importance of negative thoughts as sources of distraction comes from mood-memory studies. For example, Ellis, Seibert & Herbert (1990) demonstrated that negative self thoughts were related to poorer recall. Furthermore, in a study of mood, thought listening & memory, Seibert & Ellis (1991) found that individuals with depressed mood reported more irrelevant and distracting thoughts than did non-depressed participants. Moreover, the study also found a strong negative correlation between recall on the memory task and irrelevant thoughts that were produced, providing support for the idea that depressive deficits in memory are mediated by way of distracting thoughts (Ellis, 1991).

Taken together, the research suggests that emotional state, at least with respect to memory deficits, regulates the amount of capacity that is allocated to a task, with negative mood state leading to attention being more easily allocated to personal concerns and other thoughts irrelevant to the task. Given the fact that intentional forgetting is a controlled process that places considerable demands on cognitive resources, it is thus possible that suppression deficits may reflect a lack of resources on the part of depressed individuals.

However, the resource allocation model has been criticised on theoretical grounds (Hasher & Zacks, 1988; Hertel, 1997), as it cannot account for some findings in the depression literature. For example, research has found that depressed individuals perform as well as non-depressed individuals, and thus have sufficient resource capacity when experimental material is self-referent and congruent with their current mood (Bower, 1992). Furthermore, Weary, Marsh, Gleicher & Edwards, (1993) have found that compared to healthy non-dysphoric individuals, dysphoric individuals engage more effortful procedures in situations that threaten their social control.

1.7.3. Poorly constrained conditions

According to Hertel's (2000) cognitive-initiative account, depressed individuals have sufficient resources available for performing a task, but have difficulty in voluntarily engaging in controlled processes. This impairment in cognitive control enables habitual thinking which subsequently impairs performance. Given the fact that Hertel and Gerstle's (2003) study involved no guidance on possible strategies to use to ensure forgetting, the task required a considerable amount of cognitive control. Thus, intentional forgetting deficits demonstrated by depressed individuals in the study did not reflect a generalised deficit or lack of resources, but instead may have been due to attentional resources not being devoted to actually attending to the task in hand.

Support for this notion comes from Hertel and Rude (1991) looking at memory in depressed individuals. The study involved depressed and non-depressed participants being presented with a learning task which involved deciding whether a target word fit sensibly into a sentence frame. Participants were allocated to either the focused condition, which involved being shown the word for a portion of the trials duration, or the unfocused condition, which involved being shown the word for the entire trial duration, thus unconstraining attention. The study found that in the unfocused condition, depressed individuals were significantly impaired in recall in comparison to non-depressed participants. However, there were no significant differences in recall between depressed and non-depressed participants in the focused condition. These findings suggest that depressed individuals have sufficient resources available for performing a task, but rather these attentional resources are not devoted to attending to the task.

Furthermore, Hertel (1998) carried out a study which involved dysphoric and non-dysphoric participants learning pairs of words and subsequently being given a memory test for the word pairs. During the study and test phases, participants were allocated to one of three conditions, which involved waiting silently for the test phase, rating self focused material designed to induce rumination, or rating task and self-irrelevant material. Hertel (1998) found that dysphoric participants in the silent waiting and induced rumination conditions demonstrated significant recall deficits, whilst dysphoric participants instructed to rate task and self-irrelevant material demonstrated no deficits in recall. These findings highlight the specificity of memory deficits, and suggest that depressed and dysphoric individuals are able to perform as well as non depressed healthy individuals in structured situations, but demonstrate significant impairments using their own initiative in unconstrained situations (Hertel, 2004). Furthermore, the findings suggest that by controlling and constraining attention, depressive deficits may be eliminated.

Taken together, the findings above suggest that that unconstrained situations require cognitive flexibility and control, in that attention must be devoted to relevant material and irrelevant material must be inhibited (Hertel, 2000; Hertel, 2004). Therefore, deficits in suppression may not reflect a lack of resources on the part of depressed individuals, but may instead be due to depression-related inhibitory dysfunctions in the processing of irrelevant information (Anderson, 2003).

1.7.4. Rumination

Both the resource allocation and cognitive initiative accounts highlight the role of rumination in impaired forgetting. According to Nolen-Hoeksema (1991) rumination involves individuals focusing their thoughts and behaviour on their depressive symptoms, and the implications and consequences of these symptoms. The importance of rumination in depressive disorders has been well established, with rumination linked to depression maintenance, negative cognitions and enhanced accessibility of negative memories (Nolen-Hoeksema 2000; Lyubormirsky & Nolen-Hoeksema 1993). Furthermore, cognitive models of depression suggest that a central characteristic in depressed states is rumination (Banich, Mackiewicz, Depue, Whitmer, Miller & Heller, 2009), with individuals with a ruminative response style more vulnerable to experience depression (Nolen-Hoeksema, Morrow, & Fredrickson, 1993).

The role of rumination in intentional forgetting has been investigated. For example, Hertel and Gerstle's study (2003) found a significant correlation between self-reported rumination and overall deficits in forgetting, with individuals reporting more real life rumination having greater difficulty forgetting to-be-suppressed information than individuals reporting less real life rumination, regardless of depression scores. These findings are consistent with a recent study by Joormann and Tran (2008) which investigated the effects of rumination on directed forgetting. In the study participants were asked to learn a list of emotional words and were then told to forget this list (forget condition) and instead learn a new list of words (remember condition). Subsequently, participants were given a final recall test for words from both lists. The study found no significant differences between participants scoring high in rumination and participants scoring low in rumination in the remember condition. However, in the forget condition participants scoring high in rumination demonstrated impaired forgetting of positive and negative words, in comparison to participants low in rumination. Interestingly, the results remained significant even when depression scores were included as a covariate in the analysis. These findings implicate rumination in directed forgetting.

Depressed individuals tendency to ruminate about negative information, rather than engaging in intentional forgetting may explain why mood-congruency effects are so often observed in depression. Previous studies have found that rumination enhances cognitive biases by subsequently impairing mood, leading to enhanced recall of negative memories (Lyubormirsky, Caldwell, & Nolen-Hoeksema, 1998; Moulds, Kandris & Williams, 2007). Furthermore, Lyubormirsky, & Nolen-Hoeksema (1995) found that dysphoric participants that underwent a rumination manipulation demonstrated enhanced negative interpretations of hypothetical situations, and showed enhanced recall of negative material (McFarland & Beuhler, 1998), and negative autobiographical memories (Lyubormirsky, Caldwell, & Nolen-Hoeksema, 1998).

According to Joormann and Gotlib (2008) depression involves an inability to inhibit previously relevant negative material. This inhibitory deficit leads to prolonged activation of negative material in memory, which leads to sustained negative affect and recurring negative thoughts. Thus, the inability to remove irrelevant negative material from memory is related to the tendency to respond to negative mood and life events with rumination. To test this Joormann and Gotlib (2008) used a modified version of the Sternberg task (Oberauer, 2005), which involved participants being presented with two lists of words simultaneously. Once the lists were learnt participants were asked to ignore one list and were given a recognition test for the other list. The interference from the to-be-forgotten (or irrelevant) list of positive and negative words was then assessed. Joormann and Gotlib (2008) found that depressed participants show greater intrusion for mood congruent material, with increased interference from irrelevant material being correlated with rumination. However, interestingly this pattern was not found for positive material. These findings suggest that both rumination and depression are associated with difficulties in inhibiting negative material from memory. However, the tendency to ruminate in depressed individuals rather than engage in intentional thought suppression warrants further investigation, as it is still not clear whether rumination mediates the effects of depression on subsequent performance (Lyubormirsky & Nolen-Hoeksema, 1993).

1.7.5. Poor executive control

According to Anderson and Green (2001) unwanted memories are suppressed by engaging in executive control processes to prevent the unwanted thought from coming to mind. Executive control processes refer to higher level cognitive processes, such as the planning, initiation, sequencing, and monitoring of complex goal-directed behaviour in the face of distracting information (Dalgleish et al, 2007). Executive control processes are believed to be functionally distinct, have limited resources, and are associated with conscious awareness (Rogers & Monsell, 1995; Hillman, Snook & Jerome, 2003).

It has been proposed that a valid measure of executive control is working memory capacity (Engle, 2002; Rosen & Engle, 1998). Working memory capacity reflects the ability to focus attention on a variety of cognitive tasks (Engle, 2002). Furthermore it has been proposed that working memory capacity reflects the capacity for controlled, sustained attention, in the face of distraction, response competition, when irrelevant information needs to be suppressed, and when controlled planned memory search or error monitoring is needed (Brewin & Beaton, 2002; Engle, Kane, & Tuholski, 1999; Rosen & Engle, 1998). Thus, it can be argued that individual differences in working memory capacity might explain the variability in memory suppression (Levy & Anderson, 2002).

Recently, research has focused on the relationship between working memory capacity and the suppression of irrelevant thoughts. A study by Brewin & Beaton (2002) investigated working memory capacity in predicting the ability to intentionally suppress intrusive thoughts. The study involved using the standard 'white bear' paradigm, which involved participants suppressing thoughts of a white bear. Participants were also given the operation span with words task (OSPAN; Turner & Engle, 1989). The OSPAN task involves participants solving a series of maths operations whilst trying to remember a set of unrelated words. The study found that better performance on the OSPAN was related to having fewer intrusions (i.e. thoughts of white bears) in the suppression condition, suggesting a specific association with attempts to inhibit unwanted thoughts. Furthermore, these findings were consistent with previous findings by Rosen & Engle (1998), who found that greater working memory capacity, as measured by OSPAN was related to more successful suppression of intrusive thoughts. Taken together, these findings suggest that there is a strong relationship between working memory capacity and suppression, with individuals with poorer working memory capacity demonstrating a greater number of intrusions.

Research has accumulated to suggest that that individuals with depression and dysphoria display impairments in executive function (Austin et al, 1999; Degl'Innocenti, Agren & Backman, 1998; Landro, Stiles & Sletvold, 2001; Rogers et al, 2004), including working memory (Channon, Baker & Robertson, 1993; Gohier, et al 2008). For example, Harvey et al, (2004) used a variety of neuropsychological tasks, such as the verbal n-back task to assess executive dysfunction in depression and found that depressed participants had widespread executive dysfunctions including, updating, inhibiting and shifting processes. The study also found a correlation between depression severity and poorer updating task performance. Furthermore, Austin et al (1999) found that depressed individuals were significantly impaired on working memory tasks, such as the digit span task, providing further support for the notion that depression is associated with deficits in working memory function.

Taken together, these findings suggest that depression may temporarily reduce cognitive control, making individuals more susceptible to inappropriate intrusions and thus, rendering active attempts at thought suppression as ineffective. However, it is unclear whether the observed suppression deficits in dysphoric participants are the result of poor executive control, or whether it is the dysphoric condition itself which elicits such a deficit.

1.7.6. Depressed mood

Depressed and dysphoric individuals inability to intentionally forget material may be due to their depressed mood. Research has examined the influence of mood state on an individual’s ability to suppress thoughts, and has found that an increased number of intrusions during thought suppression are associated with greater negative affect (Freeston, Ladouceur, Thibodeau & Gagnon, 1992; Purdon & Clark, 1993), with negative mood making it more difficult to suppress unwanted thoughts. For example, Wenzlaff, Wegner & Roper (1988) asked dysphoric and non-dysphoric participants to read a positive or negative story. Half the participants in each condition were asked to suppress their thoughts related to the story, and the remaining half were not asked to suppress their thoughts. The study found that dysphoric participants who were instructed to suppress thoughts related to the negative story thought about the negative scenario as often as dysphoric participants who received no suppression instructions for that scenario. However, dysphoric participants instructed to suppress thoughts related to the positive story did not experience a subsequent increase in target thoughts. These findings are in line with those obtained by Wenzlaff, Wegner & Klein (1991) who also found a strong association between suppressed thoughts and mood states. However, it is important to note that the studies by Wenzlaff, Wegner & Roper (1988) & Wenzlaff, Wegner & Klein (1991) did not control for individual differences in executive functioning. Therefore, it is possible that negative mood may have reduced cognitive control, which may subsequently have impaired suppression.

According to research, depressed mood state is related to a difficulty in voluntarily engaging in controlled processes, which prevents effective distraction, and thus leads to more intrusive thoughts occurring (Hertel, 2000). For example, Ellis, Moore, Varner, Ottaway & Becker (1997) found that healthy individuals in an experimentally induced depressed mood performed significantly poorer on a passage comprehension task, than individuals in a neutral mood. According to Ellis et al (1997) negative mood state led to an increase in the number of task irrelevant thoughts, which subsequently diminished memory performance.

Furthermore, Howell and Conway (1992) investigated the effects of mood on suppression of positive and negative self-referent thoughts. In the study participants were either induced with a positive or negative mood, and were asked to not think about a positive or negative autobiographical memory. The study found that positive induced participants exhibited more intrusions for positive, rather than negative unwanted thoughts. However, the negative induced participants demonstrated the opposite pattern by reporting more negative unwanted intrusions. Furthermore, these findings were replicated for dysphoric individuals. Taken together, these findings suggest that mood state has a selective effect on thought suppression, thus suggesting an integration of mood and suppression. These findings may help explain why depressed and dysphoric individuals are impaired in their ability to suppress thoughts (Wenzlaff, Wegner & Roper, 1988), as negative mood state may have a detrimental effect on an individual's ability to suppress irrelevant information, which may be responsible for impaired forgetting.

In order to investigate the independent effects of negative mood on thought suppression, Brewin and Smart (2005) carried out a study using the standard thought suppression paradigm. In the study participants were first instructed to suppress an unwanted thought (thought suppression condition) and then told to report everything that came into consciousness, including the unwanted thought (thought expression condition). The study found that negative mood enhanced the likelihood of intrusions, in both the thought suppression and thought expression conditions. According to Brewin and Smart (2005) this overall increase in intrusive thoughts is likely to be due to an increase in the activation of all negative information in memory, rather than a strategic process involved in thought suppression.

Taken together, these studies highlight the importance of negative mood on an individual's ability to intentionally forget unwanted material. The studies also implicate negative mood state in impaired suppression. However, it is important to note that Wenzlaff, Wegner & Roper's (1988) study compared sub-clinical participants who reported naturally occurring elevations in depressed mood with non-dysphoric healthy participants. Therefore, it is difficult to determine whether the observed group differences in suppression are associated with mood states, or with group differences in more enduring personality traits. Furthermore, although Howell and Conway (1992) and Brewin and Smart (2005) looked at the independent effects of mood state on suppression, both studies did not give participants the suppression tasks prior to the mood induction. Thus, it is possible that the observed deficits might not be attributable to the mood of the individual per se, but to some other factor.

1.7.7. Self-reference

Joormann, Hertel, Brozovich, & Gotlib (2005) used Anderson and Green's (2001) think-no-think task to examine intentional forgetting in clinical depression, and found that depressed individuals were successful at suppressing negative words. Furthermore, a practice effect was also obtained, with greater practice in suppression producing more forgetting. However, these findings were contrary to those obtained by Power, Dalgleish, Claudio, Tata & Kentish (2000) and Hertel and Gerstle (2003), who found that both depressed and dysphoric individuals were impaired in their ability to intentionally forget emotional material. One explanation to account for the difference in findings may relate to the fact that both Power et al (2000) and Hertel and Gerstle (2003) studies involved participants encoding stimuli self-referentially, whilst Joormann et al's (2005) study did not. Research investigating mood-memory has found stronger mood-congruency effects when depressed participants are required to process the words self-referentially (Matt et al, 1992). Therefore, it is possible that suppressing negative words that have been processed with reference to the self is more difficult for clinically depressed individuals than for non-depressed individuals.

1.8. Research Overview

The research above suggests that dysphoric individuals are impaired at intentionally forgetting emotional material (Hertel and Gerstle, 2003). Given the fact that there is considerable evidence that depressed and dysphoric individuals demonstrate impaired attentional control (Beats, Sahakian & Levy, 1996; Grant, Thase & Sweeney, 2001), it is possible that the observed deficits in intentional forgetting in dysphoric individuals were the result of impaired attention. Currently, no research has investigated the effects of impaired attentional control on intentional forgetting in dysphoric individuals. Therefore, the aim of this thesis was to overcome this by examining the role of attentional control on intentional forgetting in dysphoria. Furthermore, research also suggests that rumination is related to impaired intentional forgetting in depressed individuals (Hertel and Gerstle, 2003). However, the causal relationship between rumination and intentional forgetting has not yet been determined,and it remains unclear whether rumination mediates the effects of depression on intentional forgetting (Lyubormirsky & Nolen-Hoeksema 1993). Therefore, the aim of this thesis was to investigate the role of rumination in intentional forgetting in dysphoric individuals. There is also considerable evidence that poor executive control is related to impaired suppression (DenHartog et al, 2003). Given the fact that depression is associated with impaired executive function (Brewin & Beaton, 2002; Engle, Kane, & Tuholski, 1999), it is possible that poor executive control in depressed individuals may be responsible for impaired forgetting. Therefore, the aim of the current research was to investigate the role of poor executive control in dysphoric individual's ability to intentionally forget emotional material. Furthermore, research has also found a relationship between negative mood state and intentional forgetting, with increased negative mood associated with impaired intentional forgetting (Brewin and Smart, 2005; Wenzlaff, Wegner & Roper, 1988). Therefore, the aim of this thesis was to disentangle mood and executive function influences on intentional forgetting in dysphoria, by investigating whether changes in mood state would alter participants' ability to intentionally forget information.

1.9. Overview of studies

The purpose of the present section is to provide an overview of the experimental chapters. The aim of Study 1 was to examine the role of attentional control and rumination, in intentional forgetting of emotional material in dysphoria. The study involved replicating and extending Hertel and Gerstle's (2003) findings, by including a rumination distraction manipulation to determine whether increased rumination in dysphoria leads to greater deficits in intentional forgetting. Furthermore, in order to determine whether impaired intentional forgetting in dysphoria is associated with poor attentional control, the study included the Stroop and an Intradimensional-Extradimensional (IDED) Task. Given the fact that Study 1 failed to demonstrate successful forgetting by both dysphoric and non-dysphoric participants, the aim of Study 2 was to determine whether using a thought substitution strategy would aid intentional forgetting. The study involved modifying the think/no-think task, by including the use of substitute words in the suppression phase, to determine whether recalling substitute words during suppression would increase the level of forgetting. The aim of Study 3 was to determine whether dysphoric individuals could intentionally forget emotional material using a thought substitution strategy. In particular, the study investigated whether dysphoric individuals would demonstrate impaired forgetting of mood congruent previously-suppressed words. The study involved directly replicating Study 2, but with a single exception, the words used were emotional (i.e. positive and depression-relevant). The aim of Study 4 was to examine the role of executive control in depressed individuals' ability to intentionally forget emotional material. The study included the operation span with words task (OSPAN) as a measure of cognitive control. Participants were then given the think/no-think task. Finally, the aim of Study 5 was to examine the role of negative mood state on intentional forgetting. Non-dysphoric healthy participants were given either a positive or negative mood induction. They completed two modified think/no-think tasks, one prior to the mood induction and one after the mood induction, in order to determine whether negative mood state would impair an individual's ability to intentionally forget emotionally valenced material.

CHAPTER TWO

Measures and methodology

2.1. Introduction

This chapter will provide a detailed coverage of the procedures and assessments that were commonly used in the studies reported in this thesis. The following sections will outline the procedures for assessing self-reported mood, which include depression and anxiety. An outline of the method used to provide an estimate of participants' general intellectual ability will also be provided. Furthermore, a detailed protocol of participant recruitment, including an overview of the inclusion and exclusion criteria is also included.

2.2. Self-report mood measures

2.2.1. The Beck Depression Inventory II (BDI II)

In order to allocate participants into dysphoric or non-dysphoric groups in the studies reported in this thesis the Beck Depression Inventory II (BDI II; Beck, Steer & Brown, 1996) was used. BDI II is a multiple choice, self report inventory that looks at how an individual has been feeling in the preceding two weeks. BDI II consists of 21-items, which are used to assess behavioural, cognitive and physiological symptoms of depression. These symptoms include, feelings of sadness, hopelessness, irritability, cognitions, such as guilt or feelings of being punished, fatigability, weight loss, somatic preoccupation and/or insomnia. Each item on the BDI II contains four statements, that are graded according to the severity of depression, with the least depressive statement (e.g. *"I feel the same about myself as ever"*) being scored as 0, and the most depressive statement (e.g. *"I dislike myself"*) being scored as 3. The questionnaire involves combining the numbers corresponding to the selected statements for each of the 21 items to obtain a total score. The total scores obtainable on the questionnaire range from 0-63, with higher scores indicating more severe depressive symptoms. BDI-II represents a continuous dimension of depressive symptoms. Furthermore, it is designed for use in both clinical and non-clinical populations, and is therefore not necessarily an indication of clinical depression per se.

<u>2.2.1.1. Psychometric properties of the BDI II</u>

The BDI II has been subjected to extensive psychometric evaluation, and research has consistently found that it has a high internal consistency (ranging from $\alpha = .89$ to $\alpha = .94$) (Arnau, Meagher, Norris & Bramson, 2001; Beck et al, 1996; Dozois, Dobson & Ahnberg, 1998; Steer, Rissmiller, & Beck, 2000). It is also shown to have a high one week test-retest reliability (Pearson $r = 0.93$), suggesting that it is not overly sensitive to daily variations in mood (Beck et al, 1996). The BDI II is also positively correlated with similar depression scales, such as, the Hamilton Depression Rating Scale ($\alpha = .71$) and the Depression Anxiety Stress Scale ($\alpha = .88$) (Beck et al, 1996). Furthermore, BDI II is also able to discriminate between primarily depressive and anxiety disorders, with it being more highly correlated with the Hamilton Psychiatric Rating Scale of Depression ($\alpha = .71$) compared to the Hamilton Rating Scale of Anxiety ($\alpha = .47$) (Beck et al, 1996). Moreover, Steer et al (2000) also found a higher correlation between BDI II and the Symptom Checklist-90-R (SCL-90-R) depression dimension ($\alpha = .89$), than the SCL-90-R anxiety dimension ($\alpha = .71$). Taken together, findings of a strong correlation between BDI II scores and other measures of depression suggest that the BDI II is a suitable measure of depressed mood for the studies reported in this thesis. (See the inclusion criteria below, Section 2.4.2, page 40 for how participants' BDI II scores were interpreted)

2.2.2. Spielberger State-Trait Anxiety Inventory (STAI)

Research has consistently demonstrated that anxiety impairs cognitive functioning (Williams, Watts, MacLeod & Mathews, 1997). Given the fact that depression and anxiety frequently co-occur (Gorman, 1997; Kessler et al, 1996; Robert & Hirschfeld, 2001), it is possible that the presence of anxiety may mask any group differences obtained in the current research. Therefore, it is important to determine the level of anxiety in individuals in order to control for its effects on task performance. The Spielberger State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene & Vagg, 1983) is used to assess symptoms of state and trait anxiety. State anxiety represents current transient emotional reactions, and trait anxiety refers to individual differences in enduring and more chronic levels of anxiety (Endler, Cox, Parker & Bagby, 1992). The essential qualities evaluated by STAI scales are, feelings of apprehension, tension, nervousness and worry. The Spielberger State-Trait Anxiety Inventory comprises of two questionnaires, each containing 20-items that can be separated in two groups, that either record the presence (e.g. *"I get into a state of tension and turmoil as I think over my recent concerns and interests"*) or absence (e.g. *"I feel pleasant"*) of anxiety symptoms. The latter are inverted for the purpose of calculating the total score. The state-trait scale is scored on four levels of anxiety intensity, from 1 = 'not at all' to 4 = 'very much', with scores ranging from 20-80 on each state-trait questionnaire. STAI is also designed for use in clinical and non-clinical populations, and therefore is not necessarily an indication of clinical anxiety per se.

2.2.2.1. Psychometric properties of the STAI

Research has found that STAI has good test-retest reliability. For example, trait anxiety has test-retest reliability ranging from $\alpha = .73$ - $\alpha = .86$ over 30 and 60 day intervals, whilst state anxiety has test-retest reliability ranging from $\alpha = .51$ - $\alpha =.36$ over 30 and 60 day intervals (Spielberger et al, 1983). This lower range for state anxiety is expected, given that state anxiety is considered a more changeable construct (Spielberger et al, 1983). STAI also has high internal consistency, with state anxiety ranging from $\alpha = .88$ - $\alpha =.93$, whilst trait anxiety ranges from $\alpha =.92$- $\alpha =.94$ (Kabacoff, Segal, Hersen & Van Hasselt, 1997; Spielberger et al, 1983). There are also significant correlations with State anxiety and Manifest Anxiety Scale and the Anxiety Scale Questionnaire (ranging from $\alpha =.73$ - $\alpha =.75$ (Spielberger, Sydeman, Owen & Marsh, 1999), and between trait anxiety and the Worry Scale (Stanley, Beck & Zebb, 1996). Kabacoff et al (1997) have also found that individuals with anxiety disorders have higher trait anxiety scores than individuals without anxiety disorders. Taken together, these findings suggest that the STAI is a suitable measure of anxiety in the studies reported in this thesis.

2.2.3. Visual Analogue Scales (VAS)

In order to measure current mood state Visual Analogue Scales (VAS) were created by the author. Visual Analogue Scales (Aitken, 1969; Zealley & Aitken, 1969) are continuous measurement devices (Flynn, van Schaik & van Wersch, 2004), and were created by the author to measure changes in current mood state over time. Each scale consisted of a single 100mm line, presented on a page with verbal descriptors at each end (e.g. "*I do not feel sad*" vs. "*I feel extremely sad*" denoted as 0 and 100, respectively). The participant marks on the line the point that they feel best represents their perception of their current mood state. This point is then measured from 0 to 100mm to determine a score. The 6 statements can be separated into three grouped items (happiness and sadness vs. anxious and relaxed vs. energetic and fatigue), that either record the presence or absence of negative mood. The negative scales are reversed for the purpose of calculating the total score, which ranges from 0-200 per item. For example, for half of the scales a score of 0 represents positive mood, and a score of 100 represents a negative mood, and for the remaining half a score of 0 represents negative mood, and a score of 100 represents positive mood. The latter are inverted so that a score of 0 would be interpreted as a score of 100, with higher scores representing overall increased negative mood.

2.2.3.1. Psychometric properties of VAS

Visual Analogue Scales (VAS) have been used frequently in studies assessing mood. These studies have used varying labels for the extreme of the 100mm line (e.g. *"not at all depressed"* vs. *"extremely depressed")* (Feinberg et al, 1981; Gainotti et al, 1997; House, Dennis, Hawton & Warlow, 1989; Luria, 1975; Stern & Bachman, 1991). This is because VAS is an objectified method of marking from between one extreme to another, which thus ensures that inter-rater reliability is essentially perfect. VAS is a psychometric response scale and has been tested for both reliability and validity. Test-retest reliability for VAS measuring mood ranges from $\alpha = .61 – \alpha = .91$ in different sub groups of psychiatric patients (Folstein & Luria, 1973; Luria, 1975; Robinson & Szetela, 1981). Feinberg et al (1981) studied patients with depression and reported correlations of α = .73 between VAS and the Hamilton Depression Rating Scale (HDRS) (Hamilton, 1960), and a correlation of α = .65 between VAS and the clinical global rating of depression. Furthermore, VAS is appropriate for measuring rapid changes in mood state over time (Benedetto, Lindner, Hare & Kent, 2005). Taken together, these findings, suggest that VAS is a suitable measure of changes in current mood state, and appropriate to use in the studies reported in Studies 1 and 5.

2.3. Estimation of pre-morbid intelligence

2.3.1. National Adult Reading Test (NART)

Prior investigations have found that general intellectual ability effects cognitive functioning (Duncan, Emslie, Williams, Johnson & Freer, 1996). Therefore, in order to ensure that any group differences that arise on the tasks are not confounded by group differences in intellectual ability, the National Adult Reading Test (NART; Nelson & Williamson, 1991) was used to provide an estimate of participant's general intellectual ability. The NART is composed of a list of 50 words that are presented in order of increasing difficulty. The words are 'irregular' words that cannot be pronounced through the use of common phonetic rules (e.g. *naïve*, *courteous*), thus reducing the possibility that participants are reading by phonemic decoding rather than by word recognition.

Participants are presented with one word at a time, and are instructed to read the word out aloud. Participants are asked to attempt pronouncing all the words. Responses are recorded so they can be scored later. The NART error score is the total number of errors made on the complete test (i.e. error score equals 50 minus number of words read correctly). Error scores can be used to predict WAIS full scale, verbal and performance IQ (Nelson & Williamson, 1991).

2.3.1.1. Psychometric properties of NART

NART has high inter-rater reliability (O'Carroll, 1987) and its validity as a predictor of IQ has been demonstrated in several studies (Crawford, Stewart, Parker & Besson, 1989; Moss & Dowd, 1991). NART is highly reliable and capable of predicting a large proportion of the variance of IQ in a normal population. NART performance is also resistant to effects of psychiatric disorders (Crawford et al, 1989; Crawford, Parker & Besson, 1988; Moss & Dowd, 1991), including depression (Crawford et al, 1989). Furthermore, NART has been validated for clinical populations such as, Alzheimer's disease (Crawford, Parker & Besson, 1988; Hart, Smith & Swash, 1986; Sharpe & O'Carroll, 1991), schizophrenia (Crawford et al, 1992) and depression (Crawford et al, 1992). Taken together, these findings suggest that NART is an accurate estimate of participant's pre-morbid intellectual ability, and is appropriate to use in the studies reported in this thesis.

2.4. General Assessment of Dysphoric and Non-Dysphoric Controls

2.4.1. General assessment of dysphoric and non-dysphoric participants

Dysphoric and non-dysphoric participants were recruited through Aston University using one of two methods. The first method of recruitment was Aston University's research participation scheme, which invited healthy volunteers to participate in a study investigating intentional forgetting. Participants took part in the research in exchange for course credit or the sum of £5. The second method included participants being recruited through opportunity sampling and various forms of advertisements, such as posters that invited healthy volunteers to participate in a study investigating intentional forgetting. Contact details were provided to all participants, which included an email address for the principle investigator.

Prior to the inclusion in the experimental studies all participants were screened using a screening questionnaire (see Appendix I). Screening questionnaires were used as well as the BDI as a primary means for selecting people to participate in the studies. The screening questionnaire comprised of 7 questions asking participants if they were currently suffering from, or had a history of depression, anxiety, or any other psychological condition. They were also asked if they were currently on any medication.

2.4.2. Inclusion criteria

All participants recruited to take part in the five experimental studies reported in this thesis were required to be medication-free (this included all medications for the treatment of any psychological disorders, such as depression or anxiety), and aged between 18 and 45 years of age. They were also required to be right handed, and have normal or corrected-to-normal vision. Participants were also required to provide written informed consent prior to participating in the research. All participants were given the BDI on two occasions to determine group allocation (see experimental study chapters for mean days apart between administrations). In Study 1, participants with a mean BDI score of 10 or more were allocated to the dysphoric group, whilst participants with a mean BDI score of 5 or less were allocated to the non-dysphoric group (Koster, Raedt, Goeleven, Frank & Crombez, 2005). However, given the fact that results from Study 1, failed to find the expected differences on attentional measures of Stroop and IDED, it is conceivable that the minimum BDI cut off point used for the dysphoric group was too low to capture the essential features of dysphoria. Therefore, in Studies 2-4, participants with a mean BDI score of 15 or more were allocated to the dysphoric group, whilst participants with a mean BDI score of 5 or less were allocated to the non-dysphoric group (Kao, Dritschel & Astell, 2006). There was no upper limit on BDI scores for the dysphoric group in any of the studies. Furthermore, in Study 5 only participants with a mean BDI score of 5 or less were selected to take part in the study.

2.4.3. Exclusion criteria

The exclusion criterion for all participants was identical. Participants were excluded from taking part in the experimental studies reported in this thesis, if they had a history of head injury, that resulted in prolonged loss of consciousness or which required hospital treatment. Furthermore, participants with any physical or neurological conditions, which may impair cognitive function (e.g. a learning disability, dyslexia, dyspraxia) were also excluded from taking part in the research. Based on previous findings that individuals remitted from mood disorders, such as depression show biased information processing and display dysfunctional attitudes and beliefs (Ingram & Ritter, 2000; McCabe, Gotlibb & Martin, 2000; Miranda, Persons & Byers, 1990; Segal, Gemar & Williams, 1999), participants were excluding from participating in the studies if they had a history of depression, anxiety or any other psychological disorder. Furthermore, research also suggests that certain medications, such as anti-depressants have a deleterious effect on cognition, affecting both psychomotor and memory performance (Gorenstein et al, 2006). Therefore, participants' were excluded from taking part in the research if they were diagnosed with any psychological disorders or were on any medication (such as anti-depressants), which may affect their performance on any of the tasks administered. Moreover, participants' who may have difficulties in adequately understanding written or verbal information in English were also excluded from participating in the research. This is because it was important to ensure all the participants' were given the same instructions, and by using interpreters the consistency for translation would not have been clear.

It is also important to note that given the fact that the same paradigm and materials were used for experimental Studies 3, 4 and 5, dysphoric and non-dysphoric individuals that had taken part in either one of these studies were excluded from taking part in the remaining two studies. This was to ensure that any group differences that arise on the tasks were not confounded by practice effects. Furthermore, participants taking part in more than one study (e.g. Study 1 and Study 5) were excluded if the time between the testing sessions for the two studies was less than 4 months. Only participants that met the inclusion criteria, and did not meet any of the exclusion criteria were asked to take part in the research.

2.5. Data Analysis

Parametric test assumptions were established for all of the experimental studies reported in this thesis. Mean and standard deviations were also computed to ensure that standard deviations were not larger than mean scores. In order to ensure that data was normally distributed normalisation tests were conducted. Histograms of the frequency distribution were visually inspected, to see whether a bell shaved curve was observed. Furthermore, in order to ensure that the homogeneity of variance assumption was met, the population variances for each of the groups from which the samples were drawn were examined. Sphericity assumptions were also tested for studies using repeated measures ANOVAs.

CHAPTER THREE

Investigating the roles of rumination and attention on intentional forgetting of emotional material in dysphoria

3.1. Introduction

3.1.1. Background

As reported in Chapter 1 (see Section 1.6, page 14), Hertel and Gerstle (2003) examined intentional forgetting of emotional material in dysphoria using the think/no-think paradigm, and found that regardless of word valence, dysphoric participants recalled more previously-suppressed words than did the non-dysphoric participants. Furthermore, Hertel and Gerstle (2003) also found a significant correlation between rumination and overall deficits in suppression, with individuals reporting more rumination having greater difficulty suppressing material than individuals reporting less rumination, regardless of depression scores. However, it is important to note that Hertel and Gerstle's (2003) study did not include any measures of attention, therefore it is unclear whether the observed deficits in intentional forgetting in dysphoric individuals were the result of impaired attentional control. Furthermore, although a significant correlation between rumination and intentional forgetting was found, the causal relationship remains unclear. Therefore, the aim of the present study was to examine the role of attention and rumination on intentional forgetting in dysphoria.

3.1.2. Impaired Attention

As noted above Hertel and Gerstle's (2003) findings of overall impaired intentional forgetting in dysphoric individuals may be due to impaired attention. Impaired attention is a fundamental feature in depression (DenHartog, Derix,VanBemmel, Kremer & Jolles, 2003; Egeland, Rund, Sundet et al, 2003; Mialet, Pope & Yurgelun-Todd, 1996) with deterioration of attention indicating the onset of a depressive episode (Hagerty, Williams & Liken, 1997). Indeed, depressed individuals often complain of attentional problems, such as impaired ability to concentrate or make decisions. In addition, depressed individuals also report their ability to carry out tasks requiring attention as being significantly worse when they are depressed than when in recovery (Williams, Teasdale, Segal & Soulsby, 2000).

Research investigating attentional control in depression has found that depressed individuals have diminished attentional capabilities (Mialet, Pope & Yurgelun-Todd, 1996) with marked dysfunctions in various aspects of attentional processing (Ottowitz, Dougherty & Savage, 2002). For example, Gualtieri, Johnson & Benedict (2006) found individuals with depression exhibited impairments in selective attention. Furthermore, Wilkinson & Goodyear (2006) found that depressed individuals have difficulties in switching attention from one way of working to another. Moreover, Tancer et al (1990) found that depressed individuals were impaired in their ability to maintain attention on effortful tasks requiring larger amounts of cognitive capacity, such as sustained attention tasks. Similar findings have also been obtained for dysphoric individuals (Bradley, Mogg & Lee, 1997; Koster, De Raedt, Goeleven et al, 2005).

3.1.3. Selective attention

Attention is a multifaceted construct that can be divided into subcomponents (Manly, Anderson, Nimmo-Smith et al, 2001). One of these subcomponents is selective attention. Selective attention involves the ability to filter information to detect relevant and ignore irrelevant information. One task that has been used to measure selective attention is the stroop colour naming task (MacLeod, 1991; Stroop 1935). The stroop task involves naming the colour of the ink a word is written in, whilst ignoring its meaning. The task is generally thought to measure the degree to which individuals are able to inhibit a pre-potent response (i.e. word reading) in the face of a task that requires attentional control (i.e. naming the colour of the ink a word is written in). Studies investigating selective attention in depression have found that depressed individuals demonstrate significant impairments on the stroop task (Lemelin, Baruch, Vincent, Everett &.Vincent, 1997; Lemelin, Baruch, Vincent et al, 1996; Trichard, Martinot, Alagille et al, 1995). For example, Markela-Lerenc, Kaiser, Fiedler et al (2006) looked at stroop performance in depression and found that depressed individuals showed a higher stroop interference effect, i.e. took longer to respond when word meaning and colour were in conflict (e.g. the word *'red'* written in *'blue'* ink), than non-depressed individuals.

3.1.4. Attentional control

Another subcomponent of attention is attentional control (or shifting), which involves the ability to switch or change from one way of working to another (Manly et al, 2001). Research looking at attentional control in depression has found that depressed individuals have difficulty in switching attention (Grant, Thase & Sweeney, 2001). For example, a study by Purcell, Maruff, Kyrios & Pantelis (1997) using the intra-dimensional extra-dimensional set shifting task (IDED), which involved participants deciding which one of two patterns (i.e. *'colour'* or *'shape'*) was correct by working out the rule for determining correctness, found that depressed individuals took more trials to learn the new rules compared to non-depressed individuals. These findings support those obtained by Beats, Sahakian & Levy (1996) who also used the IDED task and found that depressed individuals were impaired in switching attention.

Taken together, the above findings suggest that depressed individuals demonstrate deficits in tasks requiring attention and may account for Hertel and Gerstle's (2003) findings of impaired suppression in dysphoria. However, as Hertel and Gerstle (2003) did not include any measures of attention, it is unclear whether the observed deficits in intentional forgetting in dysphoric individuals were the result of impaired attentional control

3.1.5. Rumination and impaired forgetting

As noted above (page 44) Hertel and Gerstle's study (2003) also found that individuals reporting more real life rumination had greater difficulty forgetting previously-suppressed information, than individuals reporting less real life rumination. These findings are consistent with findings implicating rumination in directed forgetting. For example, Joormann and Tran (2008) found that regardless of depression, participants scoring high in rumination demonstrated impaired forgetting of positive and negative words, in comparison to participants low in rumination. Taken together, these findings suggest that both rumination and depression are associated with difficulties in inhibiting negative material from memory. However, although both Hertel & Gerstle (2003) and Joormann & Tran (2008) found an association between rumination and impaired performance in intentional forgetting, the causal relationship between rumination in intentional forgetting remains unclear.

In conclusion, given that Hertel and Gerstle (2003) did not include any measures of attention, it is unclear whether the observed deficits in intentional forgetting in dysphoric individuals were the result of impaired attentional control. Therefore, in order to determine whether dysphoria is associated with attentional inhibitory deficits the present study included the Stroop-Colour Naming Task (adapted from Trenerry, Crossen, DeBoe & Leber, 1989) and The Intradimensional- Extradimensional Task (IDED) (Roberts, Robbins & Everitt, 1988). Furthermore, although both Hertel & Gerstle (2003) and Joormann & Tran (2008) found an association between rumination and impaired performance in intentional forgetting, the causal relationship between impaired forgetting and rumination has not been determined, and it is still not clear whether rumination mediates the effects of depression on intentional forgetting. Therefore, in order to determine the role of rumination in intentional forgetting the present study directly manipulated rumination and assessed its impact on intentional forgetting in depression, using the think/no-think task.

3.1.6. Research Overview

Participants were asked to take part in the present study based upon their scores on the Beck Depression Inventory (BDI). The study adopted Hertel and Gerstle's (2003) methodology and involved dysphoric (BDI scores of 10+) and non-dysphoric (BDI scores 0-5) students learning a series of word pairs, whereby neutral nouns were paired with positive or negative adjectives. Participants were then presented with a cue word and were asked to recall the corresponding word for some cues and suppress the corresponding word for other cues. In order to determine whether forgetting increases with the number of times a memory is previously-suppressed, words were presented on multiple occasions (0, 1, 2 or 16). Participants were then given a final cued recall test for all the word pairs. In order to investigate whether increased rumination in dysphoria would lead to greater deficits in intentional forgetting, within each BDI group (high vs. low) half of the participants undertook a rumination manipulation, and half a distraction manipulation. Furthermore, in order to investigate whether any observed deficits in intentional forgetting were related to impaired attention, all participants completed the Stroop task and the IDED task.

3.1.7. Experimental hypotheses

1. In line with findings obtained by Hertel and Gerstle (2003), it was expected that dysphoric participants would recall a significantly higher percentage of previously-suppressed words, than would the non-dysphoric participants.
2. In line with findings obtained by Joormann and Tran (2008), it was also expected that there would be a significant interaction between group and rumination, such that dysphoric participants in the rumination group would recall a significantly higher percentage of previously-suppressed words than would all other participant groups.
3. Furthermore, consistent with findings that depressed individuals have diminished attentional capabilities (Mialet, Pope & Yurgelun-Todd, 1996), it was expected that there would be a significant correlation between performance on measures of attentional control (Stroop and IDED) and suppression, with good attentional control being associated with recalling a significantly lower percentage of previously-suppressed words then poor attentional control.
4. Moreover, in line with findings by Anderson and Green (2001) (see Chapter 1, Section 1.4.2, page 8), it was expected that forgetting would increase with the number of times a memory was previously-suppressed, for both dysphoric and non-dysphoric participants.

3.2. Method

3.2.1. Design

A 2 (group) x 2 (valence to suppress) x 2 (instruction) x 2 (rumination manipulation) x 4 (repetition) mixed factorial design was used. The between-group factors were group, valence for suppression, and rumination manipulation, and the within-group factors were instruction and repetition. The independent variables were group (dysphoric vs. non-dysphoric); valence condition (suppress negative associates vs. suppress positive associates); instruction (respond vs. suppress); rumination manipulation (rumination vs. distraction manipulation) and number of repetitions (0, 1, 8, 16). The dependent variable was the percentage of words recalled on the final cued recall test.

3.2.2. Participants

122 never-depressed participants completed the Beck Depression Inventory II (BDI-II) on two occasions (median number of days apart = 10) to determine group allocation. Participants were asked to take part in the study based upon their mean BDI scores, obtained on both occasions. Following recommended guidelines described by Koster, Raedt, Goeleven, Frank & Crombez (2005), participants with mean BDI scores of 5 or less were classified as non-dysphoric, and participants with mean BDI scores of 10 or more were classified as dysphoric. Two participants were excluded from participating in the study, as their mean BDI score was above 5 and below 10. Within each BDI group (high vs. low), half of the participants underwent a rumination manipulation and half a distraction manipulation (Lavender & Watkins, 2004; Nolen-Hoeksema and Morrow, 1993) (see Figure 3.1).

This procedure resulted in 29 dysphoric (4M, 25F; mean age = 22.31; SD = 5.5) and 32 non-dysphoric individuals (7M, 25F; mean age = 21.31 SD = 6.2) undergoing a rumination manipulation, and 31 dysphoric (4M, 27F; mean age = 21.19; SD = 4.2) and 28 non-dysphoric individuals (8M, 20F; mean age = 21.79; SD = 4.4) undergoing a distraction manipulation. Participants were recruited through Aston University's research participation scheme (full outline in Chapter 2 Section 2.4.1, page 39) and were selected to take part in the study according to the inclusion and exclusion criteria cited in Chapter 2 (Sections 2.4.2 & 2.4.3. pages 40-42)

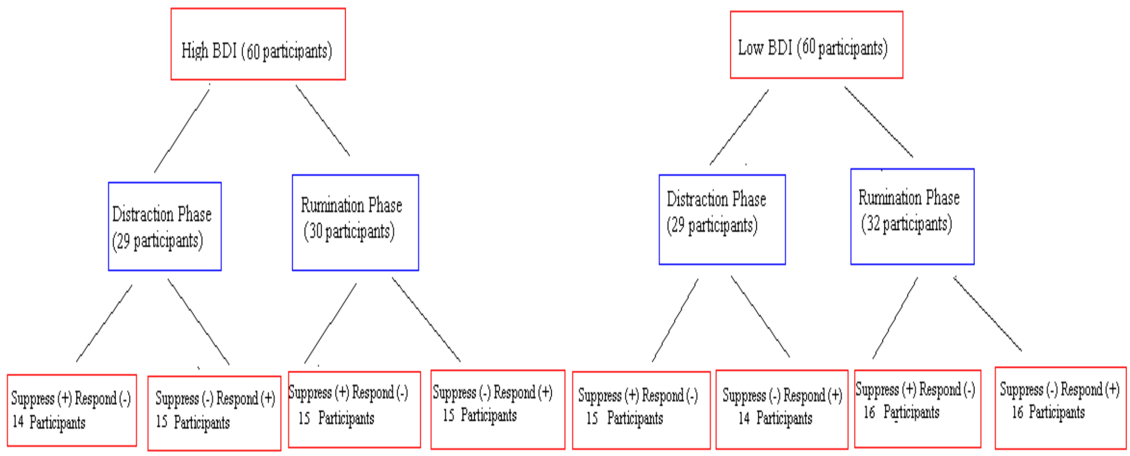

Figure 3.1 Flowchart illustrating participant group allocation

3.2.3. Measures and Materials

<u>3.2.3.1. Word Pairs</u>

A set of forty nouns (for example, cottage, officer, valley) were compiled for the present study. These were drawn from the study conducted by Hertel and Gerstle (2003). The nouns were divided into 8 sets of 5 nouns each, with each noun being accompanied by either a positive adjective or a negative adjective (e.g. '*<u>heroic</u>* officer' vs. '*<u>murdered</u>* officer'). This resulted in 4 sets of words paired with positive words and 4 sets of words paired with negative words. These pairings were fully counterbalanced. Furthermore, 10 additional neutral filler nouns (Appendix XXII) accompanied by neutral adjectives were used. These were included so that they could later be used as practice material, and to avoid any primacy or recency effects in the learning phase (for a more detailed coverage on the filler word pairs see Section 3.2.4.2, page 59). All nouns have been matched on concreteness, imageability and emotionality (Paivio, Yuille, & Madigan, 1968; Rubin & Friendly, 1986).

Within each BDI rumination-distraction group (rumination vs. distraction), half the participants were pseudo randomly assigned to suppress positive words associated with neutral cues and to respond to negative words associated with neutral cues, whilst the other half of the group suppressed negative words associated with neutral cued and responded to positive words associated with neutral cues (refer to Figure 3.1).

3.2.3.2. Battery of Self-Report Mood Measures

The Beck Depression Inventory-II (BDI-II; Beck, Steer & Brown, 1996) was used to quantify the degree of depressive symptoms, and allocate participants into dysphoric and non dysphoric groups. The Spielberger State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene & Vagg, 1983) was used to control for anxiety. Visual Analogue Scales (VAS) were created to measure changes in current mood state over the course of the experimental session (See Chapter 2, Section 2.2. page 33 for mood questionnaire properties and administration).

The Ruminative Responses to Depression Questionnaire (RRDQ; Treynor, Gonzalez & Nolen-Hoeksema, 2003) was used to measure how participants usually respond to sad feelings. The RRDQ consists of 22 statements (e.g. how often do you *"analyze recent events to try to understand why you are depressed"*) that involve participants rating their ruminative activities on a four point scale, with 1 = 'almost never' and 4 = 'almost always'. The questionnaire involves combining the numbers corresponding to the selected statements for each of the 22 statements to obtain a total score. The total scores obtainable on the questionnaire range from 22-88, with higher scores indicating more real life rumination. The RRDQ has been shown to possess good internal consistency and validity (Bagby, Rector, Bacchiochi & McBride, 2004; Nolen-Hoeksema & Morrow, 1991).

3.2.3.3. Rumination Manipulation

The manipulation followed exactly the same procedure by Lavender and Watkins (2004). This procedure was based upon the rumination manipulation originally developed by Nolen-Hoeksema and Morrow (1993), but was adjusted for British participants (for example, the item *"the way the Grand Canyon looks at sunset"* was changed to *"the way Stonehenge looks at sunset"*). Participants in both the rumination and distraction conditions were given 45 statements to read and imagine. In both conditions participants were asked to centre their attention on each item at a time, and to imagine it vividly. Participants in the rumination condition were instructed to focus their attention on thoughts that are self and emotion focused. For example, participants were asked to *"think about what their feelings might mean"*. In contrast, participants in the distraction condition were instructed to focus their attention on thoughts that are externally focused and unrelated to emotional feelings, such as being asked to *"think about clouds forming in the sky"* (Lavender & Watkins, 2004; Nolen-Hoeksema & Morrow, 1993). Participants in both conditions were instructed to concentrate on the 45 items for a total of 8 minutes. The manipulation was self-paced.

3.2.3.4. Battery of Neuropsychological Measures

Prior investigations have found that depression and dysphoria impair performance on various aspects of neuropsychological functioning, with symptoms including attention and memory-related deficits (Channon & Green, 1999). Therefore, in order to establish if the two groups differ on any of these processes, thus confounding our interpretation of any differences in intentional forgetting, a battery of tests were selected, which tap into executive functioning and working memory processes.

Tests of verbal and semantic fluency (Spreen and Benton, 1969) are amongst the most widely employed measures used to assess cognitive functioning (Henry, Crawford & Phillips, 2004). The Verbal Fluency Task requires the use of a self-generated strategy, during three 60 second trials, in which as many words as possible are generated with the letters F, A, S, respectively. The Semantic Fluency version of this task consists of two 60 second trials and requires participants to produce words within specific categories (animals and vegetables). Both of these measures require efficient organisation of verbal recall and retrieval, as well as inhibition of responses when appropriate (Rosser & Hodges, 1994). Both measures also impose significant and comparable demands on executive processes (Henry, Crawford & Phillips, 2004). For both the verbal and semantic fluency tasks, the total score reflected the sum of correct words generated across the three and two trials, respectively.

Another task which places considerable demands on working memory and executive processes is Random Number Generation (RNG; Towse & Neil, 1998). RNG is a pseudo self-generated task, which involves participants generating numbers between 1 and 9 in random order. The randomisation responses are transcribed by the experimenter, as they are given. Participants are asked to generate a number every time a cross appears on the screen. The cross appears 38 times, at variable rates of 500ms, 1000ms or 1500ms, to prevent participants anticipating the cross. This measures the tendency to count in a random series (i.e. 2, 7, 1, 6, 5). RNG involves access to a number of rules that define 'randomness', and based upon these rules requires adopting and using particular strategies to either select individual responses or suppress responses that violate the rules of 'randomness'. Responses are then monitored by being held in working memory and are compared to the concept of 'randomness'. For the random number generation task, the RNG index is computed using the RGCalc program (Towse & Neil, 1998). The RNG index is a common measure of randomness (Brown, 2006; Evans, 1978; Evans & Graham, 1980), with the total score representative of the tendency to count in a random series. The RNG index computes scores between 0 (perfect randomness) and 1 (complete predictability), with higher count scores representing less random number generation.

The Stroop-Colour Naming Task (adapted from Trenerry, Crossen, DeBoe & Leber, 1989) looks at selective attention, and is measure of the effect of interference and facilitation on performance of a colour identification task, using neutral, congruent and incongruent words. Incongruent words were defined as colour words that differed from the colour expressed by the word's semantic meaning (i.e. the word *red* printed in '*green*' ink). Congruent words were defined as colour word's that corresponded to the colour expressed by the words semantic meaning (i.e. the word *red* printed in *'red'* ink), and neutral words were word's with semantic meanings that did not relate to the colour expressed (i.e. the word *table* in '*orange'* ink). Participants were presented with a computerised E-prime version of the Stroop-colour naming task, which involved participants being presented with a random series of 96 words. 48 words were neutral, 24 were congruent words, and 24 were incongruent words. The words were in red, green, orange or blue ink. Participants were required to press the button on the keyboard that corresponded to the colour of the ink of a word, whilst ignoring the semantic meaning of the word.

To determine if there were any group differences on selective attention, Stroop responses were scored. In the task both correct and incorrect responses were recorded and error rates for colour incongruent words were analysed. Furthermore, participant's reaction times for correct responses were also analysed. Mean reaction times for neutral, congruent and incongruent words were calculated. To account for overall speed differences between dysphoric and non-dysphoric participants in the Stroop task, interference and facilitation ratios were analysed. The interference effect was expressed as the difference between the time needed to name the colour of a neutral word and the time taken to name the colour of an incongruent colour word ((incongruent – neutral) / neutral * 100)). The facilitation effect was expressed as the difference between the time needed to name the colour of a neutral word and the time taken to name the colour of a congruent colour word ((congruent – neutral) / neutral * 100)).

The Intradimensional- Extradimensional Task (IDED) adapted from Roberts, Robbins & Everitt (1988) is a cognitive rule-learning and attentional set-shifting paradigm. IDED is a computerised task (E-prime, version 1.0), whereby participants are presented with three coloured shapes in a pyramid layout. One of the bottom blocks matches the top block for shape, the other matches the colour. Participants must decide which is the current match i.e. which bottom block matches the top block, by pressing the corresponding key. After participants have pressed a key, a feedback display will appear either saying ‘correct’ or ‘incorrect’. If participants are correct then they have matched the blocks according to the correct criteria. However, if participants are incorrect, they must match according to the other criteria when the next set of blocks are presented. For example, if participants are presented with a screen showing a blue circle in the top block, a blue square in the bottom right hand block (colour), and a red circle in the bottom left hand block (shape), they must decide which is the current match. If participants match for colour, they will press the key corresponding to the blue square. If they receive feedback saying incorrect then they would know the matching criteria is not colour. Therefore, in the next trial instead of matching for colour they would match for shape. The same sorting criterion is used for several slides. After a certain number of slides the sorting criteria changes and participants must work out which criteria (*‘colour’* or *‘shape’*) to use depending on the feedback they receive. The IDED task involves 138 trials being presented (see Appendix III for an example of a trial).

To determine if there were any group differences on measures of attentional control the IDED task was scored. In the task ID shifts were defined as maintaining a previously reinforced categorisation rule, when presented with perceptually novel exemplars (e.g. continuing to sort out stimuli by *'shape'* but shift from sorting *'circles'* to *'triangles'*), and ED shifts were defined as shifting from a previously reinforced categorisation rule to a new rule (e.g. from sorting stimuli by *'shape'* to sorting stimuli by *'colour'*). In the task both correct and incorrect responses were recorded and error rates were analysed. An error was defined as the number of times participants failed to change sorting principles when the category changed, and kept sorting according to the no longer correct sorting criteria. An error was an incorrect response made after the first match in the block, which indicated to participants that there has been a shift in rule. An error after an ED shift was defined as an ED error and an error after an ID shift was defined as an ID error. For each participant total ID and ED scores reflected the sum of ID and ED errors made. Furthermore, participant's reaction times for correct responses for ID and ED shifts were also analysed. Mean reaction times for ID and ED shifts were calculated for each individual.

Given the fact that the aim of the current study is to determine whether any observed deficits in intentional forgetting in dysphoric individuals are the result of impaired attentional control, it is important to look at the relationship between measures of attentional control (i.e. Stroop and IDED) and intentional forgetting of previously-suppressed words.

3.2.4. Procedure

Participants were tested individually in a quiet room. The study involved two testing sessions.

3.2.4.1. Initial Assessment

In the first session participants were given the screening questionnaire (see Appendix I), BDI, trait scale of the STAI (STAI-T,) and the Ruminative Responses to Depression Questionnaire (RRDQ). Participants were asked to take part in the main experimental session based upon their BDI scores.

3.2.4.2. Main Test Session

On the second testing session participants were given the first set of VAS, verbal and semantic fluency and random number generation tasks. Participants then underwent the rumination-distraction manipulation and were subsequently given a further set of VAS to complete.

The experimental task was presented on a 15-in (height) *18-in (width) colour monitor with participants seated approximately 50cm from the screen. Each word pair was presented in black (Times New Roman, font size 14), using non-capital letters on the screen for 600 milliseconds. Participants were asked to create a self-referential mental image for each word pair presented. For example, if the word pair was 'sandy desert', participants could imagine walking in a sandy desert. Participants were subsequently asked to rate the meaningfulness of the image on a scale of 1 to 5 (with 1 being *'not meaningful'* and 5 being *'very personally meaningful'*). Participants were given unlimited time to respond, by pressing the key that corresponded to how meaningful the word pair was. This was then followed by a 600msec inter-trial interval. Word pairs were presented in 5 randomised blocks of 9 pairs, which included each word pair from the 8 sets, plus one neutral-filler word pair for each block that remained the same across participants (for example, *'underground cellar'*). Neutral filler word pairs were included so that they could later be used as material in the training phase of the task (see below Section 3.2.4.2, page 60). Furthermore 2 additional neutral-filler word pairs were included at the beginning of the first block and two neutral-filler word pairs were included at the end of the final block, which remained the same for all participants. These words were included to eliminate any primacy and recency effects.

Once all the word pairs had been presented, participants were given a cued recall test. Each cue word (e.g. *'sandy'*) was presented on the screen for a maximum time period of 5200ms. Participants were asked to recall aloud the corresponding target associated with the cue word as quickly as possible (e.g. *'desert'*). This was then followed by a delay of 200ms. Subsequently feedback, i.e. the correct response was given to participants, followed by an inter-trial interval of 300ms. All participants were required to achieve a minimum of 50% (mean number of trials required = 25) on the assessment to continue with the procedure. The mean number of correct trials by the dysphoric group was 34, and the mean number of correct trials by the non-dysphoric group was 31. There were no significant group differences in the number of trials correctly recalled, $p > 0.05$. Participants were given a maximum of 3 tests to achieve this criterion. If participants did not reach the criterion after 3 attempts, the experimental procedure was terminated and participants were debriefed and informed that their data would be safely discarded. However, in the present study all participants reached the criterion within 3 attempts.

To ensure that participants understood the procedure for the main suppression phase participants were given a training phase, which was exactly the same as the main suppression phase, but differed only in terms of the words used. Participants were told that they would be shown a cue word, which they either had to respond to by saying aloud the target word (response condition), or avoid saying or thinking about the corresponding target word (suppression condition). The training block consisted of 32 trials randomly presented. The material for the training block consisted of the 10 neutral filler word pairs from the learning phase. This included 4 word pairs being presented once in the respond condition, and 4 word pairs being presented once in the suppression condition. Because the study involved investigating the effects of instruction upon performance, an additional word pair was presented 8 times in the respond condition, and another word pair was presented 16 times in the suppression condition, thus resulting in 32 trials.

To ensure that participants were actively suppressing corresponding words rather than having passively forgotten them in the learning phase participants were presented with a list of 15 all negative or all positive cue words (depending on the condition that they had been assigned to), corresponding to the targets to be suppressed. Participants were given two minutes to familiarise themselves with the target words and were then required to identify all 15 cues from a list that contained 15 novel words of the same valence (these included suppression word pairs for 1, 8 and 16 repetitions. The 0 repetition (baseline) suppression word pairs were not included). Participants were given a maximum of 4 attempts to reach this criterion and continue with the study. If participants did not identify all 15 cue words correctly within 4 attempts, the procedure was terminated and participants were debriefed and informed that their data would not be included in future analysis. However, in the present study all participants reached the criterion within 4 attempts.

Each trial began with participants being instructed to focus on a small cross appearing on the screen for 200ms. Subsequently a cue word appeared for a maximum of 300ms. On a respond trial, participants were instructed to recall aloud the target word. Incorrect responses resulted in the correct target being displayed in blue for 500ms. On a suppression trial, participants were required to withhold their response. For every suppression trial, a cue word was preceded by 3 very large red Xs (in font size 36) which were displayed as a cue for suppression. This was followed by an inter-trial interval of 400ms, before the next trial began.

The total number of trials for the task was 250, which included cue words for responding being presented 1, 8 and 16 times, and cue words for suppressing also being presented 1, 8 and 16 times. The 250 trials were randomly presented. It is important to note that words in the 0 repetition condition (i.e. baseline words) were presented in the initial learning phase and on the final test, but not during the think/no-think phase. The baseline condition measures participants' memory of words that have not been recalled or suppressed.

In the final cued recall test, participants were presented with all forty cue words and were asked to disregard previous instructions and to recall all target words associated with every cue. Each trial began with participants instructed to attend to a cross displayed for 200ms. Subsequently a cue word was presented for 300 ms. Participants were asked to recall aloud the associated target word for the cue. This was then followed by an inter-trial interval of 400ms, before the next trial began.

Following the completion of the memory task, participants completed the Stroop Task and the IDED task. All participants were then asked to fill out the BDI and state scale of the STAI (STAI-S).

3.2.5. Scoring and data analysis

To determine the presence of any group differences, age, verbal and semantic fluency, and random number generation (RNG) were analysed using a one-way between groups multivariate analysis of variance. Furthermore, BDI, RRDQ and STAI were also analysed using a one-way between-groups multivariate analysis of variance. In addition, gender, marital status, occupation and education (i.e. level of education reached) were analysed using chi-square.

To determine the effectiveness of the rumination manipulation upon self-reported mood, participant scores were analysed on each measure of VAS (sadness, anxiety and fatigue) using a 2 (group) x 2 (rumination manipulation) x 2 (before and after manipulation) mixed design ANOVA. Between-subject factors consisted of group (dysphoric vs. non-dysphoric) and rumination manipulation (rumination vs. distraction) and within-subject factors was the two time points VAS was administered (before and after rumination manipulation).

The principle dependent measure of interest was the percentage of words correctly recalled on the final cued recall test. This was assessed using a 2 (group) x 2 (valence) x 2 (rumination) x 2 (instruction) x 4 (repetition) mixed design ANOVA. Between-subject factors were group (non-dysphoric vs. dysphoric), valence of cues for suppression (positive vs. negative) and rumination manipulation (rumination vs.

distraction) and within-subject factors were the type of instruction during the suppression phase (suppress vs. respond) and the number of times the cues were presented (0, 1, 8 or 16). The significance level was set at 0.05. Follow up analyses were conducted using one-way repeated measures ANOVA and independent samples t-tests. Alpha levels for pairwise comparisons were adjusted in accordance to the Bonferroni correction method (see Keppel & Wickens, 2004).

3.3. Results

3.3.1. Participant characteristics

Analysis of the participants characteristics demonstrate that the four groups (dysphoric rumination vs. dysphoric distraction vs. non-dysphoric rumination vs. non-dysphoric distraction) did not differ significantly with respect to age; occupation; marital status; education or gender (see Table 3.1). The groups did differ significantly in terms of their depression (BDI-II) scores; first measure of BDI, $F(4, 116) = 68.2$ $p < 0.0$; second measure of the BDI, $F(4, 116) = 62.8$ $p < 0.05$, with dysphoric participants in the rumination and distraction groups scoring significantly higher on both measures of BDI than non-dysphoric participants in the rumination and distraction groups; all tests $p < 0.01$. However, there were no significant differences in depression scores between dysphoric participants in the rumination and distraction groups; all tests $p > 0.01$. Moreover, there were no significant differences in depression scores between non-dysphoric participants in the rumination and distraction groups; all tests $p > 0.01$. The four groups also differed in rumination (as measured by the RRDQ), $F(4, 116) = 14.1$ $p < 0.05$, with dysphoric participants in the rumination and distraction groups ruminating significantly more than non-dysphoric participants in the rumination and distraction groups; all tests $p < 0.01$. However, there was no significant difference in the tendency to ruminate between dysphoric participants in the rumination and distraction groups, $p > 0.01$. Moreover, there was also no significant difference in rumination between non-dysphoric participants in the rumination and distraction groups, $p > 0.01$. Furthermore, significant group differences were observed for state and trait anxiety; state anxiety, $F(4, 116) = 11.4$ $p < 0.05$; trait anxiety, $F(4, 116) = 28.0$ $p < 0.05$, with dysphoric participants in the rumination and distraction groups significantly more anxious than non-dysphoric participants in the rumination and distraction groups; all tests $p < 0.01$. However, there were no significant differences in state and trait anxiety scores between dysphoric participants in the rumination and distraction groups; all tests $p > 0.01$. Moreover, there were no significant differences in state and trait anxiety scores between non-dysphoric participants in the rumination group and distraction groups; all tests $p > 0.01$ (see Table 3.1).

<u>Table 3.1-</u> Mean performance indices and p values on general characteristics and mood measures as a function of participant group *(standard deviations are presented in parentheses).*

	Dysphoric (D)		Non-Dysphoric (ND)		
	Rumination Group (n=29)	**Distraction Group (n=31)**	**Rumination Group (n=32)**	**Distraction Group (n=28)**	**P- value**
Age	22.31 (5.5)	21.19 (4.2)	22.31 (6.2)	21.79 (4.4)	p > 0.05
Sex Ratio	4 M; 25 F	4 M; 27 F	7 M; 25 F	8 M; 20 F	p > 0.05
STAI-S	42.24 (9.5)	38.42 (10.7)	31.41 (6.1)	31.36 (7.8)	p < 0.05
STAI-T	51.24 (10.0)	47.87 (12.0)	34.66 (7.1)	33.29 (7.4)	p < 0.05
RRDQ	52.03 (12.0)	50.19 (13.6)	37.16 (9.2)	36.82 (12.6)	p < 0.01
BDI (1)	17.21 (7.2)	15.68 (5.8)	3.91 (2.4)	3.61 (2.1)	p < 0.01
BDI (2)	14.90 (6.5)	15.97 (7.2)	2.94 (2.0)	2.71 (1.8)	p < 0.01

M = Male F = Female; STAI-S = State anxiety subscale on the STAI; STAI-T = Trait anxiety subscale on the STAI; RRDQ = Ruminative Responses to Depression Questionnaire; BDI (1) = First measure of the Beck Depression Inventory; BDI (2) Second Measure of the Beck Depression Inventory.

Analysis of the data (presented in Table 3.2 below) revealed that groups did not differ significantly on verbal and semantic fluency or the random number generation task; all tests $F < 1$. Further, no significant group differences were apparent on the IDED task (for both reaction times and number of errors) or the Stroop task (for all measures interference index, facilitation index and number of errors); all tests $F < 1$.

<u>Table 3.2-</u> **Mean performance indices and p values on the neuropsychological test battery as a function of participant group** ***(standard deviations are presented in parentheses).***

	Dysphoric (D)		Non-Dysphoric (ND)		
	Rumination Group (n=29)	**Distraction Group (n=31)**	**Ruminatio n Group (n=32)**	**Distraction Group (n=28)**	**P- value**
Verbal	35.66 (9.8)	38.39 (11.6)	36.28 (11.2)	34.75 (10.9)	p > 0.05
Semantic	35.07 (6.1)	34.97 (8.6)	34.91 (7.2)	33.93 (8.6)	p > 0.05
RNG	.17 (0.1)	.22 (0.1)	.21 (0.1)	.20 (0.1)	p > 0.05
Stroop-I	.27 (0.2)	.23 (0.2)	.28 (0.2)	.19 (0.1)	p > 0.05
Stroop-F	. 01 (0.1)	.02 (0.1)	.02 (0.8)	.02 (0.6)	p > 0.05
Stroop-E	.79 (0.1)	1.42 (1.6)	.72 (0.9)	1.39 (2.8)	p > 0.05
ID Errors	2.69 (5.6)	3.52 (7.4)	3.09 (4.9)	2.43 (4.5)	p > 0.05
ED errors	5.62 (6.9)	6.03 (8.7)	5.31 (6.2)	5.54 (5.2)	p > 0.05
ID RT	810.30 (270.4)	843.16 (271.6)	890.87 (694.0)	815.56 (229.9)	p > 0.05
ED RT	914.20 (302.4)	936.39 (292.7)	1045.43 (933.4)	879.74 (229.9)	p > 0.05

Verbal = Verbal Fluency; Semantic = Semantic Fluency; RNG = Random Number Generation; Stroop-I = Stroop Interference; Stroop-F = Stroop Facilitation; Stroop-E = Stroop Errors; ID RT = ID reaction time; ED RT = ED reaction time.

3.3.2. Rumination Manipulation (as measured by VAS)

Analysis of VAS revealed that there was a significant time x BDI group x rumination-distraction manipulation effect for sadness, $F(1, 119) = 4.8$ $p < 0.05$. Subsequent analysis revealed that there was no significant effect of rumination-distraction manipulation for both dysphoric (rumination M = 40.34, SD = 22.1; distraction M =

31.15, SD = 17.1) and non-dysphoric participants (rumination M = 18.69, SD = 11.1; distraction M = 19.89, SD = 10.4) on the first measure of sadness taken before the rumination-distraction manipulation; all tests $p > 0.05$. Furthermore, results revealed that there was no significant difference of rumination (M = 18.97, SD = 14.8) distraction (M = 17.5, SD = 15.9) manipulation for non-dysphoric participants on sadness, $p > 0.05$. However, there was a significant effect of the rumination-distraction manipulation for dysphoric participants on sadness, $t(59) = 4.9$ $p < 0.001$, with participants scoring significantly higher on sadness in the rumination (M = 51.38, SD = 20.4) than the distraction condition (M = 27.73, SD = 16.8) (see Figure 3.2).

Results also revealed that there was a significant time x BDI group x rumination-distraction manipulation effect for anxiety, $F(1, 119) = 9.0$ $p < 0.01$. Subsequent analysis revealed that there was no significant effect of rumination-distraction manipulation for both dysphoric (rumination M = 43.29, SD = 22.7; distraction M = 37.58, SD = 19.4) and non-dysphoric participants (rumination M = 24.98, SD = 15.3; distraction M = 21.77, SD = 18.4), on the first measure of anxiety taken before the rumination-distraction manipulation; all tests $p > 0.05$. Furthermore, results revealed that there was no significant difference of rumination (M = 24.70, SD = 18.1) distraction (M = 20.05, SD = 18.9) manipulation for non-dysphoric participants on anxiety, $p > 0.05$. However, there was a significant effect of the rumination-distraction manipulation for dysphoric participants on anxiety $t(59) = 5.5$ $p < 0.01$, with participants scoring significantly higher on anxiety in the rumination (M = 51.41, SD = 21.3) than the distraction condition (M = 24.55, SD = 16.6) (see Figure 3.3).

However, no significant interaction of time x group x rumination-distraction manipulation was found for the measure of fatigue, F(1, 119) = 1.9 p > 0.05. Furthermore, no main effects of time or rumination-manipulation were also observed for the measure of fatigue; all tests F < 1.

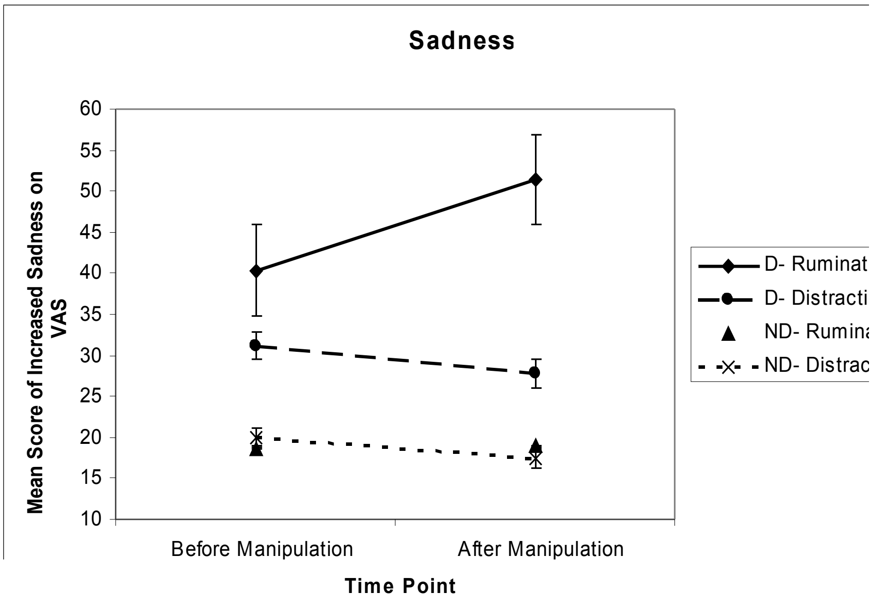

Figure 3.2. Mean VAS sadness ratings for the four groups of participants in relation to the time of rating (i.e. before and after the rumination/distraction manipulation) (error bars represent ± one standard error of the mean).

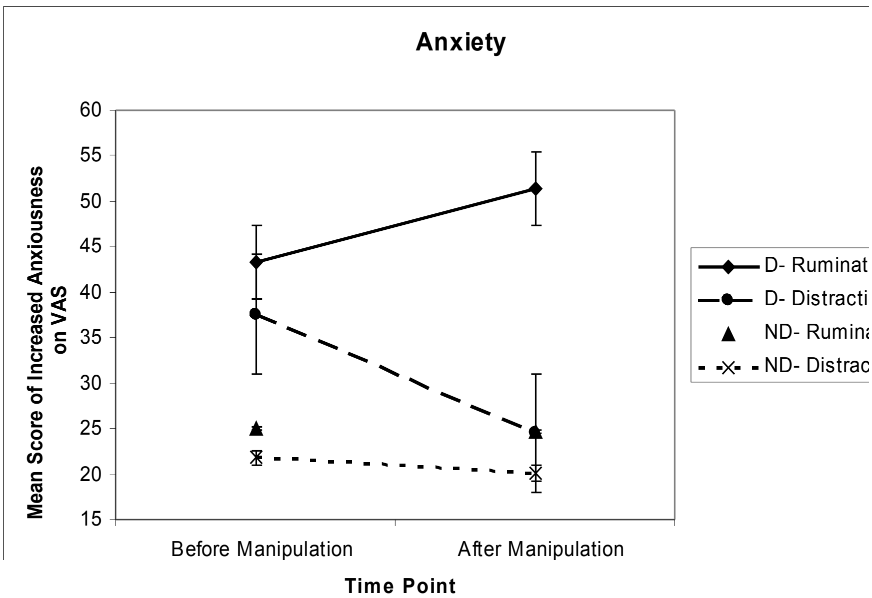

Figure 3.3. Mean VAS anxiety scores for the four groups of participants in relation to time of rating (i.e. before and after the rumination/distraction manipulation) (error bars represent ± one standard error of the mean).

3.3.3. Memory for paired associates

Analysis revealed an overall main effect of group, $F(1, 119) = 7.6$ $p < 0.03$, with the dysphoric group (M = 80.46, SD = 10.5) recalling significantly more words than the non-dysphoric group (M = 74.17, SD = 12.3). The results also revealed an overall main effect of instruction, $F(1, 119) = 29.0$, $p < 0.03$, with participants recalling significantly more respond (M = 81.29, SD = 10.2) than previously-suppressed words (M = 73.33, SD = 17.6). Furthermore, an overall main effect of repetition was also found, $F(1, 119) =102.8$ $p < 0.05$, with subsequent analyses revealing that participants recalled significantly more words presented one (M = 76.00, SD = 17.2), eight (M = 84.92, SD = 14.0) and sixteen times (M = 87.42, SD = 11.6) than baseline (M = 60.92, SD = 19.8); 1 time $t(119) = 8.9$ $p < 0.01$; 8 times $t(119) = 14.0$ $p < 0.01$; 16 times $t(119) = 15.5$ $p < 0.01$. Participants also recalled more words presented eight and sixteen times than one time, 8 times $t(119) = 5.7$ $p < 0.01$; 16 times $t(119) = 6.8$ $p < 0.01$. Furthermore, participants also recalled more words presented sixteen than eight times, $t(119) = 2.1$ $p = 0.03$.

It was predicted that *"dysphoric participants would recall a significantly higher percentage of previously-suppressed words than would the non-dysphoric participants"*. In line with this prediction results revealed a significant group x instruction interaction, $F(1, 119) = 4.1$ $p < 0.05$. Pairwise comparisons revealed that dysphoric participants recalled significantly more previously-suppressed words (M =

77.8, SD=15.3) than did the non-dysphoric participants (M = 68.8, SD=18.6); t(118) = 2.9 p < 0.03 (see Figure 3.4).

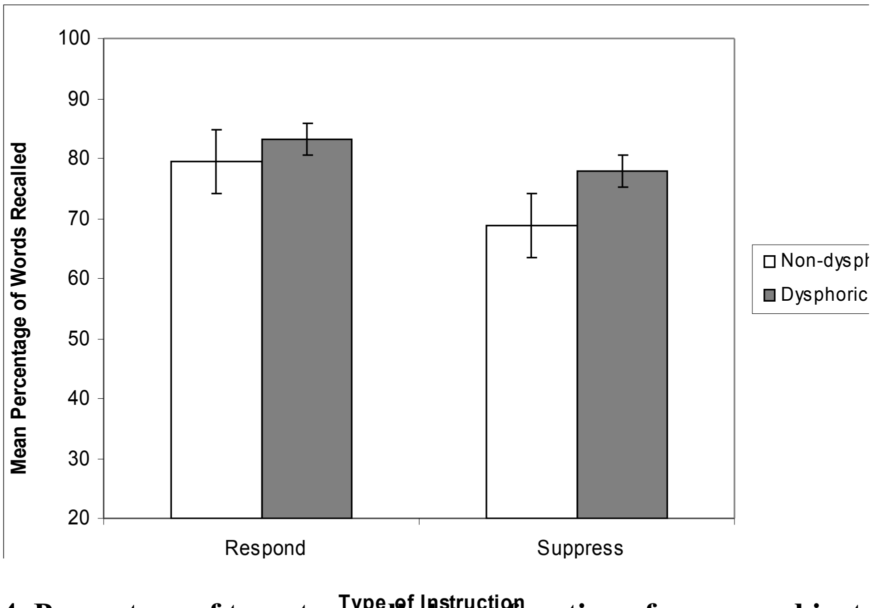

Figure 3.4. Percentage of targets recalled as a function of group and instruction (error bars represent ± one standard error of the mean).

It was also predicted that *"dysphoric participants in the rumination group would recall a significantly higher percentage of previously-suppressed words than would all other participant groups"*. However, there was no evidence of the expected interaction between instruction x rumination manipulation x group, F < 1. Furthermore, results also failed to find a significant main effect of rumination manipulation, F < 1.

Interestingly, findings revealed a significant instruction x rumination manipulation x valence for suppression effect, F(1, 119) = 4.7 p < 0.05. In order to determine whether this interaction was specific to instruction, subsequent pairwise analyses were carried out which revealed that there was no significant interaction between rumination manipulation and valence for suppression in the respond condition ((i) distraction positive M = 79.83, SD = 9.8 (ii) distraction negative M = 81.38, SD = 9.2 (iii) rumination positive M = 84.33, SD = 11.8 (iv) rumination negative M = 79.68, SD = 9.5); $p > 0.03$. Rather, the results demonstrate that the interaction between rumination manipulation and valence for suppression is specific to the suppress condition ((i) distraction positive M = 70.67, SD = 16.8 (ii) distraction negative M = 77.93, SD = 19.5 (iii) rumination positive M = 78.67, SD = 12.4 (iv) rumination negative M = 66.45, SD = 18.5); $t(119) = 3.0$ $p < 0.03$ (see Figure 3.5).

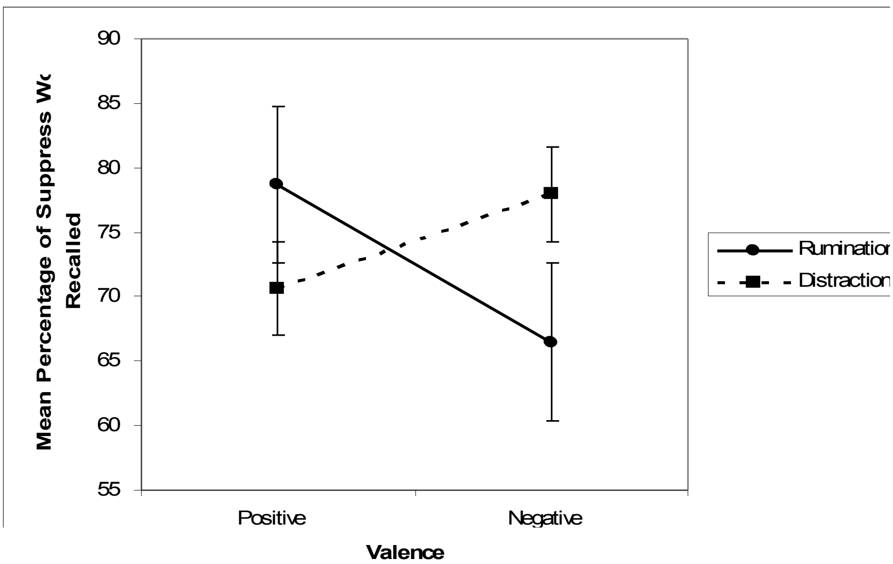

Figure 3.5. Illustrating differences in mean percentage of suppressed words recalled as a function of word valence in the rumination and distraction conditions (error bars represent ± one standard error of the mean).

Although results were not statistically significant, Table 3.3 demonstrates a general trend with the non-dysphoric group recalling more positive than negative previously-suppressed words, thus demonstrating more effective suppression of negative material. However, the dysphoric group demonstrated even handed recall of positive and negative respond and previously-suppressed words.

<u>Table 3.3-</u> **Mean performance indices (in percentage) by valence of words on suppression and respond conditions as a function of participant group *(standard deviations are presented in parentheses).***

	Dysphoric (N = 60)	**Non-Dysphoric (N = 60)**
Positive Respond	82.27 (18.8)	81.85 (11.4)
Negative Respond	84.07 (7.1)	77.58 (10.0)
Positive Suppress	80.27 (18.8)	81.85 (11.4)
Negative Suppress	84.00 (16.0)	65.45 (20.3)

It was predicted that *'forgetting would increase with the number of times the memory was previously-suppressed for both dysphoric and non-dysphoric participants'*. However, contrary to this prediction results failed to find a significant instruction x group x repetition interaction, $F < 1$.

3.3.4. Pearson Correlations

It was also predicted that *"there would be a significant correlation between performance on measures of attentional control (Stroop and IDED) and suppression, with good attentional control being associated with recalling a significantly lower percentage of previously-suppressed words then poor attentional control"*. However, there was no evidence of a significant correlation between attentional control, as measured by Stroop and IDED and the total number of previously-suppressed words recalled, Stroop interference $r(120) = 0.01$ $p > 0.05$; Stroop facilitation $r(120) = 0.02$ $p > 0.05$; Stroop errors $r(120) = 0.04$ $p > 0.05$; ID errors $r(120) = 0.06$ $p > 0.05$; ED errors $r(120) = 0.12$ $p > 0.05$; ID reaction time $r(120) = 0.12$ $p > 0.05$; ED reaction time $r(120) = 0.11$ $p > 0.05$.

A paired samples t-test revealed no significant differences between the first ($M = 10.09$, $SD = 8.0$) and second ($M = 9.51$, $SD = 8.7$) measure of the BDI; $t(1, 119) = 1.6$ $p > 0.05$. To determine whether the first measure of BDI correlated with the second measure of BDI a Pearson correlation was carried out which revealed a highly statistically significant correlation between both measures of the BDI $r(120) = 0.92$ $p < 0.001$. Subsequently a mean BDI score was calculated for the two measures and a Pearson correlation was carried out on the mean measure of BDI and the total number of previously-suppressed words recalled. The test revealed a significant positive correlation between mean BDI score and the number of previously-suppressed words recalled $r(120) = 0.28$ $p < 0.01$. These findings suggest that more depressed individuals were less successful at suppression. Pearson correlations also revealed significant effects between usual mood (anxiety measure of trait) and the number of previously-suppressed words recalled, $r(120) = 0.18$ $p < 0.05$, and rumination (as measured by the RRDQ) and the number of previously-suppressed words recalled,

$r(120) = 0.21$ $p < 0.05$, with both trait anxiety and rumination positively associated with recall of previously-suppressed words. These findings suggest that the more anxious a person was, the less successful they were at suppressing words. Furthermore, the findings also suggest that individuals reporting more real-life rumination were less successful at suppression.

In order to determine the degree of association between each of the three factors (i.e. rumination, trait anxiety and depression), with the number of previously-suppressed words recalled, whilst controlling for the effects of the remaining two factors, partial correlations were carried out. Partialling out the effects of rumination and trait anxiety, results found a significant positive Pearson correlation between the mean measure of BDI and the number of previously-suppressed words recalled $r(120) = 0.22$ $p < 0.05$. However, no significant correlations were obtained between rumination and the number of previously-suppressed words recalled when anxiety and BDI were partialled out or between anxiety and the number of previously-suppressed words recalled when rumination and BDI were partialled out, all tests $p > 0.05$. Taken together, these findings suggest that impaired forgetting of previously-suppressed words is specifically related to depression.

Interestingly, subsequent analysis carried out on both positive and negative previously-suppressed words revealed that the correlation between mean BDI and the number of previously-suppressed words recalled was specific to negative words $r(120) = 0.31$ $p < 0.01$ Thus demonstrating that individuals scoring high on the BDI, recalled more negative previously-suppressed words. However, there was no significant correlation between mean BDI score and the number of positive previously-suppressed words recalled.

3.4. Discussion

3.4.1. Background

The primary purpose of the present study was to extend the work on intentional forgetting in dysphoria. In particular, the aim of the study was to investigate the role of rumination and attentional control on intentional forgetting in dysphoria.

3.4.2. Group differences in suppression

The prediction that *"dysphoric participants would recall a significantly higher percentage of previously-suppressed words than would the non-dysphoric participants"* was supported by the present findings. These findings are consistent with those obtained by Hertel and Gerstle (2003), who also found that compared to non-dysphoric participants, dysphoric individuals forgot fewer target words after having been instructed to suppress them. Furthermore, the findings are consistent with studies using the list method directed forgetting paradigm, which have found that depressed individuals are impaired in their ability to suppress emotional words (Power, Dalgleish, Claudio, Tata & Kentish, 2000). Taken together, these findings suggest that dysphoria is associated with deficits in intentional forgetting.

Furthermore, the present study also found that this deficit in suppression was not specific to negative words, but was for both positive and negative material. These findings are consistent with Hertel and Gerstle's (2003) study and previous research using standard memory paradigms, which has demonstrated even-handed processing of emotional material in dysphoria (Gilboa & Gotlib, 1997; Mathews & Bradley, 1983; see also Matt, Vazquez & Campbell, 1992 for a review). Furthermore, the findings are also consistent with a recent study by Wong and Moulds (2008), which used an item method directed forgetting paradigm and found that dysphoric individuals demonstrated even handed forgetting of positive and negative words. Taken together, these findings suggest that dysphoric individuals even handed recall of positive and negative material in memory also extends to intentional forgetting.

However, both the present study and Hertel and Gerstle's (2003) study used the same stimuli to test participants. Therefore, it is possible that the non-significant effects of valence on impaired intentional forgetting in dysphoric individuals may relate to the negative material that was used. Literature concerning memory for emotionally valenced material in depression has reported that depressed and dysphoric individuals exhibit a specific bias for depression-relevant (sad) material, and not a general bias for all types of negative stimuli (Bellew & Hill, 1990; Direnfeld & Roberts, 2006; Watkins, Mathews, Williamson & Fuller, 1992; see also Williams, Watts, MacLeod & Mathews, 1997). Furthermore, research has also found that depressed individuals are less able to successfully suppress mood-congruent material in more sustained attempts (Wegner, 1997). Therefore, it is possible that no valence-specific effects were found for dysphoric participants in the present study because the negative words used were not relevant to dysphoric individuals concerns, and thus did not elicit such biases.

However, it is important to note that the findings revealed a significant correlation between depression scores and the number of previously-suppressed negative words recalled. Given the fact that dysphoric participants demonstrate even handed recall of positive and negative previously-suppressed words, these findings suggest that individuals with lower scores on the BDI are more successful at suppressing negative words. This is consistent with previous research which has found that non-depressed healthy individuals demonstrate enhanced forgetting of negative over positive material (Powers et al, 2000). Taken together, these findings suggest that enhanced forgetting of negative material may be impaired in dysphoric individuals.

3.4.3. Effects of rumination on suppression

The hypothesis predicted that *"dysphoric participants in the rumination group would recall a significantly higher percentage of previously-suppressed words than would all other participant groups"*. However, contrary to predictions there was no evidence of a group x rumination x instructions interaction. These findings were inconsistent with Hertel and Gerstle's (2003) study, which demonstrated that individuals reporting more real life rumination had greater difficulty suppressing material. The findings were also inconsistent with recent findings by Joormann and Tran (2008), which found a significant relationship between rumination and impaired forgetting. However, it is important to note that although both Hertel and Gerstle's (2003) and Joormann and Tran's (2008) studies found that rumination and impaired intentional forgetting are associated, their findings were correlational. Therefore, these studies cannot infer that rumination causes impaired intentional forgetting. The present study investigated the causal role of rumination on intentional forgetting by using a rumination manipulation and found that rumination does not mediate the effects of depression on intentional forgetting.

3.4.4. Attentional control and suppression

The prediction that *"there would be a significant correlation between performance on measures of attentional control (Stroop and IDED) and suppression, with good attentional control being associated with recalling a significantly lower percentage of previously-suppressed words then poor attentional control"* was not supported by the results of the current study. Furthermore, the study also failed to find any group differences between dysphoric and non-dysphoric participants on attentional measures of Stroop interference and the number of errors made for incongruent stimuli.

Although these findings are contrary to a large body of research which has found a variety of impairments in depressed individual's performance on the Stroop task (Ottowitz, Dougherty & Savage, 2002; Lemelin et al, 1996; Trichard et al, 1995), which also extend to dysphoric individuals (Killgore, Gruber & Yurgelun-Todd, 2007), the findings are consistent with studies which have found no significant differences between depressed and non-depressed individuals in reaction times to incongruent stimuli (Siegle, Steinhauer & Thase, 2004).

Furthermore, the study also found that there were no group differences between dysphoric and non-dysphoric participants on attentional measures of ID or ED errors. These findings are contrary to findings obtained by Purcell, Maruff, Kyrios & Pantelis (1997) and Beats, Sahakian & Levy (1996), which have both found that depressed individuals require more trials to learn new rules compared to non-depressed individuals. However, these findings are consistent with previous findings that have found no significant differences in ID or ED errors between depressed and non-depressed individuals (Elliott et al, 1996; Kyte, Goodyer & Sahakian, 2005; Sweeney, Kmiec & Kupfer, 2000).

Taken together, the present findings demonstrate that dysphoric individuals are able to perform as well as non-dysphoric individuals on cognitive control measures of Stroop and IDED. These findings are inconsistent with the resource allocation model, which suggests that depressed mood displaces a portion of the total capacity available, which subsequently reduces the amount of task-relevant processing that takes place, thus impairing performance (see Chapter 1, Section 1.7.2, page 17). Instead, the results suggest that dysphoric individuals have sufficient resources to perform a task. The findings are consistent with previous findings that have demonstrated that depressed and dysphoric individuals can perform as well as controls on a variety of cognitive tasks (Sweeney, Kmiec & Kupfer, 2000).

3.4.5. The effects of practice on suppression

The prediction that *"forgetting would increase with the number of times the memory was previously-suppressed for both dysphoric and non-dysphoric participants"* was not supported by the results of the present findings. These findings are inconsistent with those obtained by Anderson and Green (2001), which found that participants were more successful at forgetting as a function of suppression practice. However, given the fact that the present study found that both groups were not successful at suppressing in comparison to the baseline condition, these findings are not surprising.

3.4.6. Overall suppression deficits

Findings showing unsuccessful suppression by the control group (i.e. recalling more previously-suppressed words than words presented in the initial learning phase and the final recall test (baseline), are contrary to previous findings showing successful forgetting in healthy individuals (Anderson & Green, 2001; Anderson et al, 2004). However, the findings are consistent with a growing number of studies which have failed to find below baseline forgetting in healthy individuals (Algarabel, Luciano & Martinez, 2006; Bulevich, Roediger, Balota & Butler, 2006; Hertel & Gerstle, 2003), and lend further support to the notion that attempting to suppress unwanted memories may not necessarily lead to successful forgetting.

A possible explanation for the present findings and those obtained by Hertel and Gerstle (2003) may relate to the fact that simply instructing people to not think about a word leads to those thoughts coming to mind more frequently. These findings provide support for theories on mental control based on post-conscious processes (Dorris & Moran, 2005), which suggest that suppression primes the unwanted thought, which provokes a long-term preoccupation with it. For example, using a word association task Wegner and Erber (1992) found that participants instructed to suppress target words recalled these words more frequently than participants that were actively trying to think of the target words. Furthermore, Liberman and Forster (2000) found that participants in the suppression condition that were instructed to suppress colour stimuli later were more preoccupied with the unwanted stimuli, than participants in the no-suppression condition. Taken together these findings suggest that suppression precipitates more preoccupation with unwanted information (Purdon, 1999).

The findings are consistent with Wegner's theory of ironic processes (1994). According to the theory there are two processes that are required for suppression. The first is an intentional operating process, which involves a conscious and effortful search for thoughts that are not to-be suppressed. The second is the ironic monitoring process, which involves an unconscious and automatic search for thoughts that signal a failure in the suppression attempt (Purdon, 1999). Although the monitoring process usually functions just to activate the operating process, during stress or under mental load, the monitor's effects on the mind can supersede those of the operator, producing more thoughts that are relevant to the unwanted thought. These thoughts act as cues for the unwanted thought and are readily detected by the monitor. This association between the cues and the unwanted thought leads to evoking the unwanted thought (Purdon, 1999; Wegner, 1994; Wegner & Erber, 1992; Wegner, Erber & Zanakos, 1993). Thus, an individual's attempts to suppress a thought may actually lead to the unwanted thought coming to mind, with the processes used in suppression working to elicit the thought. According to this theory, when participants in the present study were asked to suppress target words, the ironic monitor searched for the suppress words in order to determine whether or not the operator was doing its job successfully. During the search more stimuli became relevant to the unwanted thought, which subsequently led to an increase in the activation of the suppress words, to the extent that they surfaced into consciousness, leading to enhanced recall of previously-suppressed words in comparison to baseline. Therefore, this suggests that any attention devoted to the task of suppression likely disrupts procedures that require sustained attention or planning (Conway, Howell & Giannopoulos, 1991; Wegner & Zanakos, 1994). Thus, instructions to suppress are much harder to follow when they are not accompanied by a task that directs attention through external means (Wegner, Schneider, Knutson & McMahon, 1991).

3.4.7. Methodological Considerations

There are a number of important methodological issues arising from the present study that require consideration. The first concerns the materials used in the TNT task. As noted above, the stimuli used in the present study were negative, but not depression-relevant. Given that there is considerable evidence that depression biases processing of emotional material that is congruent with the disorder (Williams, Watts, MacLeod & Mathews, 1997), it is possible that individuals with dysphoria may experience greater difficulty in suppressing depression-relevant words. Therefore, future research could be carried out using depression-relevant words to determine whether the use of these words leads to a different pattern of suppression, compared to positive words in dysphoric individuals.

A second methodological issue concerns the effectiveness of the TNT paradigm to induce forgetting in healthy individuals. Although Anderson and Green (2001) found that healthy non-depressed individuals could successfully suppress neutral material, these findings have not been consistently found. For example, Bulevich, Roediger, Balota & Butler (2006) replicated Anderson and Green's (2001) study and failed to find successful suppression. Taken together, these findings suggest that repeatedly instructing participants to forget may not necessarily lead to successful forgetting. It is important to note, that in order to investigate intentional forgetting in depression it is important to establish successful forgetting in healthy individuals. Therefore, future research needs to modify the current TNT paradigm to ensure that healthy individuals can be successfully induced to forget.

A third methodological issue is that the sample size was relatively small, with each BDI-Rumination group consisting of approximately 15 participants in each condition (i.e. 15 participants suppressing positive words and 15 participants suppressing negative words). It is possible that the small sample size may have reduced the studies power to detect potentially significant associations. Therefore, a larger sample would have been advantageous. However, it is important to note that the present study did find some significant effects. Furthermore, the present study also replicated previous findings by Hertel and Gerstle (2003) and found that dysphoric individuals were significantly impaired at intentionally forgetting emotional material.

It is also important to note that in the present study, participants were given additional study time to familiarise themselves with the to-be-suppressed words. Although this procedural element was included in the original Anderson and Green (2001) think/no-think paradigm, and also included in Hertel and Gerstle's (2003) study, the familiarisation period resulted in previously-suppressed words being presented more often than respond words. This confound may explain why both dysphoric and non-dysphoric individuals recalled more previously-suppressed words than baseline. However, this confound still does not explain why dysphoric individuals recalled significantly more previously-suppressed words than non-dysphoric individuals.

3.4.8. Summary

The study found that, as expected, dysphoric participants recalled more previously-suppressed words than did the non-dysphoric participants, supporting previous findings of impaired forgetting in depression. Contrary to expectations, findings also revealed that forgetting did not increase with the number of times the memory was suppressed. However, these results need to be considered with caution, as both dysphoric and non-dysphoric participants failed to suppress words, in comparison to the baseline condition. Furthermore, contrary to predictions, the present study failed to find a significant difference in the recall of previously-suppressed words between dysphoric participants in the rumination group and all other groups. Moreover, the expected relationship between attentional control and successful suppression was not observed. The present study suggests directions for future work to address some of the issues concerning intentional forgetting in dysphoria. These issues will be addressed in the subsequent studies reported in this thesis.

CHAPTER FOUR

The role of thought substitution in intentional forgetting in dysphoria: Modifying the think/no-think paradigm

4.1. Introduction

4.1.1. Background

Study 1 investigated whether dysphoric individuals could intentionally forget emotional material, using the think-no-think paradigm (Anderson & Green, 2001). The study found that, as expected, dysphoric individuals recalled more previously-suppressed words than did the non-dysphoric participants. However, the results also revealed that both groups were recalling significantly more words in the suppression condition than at baseline. This suggests that both groups were unsuccessful at intentionally forgetting emotional material. Therefore, the aim of the present study was to determine whether using a thought substitution strategy aids intentional forgetting in dysphoric and non-dysphoric participants.

4.1.2. The role of focused distraction in suppression

As discussed in Study 1 (Section 3.4.6, page 82), one explanation for these findings may relate to the fact that simply instructing people to not think about a thought leads to the unwanted thought coming to mind more frequently (Liberman & Forster, 2000; Wegner & Erber, 1992; Salkovskis & Campbell, 1994). For example, Salkovskis and Campbell (1994) found that the use of suppression was associated with an increase in the unwanted thought coming to mind. However, when participants were instructed to employ focused distraction (i.e. to suppress the unwanted thought by engaging in a competing task), they reported a decrease in the unwanted thought coming to mind. These findings suggest that focused distraction can play an important moderating role in suppression.

4.1.3. Thought substitution in the think/no-think paradigm

Given the fact that suppression training during the think/no-think task does not involve the use of any specific thought suppression strategies, or provide participants with any guidance on how to keep the unwanted thought from coming to mind, it thus requires a considerable amount of cognitive control. Hence, participants' attempts at suppressing unwanted material through direct suppression may be rendered ineffective. However, recent research (e.g. Hertel & Calcaterra, 2005) has demonstrated that suppression in the think/no-think paradigm can be strengthened when a strategy to constrain the focus of attention is used.

Hertel and Calcaterra (2005) employed the think/no-think paradigm and demonstrated that when participants were provided with substitute words to think about, instead of the previously learned to-be-suppressed words, the level of forgetting was higher. In the unaided suppression condition, participants were instructed to avoid saying or thinking about the associated response word, whereas in the aided suppression (thought substitution) condition, participants were told to recall new nouns (provided by the experimenter) in order to avoid thinking about the original associated response words. Their results revealed that participants demonstrated successful forgetting in the aided suppression condition, but not in the unaided condition. Interestingly, participants in the unaided suppression condition who spontaneously employed focused distraction (i.e. "*kept myself from thinking about the original response word* *by thinking about another word or image"*) also reported levels of forgetting similar to those obtained in the aided condition, which is an important indicator of the effectiveness of thought substitution in suppression.

Furthermore, Hotta and Kawaguchi (2009) also used the think/no-think paradigm to investigate thought substitution in a sample of healthy participants and found that participants that used a thought substitution strategy recalled significantly fewer previously-suppressed words in comparison to the baseline condition (i.e. never-suppressed words), and this effect lasted for up to 24 hours. Taken together, these findings suggest that using specific techniques, such as distraction, it is possible to prime alternative thoughts which reduce accessibility of the unwanted thought, making it easier to suppress.

4.1.4. Underlying mechanisms responsible for intentional forgetting

It is not possible to determine the underlying mechanism responsible for successful suppression from the findings of Hertel & Calcaterra (2005) and Hotta & Kawaguchi (2009). According to Anderson and Green (2001) using an independent probe test is essential to determine whether impaired memory for previously-suppressed words is due to inhibition, as opposed to associative interference (see Chapter 1, Section 1.4.2.2, page 9). Associative interference involves creating new associations with the cue word in order to 'not think' about the target word and is essentially limited to the cue target association. However, inhibition involves inhibiting the target word itself to prevent it from coming to mind, and can be observed on any test looking at memory of the target word. Given the fact that Hertel and Calcattera (2005) did not use an independent probe test, it remains unclear whether the forgetting effects observed in the study were due to inhibition or associative interference.

A recent study by Bergstrom, De Fockert & Richardson-Klavehn (2009) investigated whether successful suppression using thought substitution in the think/no-think paradigm was due to inhibitory or non-inhibitory mechanisms. The study involved half of the participants being allocated to a thought substitution condition whilst the other half were allocated to the thought suppression condition. Participants were given a final cued recall test and an independent probe memory test. The study found that although both groups showed successful forgetting in the final cued recall test, only participants in the thought suppression condition showed successful forgetting on the independent probe test. These findings suggest that, whilst direct suppression involves engaging inhibitory mechanisms that contribute to forgetting, thought substitution may be due to a non-inhibitory mechanism, such as associative interference.

Although the studies by Hertel & Calcaterra (2005) and Bergstrom, De Fockert & Richardson-Klavehn (2006) have found successful suppression using a thought substitution strategy, their samples consisted of normal healthy participants. Therefore, it is unclear whether dysphoric individuals can intentionally forget material using a thought substitution strategy. The aim of the present study was to address this issue, in order to determine whether thought substitution aids dysphoric individuals to successfully suppress to-be-forgotten material. Furthermore, in order to determine the mechanism responsible for successful suppression, the study also included the use of an independent probe test.

It is also important to note that because Anderson and Green's (2001) study used neutral material and Study 1 used emotional material, it is possible that participants failed to suppress material in Study 1, as well as Hertel and Gerstle's (2003) study because emotional material was used. Therefore, in order to determine whether this discrepancy between findings was due to the affective valence of the stimuli used, the present study used neutral word pairs.

Furthermore, as previously discussed, Study 1 involved participants being given additional study time to familiarise themselves with the to-be-suppressed words. Although this procedural element was included in the original Anderson and Green (2001) think/no-think paradigm, the familiarisation period resulted in previously-suppressed words being presented more often than respond words. Therefore, the present study did not include this procedural element, and thus eliminated this confound.

Given the fact that results from Study 1 1 (Section 3.3.4, page 74) failed to find the expected differences on attentional measures of Stroop and IDED, it is conceivable that the minimum BDI cut off point used for the dysphoric group (10) was too low to capture the essential features of dysphoria, such as sad mood and/or loss of interest. Instead the scores may reflect secondary features of dysphoria, which are not prerequisite symptoms in dysphoria, such as changes in sleep and appetite (Tennen, Hall & Affleck, 1995) Therefore, the present study followed recommended guidelines described by Kao, Dritschel & Astell (2006) and classified participants with BDI scores of 5 or less as non-dysphoric, and participants with BDI scores of 15 or more as dysphoric.

4.1.5. Research overview

Dysphoric (BDI scores of 15+) and non-dysphoric (BDI scores 0-5) students took part in the study. The study used the same methodology as Study 1. However in the present study, participants learnt a series of neutral adjective-noun pairs. Furthermore, in the suppression phase participants were allocated to one of two conditions: unaided condition or aided (thought substitution) condition. The unaided suppression condition involved participants being presented a cue, and instructed to avoid saying or thinking about the associated response word. The aided suppression condition involved participants recalling alternative nouns (provided by the experimenter), in order to avoid thinking about the original associated response word. Final memory testing was assessed using final cued-recall and independent memory tests. In the independent test, participants were presented with the semantic category and the first letter of the target word and were asked to recall the target word. This form of independent test has been used previously by Anderson and Green (2001) to determine the mechanism underlying intentional forgetting.

4.1.6. Experimental hypotheses

1. In line with Study 1 findings, it was predicted that dysphoric participants would recall significantly more previously-suppressed words than would the non-dysphoric participants in the unaided condition.

2. However, in line with the above findings by Hertel and Calcaterra (2005), as well as Hertel's (2000) cognitive-initiative account (see Chapter 1, Section 1.7.3, page 19 for a detailed summary), which posits that depressive deficits maybe eliminated by constraining attention, it was expected that both dysphoric and non-dysphoric participants would be successful at suppressing words in the aided condition on the

final cued recall test. Thus, the impairment in intentional forgetting in the dysphoric group would be limited to the unaided condition.

3. In line with findings by Anderson and Green (2001), it was predicted that forgetting would increase with the number of times a memory was previously-suppressed.

4. Furthermore, consistent with findings obtained by Bergstrom, De Fockert & Richardson-Klavehn (2009) (see above Section 4.1.4, page 89), it was predicted that successful suppression would not be observed for the aided condition on the independent probe test.

4.2. Method

4.2.1. Design

A 2 (group) x 2 (condition) x 2(instruction) x 3 (repetition) mixed factorial design was used. The between-group factors were group and condition, and the within-group factors were instruction and repetition. The independent variables were group (dysphoric vs. non-dysphoric); instruction (respond vs. suppress); condition (aided vs. unaided) and the number of repetitions (0, 2, 8). The dependent variables were the mean percentage of words recalled on the final cued recall test and the mean percentage of words recalled on the independent test.

4.2.2. Participants

91 never-depressed participants (23M, 68F) completed the Beck Depression Inventory II (BDI-II; Beck et al, 1996) on two occasions, 7 to 14 days apart (median number of days apart = 9), so that a reliable measure of mood could be obtained. Participants were asked to take part in the study based upon their mean BDI scores on both occasions. In line with Kao, Dritschel & Astell (2006), participants with a mean BDI

score of 5 or below were categorised as non-dysphoric and participants with a mean BDI score of 15 and above were classified as dysphoric. This procedure resulted in four groups of 18 participants. 18 dysphoric (4M, 14F; mean age = 22.44; SD = 5.8) and 18 non-dysphoric participants (5M, 13F; mean age = 24.11; SD = 8.7) were allocated to the aided (thought substitution) condition. Moreover, 18 dysphoric (6M, 12F; mean age = 20.83; SD = 4.1) and 18 non-dysphoric participants (5M, 13F; mean age = 22.67; SD = 5.2) were allocated to the unaided condition. 19 participants (3M, 16F) were excluded from the study as their mean BDI scores were above 5 but below 15. The general inclusion and exclusion criteria are cited in Chapter 2 (Sections 2.4.2 & 2.4.3, pages 40-42).

4.2.3. Materials

4.2.3.1. Word Pairs

A set of thirty six noun-adjective word pairs used by Hertel and Calcaterra (2005) were utilised in the present study (see Appendix VI). The nouns-adjective word pairs (e.g. *'security officer'*, *'racing hound'*) were divided into 6 sets of 6 word pairs. Furthermore, 10 additional nouns accompanied by neutral adjectives were also used (see Appendix XXII). For the aided suppression (thought substitution) condition, new nouns (also drawn from Hertel & Calcaterra, 2005) associated with the original adjectives were used (e.g. *'security vehicle'*, *'racing costume'*). All nouns were matched on concreteness, imageability and emotionality (Hertel & Parks, 2002).

4.2.3.2. Assessment of mood and general intellectual function

The Beck Depression Inventory-II (BDI-II; Beck et al, 1996) was used to allocate participants into dysphoric and non dysphoric groups, and assess the degree of depressed mood state. The Spielberger State-Trait Anxiety Inventory (STAI; Spielberger et al, 1983) was used to control for anxiety. The National Adult Reading Test (NART) (Nelson & Williamson, 1991) was used to measure participant's general intellectual function. This was included to control for any group differences in general intellectual ability, as such differences could confound the interpretation of the results obtained. (See Chapter 2 Sections 2.2 & 2.3 pages 33-39 for psychometric properties of the mood questionnaires and the NART and details of their administration).

4.2.3.3. Strategies questionnaire

The no-think (suppression) phase of the think/no-think task involved instructing participants to 'not-think' about the associated response word (i.e. the unwanted memory). However, because participants receive no guidance on how to prevent the associated response word from entering awareness, it is plausible that participants may employ self-initiated thought substitution strategies to prevent the associated response word from coming to mind. Furthermore, because the task requires considerable cognitive control, it is possible that participants may find it difficult to comply with suppression instructions. Therefore, in order to determine whether participants complied with suppression instructions during the 'no-think' suppression phase, and to investigate the extent to which participants used a thought substitution strategy to prevent items from entering awareness, the strategies questionnaire (Hertel & Calcaterra, 2005) was used. The strategies questionnaire consists of four statements (e.g. *"made sure I still knew the associated word first, and then tried to not think of this associated word"*) that look at the uninstructed use of a thought substitution strategy, and success in suppression during the 'no-think' suppression phase. Participants are instructed to read the four statements and indicate how often they used the subsequent strategy by circling one of five responses. These five responses are scored on five levels, from 1 = “never” 2 = “rarely” 3 = “sometimes” 4 = “frequently” and 5 = “very frequently”. The first three statements on the questionnaire look at participant’s compliance with instructions. Higher scores on the first three statements reflect poor compliance. A total score for non-compliance is obtained by adding together participant’s responses to the first three statements. A median split on these scores is then carried out to produce a non-compliance factor. The fourth statement on the questionnaire looks at the use of a thought substitution strategy (e.g. *“kept myself from thinking about the original response word by thinking about something else”*) in the suppression condition. Higher scores on the fourth statement reflect increased use of thought substitution.

4.2.4. Procedure

The study involved two testing sessions. In the first session participants were given the screening questionnaire (see Appendix I), BDI, and the trait scale of STAI (STAI-T) to fill in. Participants were asked to take part in the main experimental session based upon their BDI scores. On the second testing session participants were initially given the NART.

Stage 1 – Learning phase

This phase of the task was identical to the learning phase of the forgetting task in Study 1 (refer to page 59 for more information).

Word pairs were presented in 6 randomised blocks of 7 pairs, which included each word pair from the 6 sets, plus one neutral-filler word pair for each block that remained the same across participants (e.g. *'underground cellar'*). Furthermore 2 additional neutral-filler word pairs were included at the beginning of the first block, and two neutral-filler word pairs were included at the end of the final block, which remained the same for all participants. These words were included to eliminate any primacy and recency effects.

Stage 2 – Recall Phase

Once all the word pairs had been presented participants were given a cued recall test. Each cue word (e.g. *'sandy'*) was presented on the screen for a maximum time period of 5200ms. Participants were asked to recall (aloud) the corresponding target word associated with the cue, as quickly as possible (e.g. *'desert'*). This was then followed by a delay of 200ms. Subsequently feedback, i.e. the correct response was given to participants followed by an inter-trial interval of 300ms. All participants were required to achieve a minimum of 50% (mean number of trials required = 23) on the assessment to continue with the procedure. The mean number of correct trials by the dysphoric group was 30 (65%) and the mean number of correct trials by the non-dysphoric group was 31 (67%). There were no significant group differences in the number of trials correctly recalled, $p > 0.05$. Participants were given a maximum of 3 tests to achieve this criterion. If participants did not reach the criterion after 3 attempts, the experimental procedure was terminated and participants were debriefed and informed that their data would be safely discarded. In the present study, only one participant failed to reach the criterion within 3 attempts.

Stage 3 – Training phase

To ensure that participants understood the procedure for the main suppression phase, participants were given a training phase which was exactly the same as the main suppression phase, but differed only in terms of the words that were used. Participants were informed that they would see some cue words, all of which they had seen previously. The cue words were either presented in a red or green font. Participants were told to respond to green cues as they had in the recall phase (respond condition). To red cues, participants were asked to avoid saying or thinking about the corresponding target word (suppression condition). 9 filler cue words appeared in green (two times each) and one cue appeared in red 8 times, thus resulting in 26 trials. Participants in the aided suppression condition were given a substitute word to recall when the cue word appeared and told that it would help them to not think about the original response word.

Analysis of the three suppression sets (excluding the baseline 0 suppression set) in Study 1 found that dysphoric participants recalled significantly more suppressed nouns associated with cues presented 1, and 8 times than did non-dysphoric participants. However, there was no significant group differences in the recall of suppressed nouns associated with cues presented 16 times (see Appendix V for subsequent analysis). Therefore, given the lack of group differences observed for suppressed nouns associated with cues presented 16 times in Study 1 and the fact that Hertel and Calcaterra's (2005) study found significant forgetting effects when words were presented 2 and 8 times, it was decided to use these repetition conditions to allow for a better characterisation of recall as a function of repetition.

Stage 4 – Suppression and respond phase

Unaided (suppression) condition

Each trial began with a small cross appearing on the screen for 200ms. Subsequently a cue word appeared for 300ms. Green cues were respond cues, and red cues were suppress cues. On a respond trial, participants were instructed to recall aloud the target word. Incorrect responses resulted in the correct target being displayed for 500ms in blue. On an unaided suppression trial, participants were required to withhold their response. For every suppression trial 3 very large red Xs (in font size 36) were displayed as a cue for suppression. This was then followed by the presentation of a cue word and then an inter-trial interval of 400ms before the next trial began.

Aided (thought substitution) condition

Before the main suppression phase, participants in the aided suppression condition viewed 12 randomly ordered cue substitute pairs for 300 ms each. They were instructed to learn the words but to never think about the original response to each cue. On a respond trial, participants were instructed to recall aloud the target word. Incorrect responses resulted in the correct target being displayed for 500ms in blue. On an aided suppression trial, participants were required to withhold the initial response learnt and instead recall the new substitute word they had learnt. For every suppression trial 3 very large red Xs (in font size 36) were displayed as a cue for suppression. Subsequently a cue word was presented, followed by a 500 ms display of the substitute word and an inter-trial interval of 400ms, before the next trial began.

The total number of trials for the task were 184, which included cue words for responding being presented 2 or 8 times and cue words for suppression also being presented 2 or 8 times. The total number of trials also included 8 filler cues for responding each being presented 8 times in green for an additional 64 trials. The 184 trials were randomly presented.

Stage 5 – Final recall tests

Participants were then presented with both the cued recall and the independent probe tests. Test administration order was counterbalanced.

Final cued recall test

The cued recall test involved participants being presented all thirty six cue words. Participants were asked to disregard previous instructions and to recall all original target words associated with every cue. Each trial began with a cross being displayed for 200ms. Subsequently a cue word was presented for 400 ms. Participants were asked to recall aloud the associated target word for the cue. This was then followed by an inter-trial interval of 400ms before the next trial began.

Independent probe recall test

The independent probe test involved participants being presented with the first letter and the semantic category of all thirty six target words. Participants were informed that all the target words had been seen by them previously. Each trial began with a cross being displayed for 200ms. Subsequently the first letter and the semantic category of the target word was presented for 400 ms. Participants were asked to recall aloud the target word. This was then followed by an inter-trial interval of 400ms before the next trial began.

For both the final cued recall test and the independent probe test, all participants were instructed to recall responses learnt from the first part (i.e. learning phase) of the study. They were also informed that if more than one word came to mind they may recall that word as well, and not be concerned about which is the correct word. In the aided condition, participants were further told that as they had learnt substitutes for some of the cues they may say both initial responses learnt and the substitute words. Everyone was reminded that it was very important to recall the correct response word from the learning phase of the experiment (in line with the procedure of Hertel & Calcaterra, 2005).

Following the completion of the think/no-think task, all participants completed the BDI, the state scale of the STAI (STAI-S) and the strategy questionnaires.

4.2.5. Scoring and Data Analysis

To determine whether there were any group differences, participants' demographic characteristics were analysed. Age was analysed using a one-way between groups univariate analysis of variance. In addition, gender, marital status, occupation and education (i.e. level of education reached) were analysed using chi-square. Furthermore, to determine any group differences in general intellectual ability National Adult Reading Test (NART) error scores were analysed using a one-way between groups univariate analysis of variance. In addition, data obtained on self-report mood measures of BDI and STAI-S were also analysed using a one-way between-groups multivariate analysis of variance.

The principle dependent measures of interest were the percentage of words correctly recalled on the final cued recall test and the percentage of words recalled on independent test. Each of these were assessed using a 2 (group) x 2 (condition) x 2 (instruction) x 3 (repetition) mixed design ANOVA. Between-subject factors were group (dysphoric vs. non-dysphoric) and condition (aided vs. unaided) and within-subject factor was the type of instruction during the suppression phase (suppress vs. respond) and the number of times the cues were presented (0, 2 or 8). The significance was set at the 5% level. Follow up analyses were conducted using one-way repeated measures ANOVA, independent and paired samples t-tests. As reported in Study 1(Chapter 3, Section 3.2.5, page 64) alpha levels for pairwise comparisons were adjusted in accordance to the Bonferroni correction method (see Keppel & Wickens, 2004).

4.3. Results

4.3.1. Participant Characteristics

Analysis of participants' characteristics (see Table 4.1) demonstrate that dysphoric (D) and non-dysphoric (ND) groups did not differ significantly with respect to age, gender, occupation; marital status and education (results for occupation, marital status and education are not shown in the table); all tests $p > 0.05$. Furthermore, the two groups did not differ significantly on the NART, $F(1, 71) = 1.4$ $p > 0.05$. However, the two groups did differ significantly in terms of their depression scores, with dysphoric individuals scoring significantly higher on both measures of BDI than non-dysphoric individuals; first measure of BDI, $F(1, 71) = 420.9$ $p < 0.05$; second measure of BDI, $F(1, 71) = 365.5$ $p < 0.05$. The two groups also differed in state and trait anxiety, with dysphoric individuals significantly more anxious than non-dysphoric individuals; state anxiety, $F(1, 71) = 29.0$ $p < 0.05$; trait anxiety, $F(1, 71) = 31.3$ $p < 0.05$.

<u>Table 4.1-</u> Mean performance indices and p values for general characteristics, the National Adult Reading Test(NART) and mood measures as a function of participant group *(standard deviations are presented in parentheses).*

	Dysphoric		Non-dysphoric		
	Aided **(n=18)**	Unaided **(n=18)**	Aided **(n=18)**	Unaided **(n=18)**	**p- value**
Age	22.44 (5.8)	20.83 (4.1)	24.11 (8.7)	22.67 (5.2)	$p > 0.05$
Gender	4M; 14F	6M; 12F	5M; 13F	5M; 13F	$p > 0.05$
NART	27.39 (5.5)	23.17 (8.1)	24.17 (5.4)	22.28 (8.9)	$p > 0.05$
STAI-S	39.28 (10.1)	40.33 (9.1)	31.11 (6.5)	28.22 (5.5)	$p < 0.01$
STAI-T	43.83 (6.5)	43.72 (8.7)	33.78 (8.1)	33.78 (7.4)	$p < 0.01$
BDI (1)	19.0 (4.7)	19.17 (3.9)	2.67 (2.1)	3.39 (1.9)	$p < 0.01$
BDI (2)	19.06 (4.2)	17.50 (4.7)	2.72 (1.9)	2.94 (2.0)	$p < 0.01$

M = Male F = Female; NART =Error score on the National Adult Reading Task; STAI-S = State anxiety subscale on the STAI; STAI-T = Trait anxiety subscale on the STAI; BDI (1) = First measure of the Beck Depression Inventory; BDI (2) Second Measure of the Beck Depression Inventory.

4.3.2. Memory for paired associates

4.3.2.1. Final cued recall test

The results revealed an overall main effect of condition, $F(1, 71) = 117.6$ $p < 0.05$, with participants in the unaided group ($M = 77.70$, $SD = 14.9$) recalling significantly more words than participants in the aided group ($M = 61.65$, $SD = 11.7$). The results also revealed a significant overall main effect of instruction, $F(1, 71) = 124.9$ $p < 0.05$, with participants recalling significantly more respond ($M = 90.86$, $SD = 15.1$) than previously-suppressed words ($M = 51.27$, $SD = 30.2$). Furthermore, an overall main effect of repetition was also found, $F(1, 71) = 6.7$ $p < 0.05$. However, although participants recalled more words presented two ($M = 69.91$, $SD = 21.3$) and eight times ($M = 72.22$, $SD = 18.6$) than baseline ($M = 66.90$, $SD = 21.3$), these effects failed to reach significance, 2 times $t(71) = 1.1$ $p > 0.03$; 8 times $t(71) = 1.7$ $p > 0.03$. Results also failed to find an overall main effect of group, $F < 1$.

The hypothesis predicted *that "dysphoric participants would recall significantly more previously-suppressed words than would the non-dysphoric participants in the unaided condition"*. However, contrary to predictions, results failed to find a significant group x instruction interaction in the unaided condition, $F < 1$.

The hypothesis also predicted that *"both dysphoric and non-dysphoric participants would be successful at suppressing words in the aided condition"*. Consistent with this prediction results revealed a significant instruction x repetition x condition interaction, $F(1, 71) = 7.2$ $p < 0.05$ (see Figure 4.1). In order to determine whether participants were suppressing, subsequent analysis were conducted which revealed that regardless of group, participants in the aided condition were recalling significantly fewer words that had been suppressed two ($M = 37.04$, $SD = 28.5$) and eight times (M = 31.48, SD = 25.4) than words that had not been suppressed (M = 61.57, SD = 24.8); 2 times $t(35) = 3.9$ $p < 0.01$; 8 times $t(35) = 5.2$ $p < 0.01$. These findings suggest that participants in both groups were successfully forgetting previously-suppressed words in the aided condition.

However, it is important to note that pairwise analysis of participants' recall of previously-suppressed words in the unaided condition revealed that there were no significant differences between participants' recall of previously-suppressed words presented two (M = 73.61, SD = 26.5) and eight times (M = 75.93, SD = 27.7) than words that had not been suppressed (M = 66.67, SD = 21.5); two times $t(35) = 1.6$ $p > 0.01$; eight times $t(35) = 1.7$ $p > 0.01$. These findings suggest that participants in both groups were not forgetting previously-suppressed words in the unaided condition.

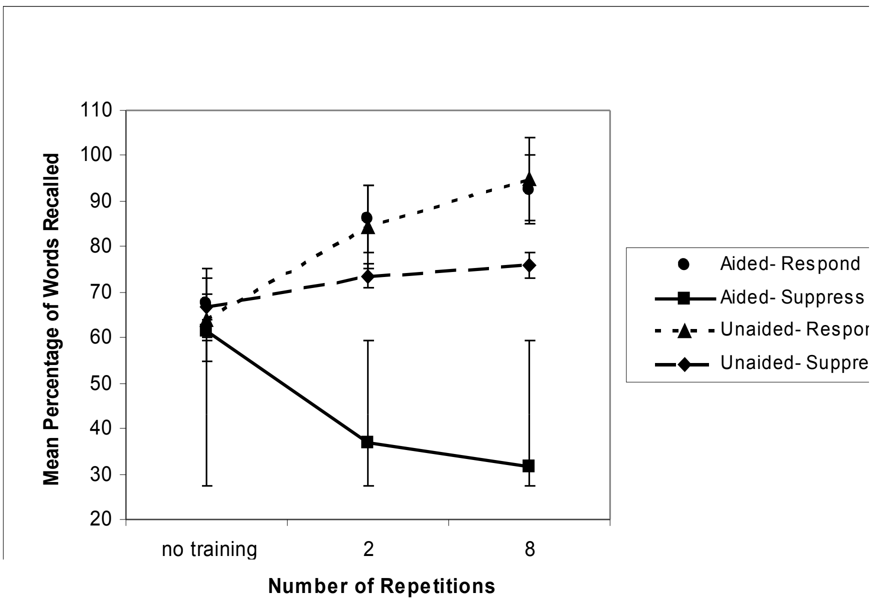

Figure 4.1. Percentage of respond and previously-suppressed targets recalled in the aided and unaided conditions as a function of cue presentations on the final cued recall test (error bars represent ± one standard error of the mean).

The hypothesis also predicted *'that forgetting would increase with the number of times a memory was previously-suppressed'*. Consistent with the hypothesis results revealed a significant instruction x repetition interaction, $F(1, 71) = 34.3$ $p < 0.01$. However, subsequent pairwise analysis revealed that there was no significant difference between the recall of previously-suppressed words presented two ($M = 55.30$, $SD = 33.0$) and eight times ($M = 53.70$, $SD = 34.6$); $t(71) = 0.4$ $p > 0.01$. These findings suggest that forgetting did not increase with the number of times the memory was suppressed.

Although findings failed to find a significant group x condition x instruction interaction, $p > 0.05$, given the fact that Study 1 found that dysphoric individuals were significantly worse at suppression than non-dysphoric individuals, it was important to determine whether there were any group differences in suppression in the aided condition. Subsequent pairwise analysis revealed that there were no significant differences between dysphoric ($M = 68.52$, $SD = 18.9$) and non-dysphoric participants' ($M = 54.63$, $SD = 28.5$) recall of previously-suppressed words in the baseline suppression condition; $p > 0.05$. However, the results did reveal that dysphoric participants' (2 times $M = 46.30$, $SD = 32.1$; 8 times $M = 41.67$, $SD = 26.4$) were recalling significantly more previously-suppressed words presented two and eight times than non-dysphoric participants' (2 times $M = 27.78$, $SD = 21.4$; 8 times $M = 21.36$, $SD = 20.5$) in the aided condition; 2 times $t(34) = 2.0$ $p < 0.03$; 8 times $t(34) = 2.6$ $p < 0.03$. Taken together, these findings suggest that although the dysphoric group were successful at suppression in the aided condition, they were recalling more previous-suppressed words than non-dysphoric participants.

4.3.2.2. Independent probe test

The results revealed an overall main effect of condition, $F(1, 71) = 14.0$ $p < 0.05$, with participants in the unaided group ($M = 48.77$, $SD = 10.6$) recalling significantly more words than participants in the aided group ($M = 40.51$, $SD = 7.6$). The results also revealed a significant overall main effect of instruction, $F(1, 71) = 30.64$ $p < 0.05$, with participants recalling significantly more respond ($M = 53.82$, $SD = 16.2$) than previously-suppressed words ($M = 37.39$, $SD = 18.3$). However, results failed to find main effects of group or repetition, all tests $F < 1$.

The hypothesis predicted that *"successful suppression would not be observed for the aided condition on the independent probe test"*. However, contrary to predictions results revealed a significant instruction x repetition x condition interaction, $F(1, 71) = 12.6$ $p < 0.05$ (see Figure 4.2). Furthermore, subsequent pairwise analysis revealed that participants in the aided condition were recalling significantly fewer previously-suppressed words presented two ($M = 34.72$, $SD = 23.4$) and eight times ($M = 26.39$, $SD = 21.6$) than words that had not been suppressed ($M = 60.65$, $SD = 28.2$); 2 times $t(35) = 3.8$ $p < 0.03$; 8 times $t(35) = 6.0$ $p < 0.03$. These findings suggest that both dysphoric and non-dysphoric participants were successful at inhibiting previously-suppressed words.

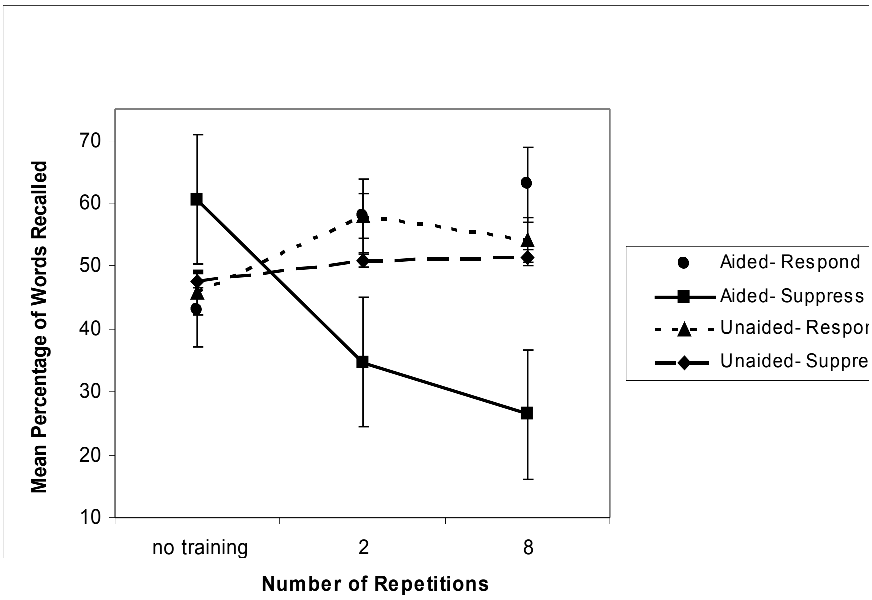

Figure 4.2. Percentage of respond and previously-suppressed targets recalled in the aided and unaided conditions as a function of cue presentations on the independent probe test (error bars represent ± one standard error of the mean).

4.3.3. Compliance in the unaided condition

<u>4.3.3.1. Calculating the compliance score</u>

Findings revealed that both dysphoric and non-dysphoric participants were not suppressing in the unaided condition. To further evaluate the lack of below baseline suppression in this condition, self report measures looking at compliance with suppression instructions were analysed. A total score for non-compliance was obtained by adding together participants' responses to the first three questions on the strategies questionnaire. A median split on these scores was then carried out to produce a non-compliance factor. This factor was included in a repeated measures design along with a between factor of group (dysphoric vs. non-dysphoric), and within factors of instruction (respond vs. suppress) and repetition (0 vs. 2 vs. 8).

4.3.3.2. Final cued recall test

Results revealed a significant instruction x non-compliance x group interaction, $F(1, 71) = 3.2$ $p < 0.05$, with subsequent analysis demonstrating that non-dysphoric non-compliant participants (n=12) ($M = 84.72$, $SD = 8.3$) recalled significantly more previously-suppressed words than non-dysphoric compliant participants (n=24) ($M = 63.49$, $SD = 21.3$); $t(35) = 3.0$ $p < 0.03$. Furthermore, although dysphoric non-compliant participants (n=21) ($M = 79.49$, $SD = 13.3$) also recalled more previously-suppressed words than dysphoric participants that complied with instructions (n=15) ($M = 66.67$, $SD = 11.8$), this effect just failed to reach significance, $t(35) = 1.9$ $p = 0.08$.

4.3.3.3. Independent probe test

Results also revealed a significant non-compliance x group effect $F(1, 71) = 8.8$ $p < 0.05$, with subsequent analysis revealing that non-dysphoric non-compliant participants ($M = 56.99$, $SD = 1.6$) recalled significantly more previously-suppressed words than non-dysphoric compliant participants ($M = 45.44$, $SD = 8.8$); $t(35) = 2.6$ $p < 0.03$. Furthermore, dysphoric non-compliant participants ($M = 58.33$, $SD = 10.0$) also recalled significantly more previously-suppressed words than dysphoric participants that complied with instructions ($M = 39.44$, $SD = 9.5$), $t(35) = 3.6$ $p < 0.03$.

4.3.4. Thought substitution in the unaided condition

A correlation was carried out between scores on strategy question 4 *('kept myself from thinking about the original response word by thinking about something else')* and the size of instruction effect (i.e. the total number of respond nouns associated with cues presented 2 and 8 times, minus the total number of suppress nouns associated with cues presented 2 and 8 times, excluding all baseline measures). The results revealed a significant correlation between instruction effect and ratings on question 4 for the final cued recall test, $r(36) = 0.35$ $p < 0.05$ and the independent probe test, $r(36) = 0.40$ $p < 0.05$. These results demonstrate that participants reporting a larger instruction effect, thought about something else more frequently. Furthermore the instruction effect was not significantly correlated with non-compliance scores; $r(72) = 0.23$ $p > 0.05$, thus demonstrating that the use of a substitution strategy to account for successful suppression was not an artefact of whether participants had complied with instructions.

4.3.5. Pearson correlations to investigate the differential impact of depression and co-morbid anxiety on suppression

A paired samples t-test revealed no significant differences between the first (M = 11.06, SD = 8.7) and second (M = 10.56, SD = 8.4) measure of the BDI; $p > 0.05$. To determine whether the first measure of BDI correlated with the second measure of BDI, a Pearson correlation was carried out which revealed a highly statistically significant correlation between both measures of the BDI $r(72) = 0.93$ $p < 0.01$. Subsequently a mean BDI score was calculated for the two measures, and a Pearson correlation was carried out on the mean measure of BDI and the total number of previously-suppressed words recalled.

4.3.5.1. Final cued recall test

The test revealed a significant positive correlation between mean BDI score and the number of previously-suppressed words recalled $r(72) = 0.27$ $p < 0.05$. However, no significant correlation was obtained between anxiety and the number of previously-suppressed words recalled, all tests $p > 0.05$.

4.3.5.2. Independent probe test

Pearson correlations also revealed a significant positive correlation between BDI and the number of previously-suppressed words recalled $r(72) = 0.64$ $p < 0.01$. However, no significant correlation was obtained between anxiety and the number of previously-suppressed words recalled, all tests $p > 0.05$. Taken together, these findings suggest that impaired forgetting of previously-suppressed words is specifically related to depression.

4.4. Discussion

The aim of the present study was to investigate the influence of thought substitution on intentional forgetting in dysphoria.

4.4.1. Group differences in the unaided condition

The prediction that *"dysphoric participants would recall significantly more previously-suppressed words than would the non-dysphoric participants"* was not supported by the results of the final cued recall and independent probe tests. These findings are inconsistent with Hertel and Gerstle's (2003) study, as well as the findings obtained in Study 1, which found that dysphoric individuals were significantly impaired at suppressing words in comparison to non-dysphoric individuals. One possible explanation to account for these findings may relate to the fact that Study 1 and the study carried out by Hertel and Gerstle (2003) both used emotionally valenced words, whilst the present study used neutral words.

According to the retrieval inhibition theory (Bjork, 1989) during intentional forgetting, individuals attempt to isolate the unwanted memory from other memories and block access to it (see Chapter 1, Section 1.7.1, page 16). However, because emotional material is processed more elaborately than non-emotional material (Payne & Corrigan, 2007; Nagae & Moscovitch, 2002) individuals may form more associations between emotional memories and other memories, thereby reducing mental segregation between remember and forget items, which results in enhanced recall of forget words.

Furthermore, under conditions of capacity limitations, such as depressed mood the monitoring process may supersede inhibitory processes, thus creating more sensitivity to material intended to be forgotten (Wegner, 1994) (see Chapter 3, Section 3.4.6, page 82). Therefore, it is possible that in Study 1 depressed mood may have reduced capacity in dysphoric individuals, and coupled with a greater difficulty in inhibiting emotional words (Payne & Corrigan, 2007) resulted in increased monitoring of these words, thereby enhancing recall of the to-be forgotten items.

Support for this notion comes from Barnier, Conway, Mayoh et al, (2007), who looked at forgetting of emotional and neutral autobiographical memories, and found that although participants were successful at forgetting neutral memories, they were unsuccessful at intentionally forgetting emotional memories. Furthermore, Minnema and Knowlton (2008) investigated directed forgetting of emotional words and assessed whether mood state interacts with emotional content to affect the degree of directed forgetting. The study involved participants completing a list method directed forgetting task, and found that participants recalled significantly more words in the remember condition and less words in the forget condition, when the words were neutral. However, when the words were emotional, participants recalled significantly more emotional forget words and this effect was strongly related to negative mood. Taken together, these findings suggest that emotional material, coupled with an increased negative mood can attenuate directed forgetting effects.

4.4.2. Suppression in the unaided condition

It is important to note that consistent with the findings obtained in Study 1, the present findings revealed that both dysphoric and non-dysphoric participants were impaired in their ability to successfully forget previously-suppressed words in the unaided thought suppression condition. These findings are consistent with Wegner's (1994) ironic processes theory (Chapter 3 Section 3.4.6 page 82), which posits that efforts to deliberately suppress material results in an increase in the occurrence of the unwanted thought coming to mind. Furthermore, the findings provide support for the negative cueing hypothesis (Wegner, Schneider, Carter & White, 1987; Wegner, Schneider, Knutson & McMahon, 1991), which suggests that unwanted thoughts are more likely to occur when individuals try to suppress such thoughts, by attempting to distract themselves with cues in the environment. However, these cues become associated with the unwanted thought, which subsequently trigger the unwanted thought coming to mind.

4.4.3. Suppression in the aided condition

The prediction that *"both dysphoric and non-dysphoric participants would be successful at suppressing words in the aided condition"* was supported by the results of the final cued recall test, which revealed that both dysphoric and non-dysphoric individuals were recalling significantly fewer previously-suppressed words than baseline (i.e. never-suppressed) words. Findings demonstrating successful suppression in healthy non-dysphoric individuals are consistent with the findings of Hertel & Calcaterra (2005) and Hotta & Kawaguchi (2009), and suggest that suppression depends on alternative thoughts being generated. Furthermore, the findings are also consistent with previous research which found that individuals using focused distraction report less intrusions of the unwanted thought than individuals in the typical suppression condition (Wegner, Schneider, Carter & White, 1987).

One explanation as to why thought substitution may be more effective than general suppression in reducing unwanted thoughts is that individuals given suppression instructions may engage in more general distraction, and thus frequently think about how to suppress the unwanted thought, rendering more possibilities for the unwanted thought to intrude (Salkovis & Campbell, 1994). However, in the thought substitution condition, individuals concentrate on pursuing an alternative goal (i.e. recalling the more recently learned substitute word), which reduces the chances that the unwanted thought will come to mind. Taken together, these findings suggest that thought substitution is a powerful tool that aids intentional forgetting in depression, at least for neutral words.

4.4.4. The effect of practice on suppression

The hypothesis that *"forgetting would increase with the number of times a memory was previously-suppressed"* was not supported by the results of the final cued recall test. These findings are consistent with previous findings obtained in Study 1 (Chapter

3, Section 3.3.3, page 74), and suggest that forgetting does not increase with the number of times a memory is previously-suppressed.

4.4.5. Inhibitory mechanism in thought substitution

In line with the findings obtained by Bergstrom et al (200) the hypothesis also predicted that *"suppression would not be observed for the aided condition on the independent probe test"*. However, contrary to predictions, the present results revealed a similar pattern of findings for the independent probe test, as the final cued recall test. These findings are inconsistent with those obtained by Bergstrom, De Fockert & Richardson-Klavehn (2009). Furthermore, the findings are also inconsistent with the associative interference account, which suggests that forgetting involves creating new associations with the cue word in order to 'not think' about the previously-suppressed word, which essentially interferes with the ability to recall the target word (Camp, 2009). Instead the present findings suggest that am inhibitory mechanism acts upon the memory representation of the unwanted word, deliberately impairing retention and keeping it out of consciousness (Anderson, 2003).

Findings that dysphoric participants are successful at suppressing unwanted thoughts, thus demonstrating an intact inhibitory mechanism are inconsistent with previous findings in the literature, which have found that depression is associated with impairments in executive control, including inhibition (Moritz et al, 2002) (see Chapter 1, Section 1.7.5, page 25). One explanation proposed to account for the inconsistent findings in the literature is Hertel's (2000) cognitive-initiative account (see Chapter 1, Section 1.7.3, page 19). As previously discussed in Chapter one Hertel's (2000) cognitive-initiative account posits that tasks in which executive control processes are poorly constrained result in depressed individuals exhibiting impaired performance, due to a deficit in the ability to initiate relevant strategies (observed in Study 1). However, by controlling and constraining attention, depressive deficits may be eliminated. Given the fact that the thought suppression condition does not provide participants with any guidance on how to keep the unwanted thought from coming to mind, it requires a considerable amount of cognitive control. Thus, participant's attempts at suppressing unwanted material may be ineffective. However, because the thought substitution condition provides participants with guidance on how to keep the unwanted memory from coming to mind, it constrains the focus of attention, and thus alleviates depressive deficits in the performance on the think/no-think task.

4.4.6. The use of strategies in the thought suppression (unaided) condition

Upon investigating the use of strategies in the unaided condition, findings revealed that dysphoric and non-dysphoric non-compliant individuals recalled more previously-suppressed words than dysphoric and non-dysphoric compliant individuals, in both the final cued recall test and the independent probe test. These findings were consistent with those obtained by Hertel and Calcaterra (2005), and suggest that participants that actually attempted to keep the to-be-suppressed words out of their mind, demonstrated successful suppression of these words in the final tests. The findings also suggest that the effect of suppression is dependent upon the use of self-initiated strategies to keep the unwanted memory from coming to mind. Furthermore results also found a significant correlation between those participants that used a self-initiated strategy of thought substitution in the unaided condition and an instruction effect (i.e. the total number of respond nouns associated with cues presented 2 and 8 times minus the total number of suppress nouns associated with cues presented 2 and 8 times, excluding all baseline measures). These findings are also consistent with those obtained by Hertel and Calcaterra (2005), and suggest that participants that thought about something else more frequently demonstrated a bigger instruction difference (i.e. a bigger difference in the recall of respond and previously-suppressed words), providing further support that by focusing ones thoughts on something else that is meaningfully related to the cue that evokes the unwanted memory is an effective strategy to aid forgetting.

4.4.7. Methodological considerations

One important methodological issues arising from Study 1 and the present study which still requires consideration concerns the materials used in the think/no-think task. As noted above the stimuli used in the present study were neutral. There is considerable evidence that depression biases processing of emotional material that is congruent with the disorder (Williams, Watts, MacLeod & Mathews, 1997). For example, Watkins, Mathews, Williamson & Fuller (1992) have found that depressed individuals exhibit a bias for depression-relevant material. Thus, it is possible that individuals with dysphoria may experience greater difficulty in suppressing depression-relevant words. Therefore, future research will be carried out using depression-relevant words, to determine whether the use of these words leads to a different pattern of suppression in dysphoric individuals.

4.4.8. Summary

The study found that both the dysphoric group and the non-dysphoric group were successful at suppressing in the aided condition. This pattern of findings was also observed in the independent probe test, suggesting that participants had successfully inhibited the previously-suppressed words. Furthermore, although both the dysphoric group and the non-dysphoric group were impaired in their ability to suppress words in the thought suppression (unaided) condition, there were no significant differences in the recall of previously-suppressed words between dysphoric and non-dysphoric participants. The lack of between group findings were inconsistent with findings obtained in Study 1, and suggest that group differences in suppression may be specific and only observed when the material used is emotional.

CHAPTER FIVE

The role of thought substitution in intentional forgetting of emotional words in dysphoria

5.1. Introduction

5.1.1. Background

The findings of Study 1 revealed that dysphoric individuals were impaired in their ability to intentionally forget previously-suppressed words. The findings of the subsequent study (Study 2) revealed that dysphoric participants could intentionally forget neutral previously-suppressed words, if they were provided with a substitute thought to use, to inhibit their memory for the unwanted word. Therefore, the aim of the present study was to determine whether dysphoric individuals could intentionally forget emotional material using a thought substitution strategy.

5.1.2. Intentional forgetting of emotional words in dysphoria

One finding emerging from Study 2 was that there were no significant differences in the recall of previously-suppressed words between dysphoric and non-dysphoric participants in the unaided condition. These findings were contrary to those obtained in Study 1. One explanation to account for these differential findings may relate to differences between studies in the emotional content of material that was used, as Study 1 used emotional words, whilst Study 2 used neutral words. Given the fact that research suggests that emotional material is processed more elaborately than non-emotional material (Hamann, 2001; Rolls, 2000), and that depressed individuals have difficulty in voluntarily engaging in controlled processes (Hertel, 2000), it is possible that depressed mood, coupled with heightened encoding of emotional material results in greater recall of previously-suppressed material.

However, a recent study by Joormann, Hertel, LeMoult & Gotlib (2009) investigated thought substitution in intentional forgetting using the think/no-think paradigm and found that depressed individuals could be trained to intentionally forget emotional material. In their study depressed and non-depressed individuals learnt a series of positive and negative word pairs. They were then given the think/no-think task. In the no-think phase, participants were allocated to the unaided suppression condition, a positive-substitute condition, or a negative-substitute condition. The substitute conditions involved participants recalling new targets to help them not think of the original targets. The study found that depressed individuals in both the positive and negative substitute condition demonstrated successful forgetting of negative material.

These findings suggest that depressed individuals can be trained to intentionally forget negative material, provided that they are given strategies to constrain their attention. The findings are consistent with Hertel's (2000) cognitive-initiative account (see Chapter 1, Section 1.7.3, page 19), which suggests that depressed and dysphoric individuals are able to perform as well as non depressed healthy individuals in structured situations, which control and constrain attention, thus eliminating depressive deficits.

5.1.3. Processing biases for depression-relevant material in dysphoria

It is also important to note that no effect of valence on dysphoric individuals' ability to forget previously-suppressed words was observed in Study 1. Given the fact that the stimuli used in Study 1 were negative and not depression-relevant, these findings are not altogether surprising. Thus, although words such as *'vengeful'* and *'infested'* are negative, they are not depression-relevant. This is consistent with research which has found that depressed individuals demonstrate enhanced memory for sad but not threat-related stimuli (Bellew & Hill, 1990; Watkins, Mathews, Williamson & Fuller, 1992)

Study 2 found that dysphoric individuals were successful at suppressing neutral material using a thought substitution strategy. However, given the fact that some research suggests that emotional material, coupled with an increased negative mood can attenuate directed forgetting effects (Minnema & Knowlton, 2008), whereas other research indicates that depressed individuals can be trained to forget emotional material using thought substitution (Joormann et al, 2009) the aim of the present study was to determine whether dysphoric individuals can intentionally forget emotional material using a thought substitution strategy. Furthermore, given that research suggests that dysphoric individuals demonstrate processing biases for depression-relevant material, the present study aimed to investigate whether dysphoric individuals demonstrate impaired inhibition of previously-suppressed depression-relevant words.

The present study followed an identical protocol used in Study 2, with two notable exceptions. The first was that the nouns were paired with emotional and not neutral adjectives (half were positive and half were depression-relevant adjectives). The valence of the cues was counterbalanced, such that participants were told to suppress, either positive words associated with neutral cues, or depression-relevant words associated with neutral cues. The effectiveness of the different suppression techniques and the influence of the different types of word cues on the level of suppression were assessed by looking at retrieval patterns of the two groups, during the final cued recall and the independent tests. The second exception was the independent test that was used. In Study 2 an item-specific word stem task was used. However, in the present study a word-fragment completion task was used. Given the fact that the inhibitory account (discussed in Chapter 1, Section 1.4.2.1, page 9) suggests that the unwanted memory itself is inhibited, it therefore follows that retrieval of the unwanted memory should be impaired on any test that is used to access that memory.

5.1.4. Research overview

With the exception of the use of emotional words and the type of independent test used, the procedure for the present study replicated Study 2 (Chapter 4, Section 4.2.4, page 95). Dysphoric and non-dysphoric participants learnt a series of paired associates, whereby neutral nouns were paired with positive or depression-relevant adjectives. Participants then underwent the think/no-think task and were subsequently given the final cued recall and the independent tests. The independent test involved participants being presented with fragments of all of the target words they had seen previously. Each fragment contained some letters and some blank spaces. Participants were given a sheet of paper with all the fragment words (including blanks spaces), and were asked to fill in the blanks to make the whole word, when they saw the fragment on the screen.

5.1.5. Experimental hypotheses

1. In line with findings obtained by Joormann et al (2009), as well as the previous study findings (Chapter 4, Section 4.3.2, page 103), it was predicted that dysphoric individuals would be successful at suppressing in the aided condition.

2. In line with the previous study findings (Study 2), it was also predicted that non-dysphoric individuals would successfully suppress emotional words in the aided condition.

3. In line with Study 1 findings (Chapter 3, Section 3.3.3, page 70), it was expected that in the unaided suppression condition the dysphoric group would recall a significantly higher percentage of previously-suppressed words than would the non-dysphoric group.

4. Furthermore, in line with Beck's (1972) content-specificity hypothesis it was also expected that overall dysphoric participants in both the aided and unaided conditions would recall significantly more depression-relevant than positive previously-suppressed words.

5. Given that the both Studies 1 and 2 failed to find that forgetting increases with the number of times a memory was suppressed, it was expected that forgetting would not increase with the number of times a memory was previously-suppressed in the present study.

5.2. Method

5.2.1. Design

A 2 (group) x 2 (instruction) x 2 (condition) x 2 (valence for suppression) x 3 (repetition) mixed factorial design was used. The between factors were group, valence for suppression and condition, and the within factors were, instruction and repetition.

The independent variables were group (dysphoric vs. non-dysphoric), condition (aided vs. unaided), instruction (respond vs. suppress), valence for suppression (positive vs. depression-relevant) and the number of repetitions (0, 2, 8). The dependent variables were the mean percentage of words recalled on the final cued recall test and the mean percentage of words recalled on the independent test.

5.2.2. Participants

A total of 97 participants (22M, 71F) completed the BDI-II on two occasions approximately a week apart (median number of days between the two occasions = 10). Participants were asked to take part in the main session of the study based upon the mean of their two BDI scores. Following recommended guidelines described by Kao, Dritschel & Astell (2006), participants with BDI scores of 5 or less were classified as non-dysphoric, and participants with BDI scores of 15 or more were classified as dysphoric. Based on this procedure, 18 dysphoric (6M, 12F; mean age = 19.11; SD = 1.0) and 18 non-dysphoric participants (2M, 16F; mean age = 22.28; SD = 8.2) were allocated to the aided (thought substitution) condition, and 18 dysphoric (5M, 13F; mean age = 20.06; SD = 3.4) and 18 non-dysphoric participants (4M, 14F; mean age = 22.39; SD = 6.4) were allocated to the unaided condition. 21 participants (5M, 16F) were excluded from participating in the study, as their mean BDI scores were above 5 and below 15. Participants were selected to take part in the study according to the inclusion and exclusion criteria cited in Chapter 2 (Sections 2.4.2 & 2.4.3, pages 40-42).

In each BDI group (dysphoric vs. non-dysphoric), half of the participants were pseudo randomly allocated to the aided (thought substitution) condition and half were allocated to the unaided condition. Furthermore, within each BDI-condition group (i.e. dysphoric aided vs. dysphoric unaided vs. non-dysphoric aided vs. non-dysphoric unaided), half the participants were pseudo randomly assigned to suppress positive words associated with neutral cues and to respond to depression-relevant words associated with neutral cues, whilst the other half of the group suppressed depression-relevant words associated with neutral cued and responded to positive words associated with neutral cues.

5.2.3. Materials

5.2.3.1. Affective words

A set of 36 adjective-noun pairs drawn from a larger set of words were compiled during a pilot study by the author (see Appendix VIII for a full outline of the pilot study). In that study 42 positive, 42 depression-relevant and 42 neutral words were obtained (positive and depression-relevant words were obtained from John, 1988). Each positive, depression-relevant and neutral word was matched together by the author with a noun. For example, *'loving'*, *'helpless'* and *'big'* were matched together with the noun baby to create *'loving baby'*, *'helpless baby'* and *'big baby'*. This was done for all the words, so that 42 nouns were used to create 126 noun-adjective word pairs (42 positively valenced, 42 negatively valenced and 42 neutral in valence).

The 126 word pairs were divided into three sets of forty two word pairs, with a third of the nouns accompanied by positive adjectives, a third by depression-relevant adjectives, and a third by neutral adjectives. These pairings were fully counterbalanced.

5.2.3.1.1. Emotionality ratings

Initially emotionality ratings were collected on the 126 word pairs. 20 participants (8M, 12F) were presented with a booklet containing one of the three sets of 42 word pairs. Participants were instructed to rate their emotional reaction to each word pair on a 5-point scale, with 1 = extremely negative and 5 = extremely positive. Participants were given unlimited time to complete the booklets. Results revealed that participants rated positive word pairs ($M = 3.70$, $SD = 0.4$) as being significantly more positive than neutral word pairs ($M = 3.10$, $SD = 0.5$); $t(19) = 8.2$ $p < 0.01$, whilst depression-relevant word pairs ($M = 2.20$, $SD = 0.4$) were rated as being significantly more negative than neutral word pairs; $t(19) = 12.7$ $p < 0.01$.

5.2.3.1.2. Memory for words

In order to ensure that positive and depression-relevant words were equally well remembered, 40 participants (16M, 24F) underwent a computerised memory task. Participants were presented with one of the three sets of 42 word pairs. In the task participants were presented with a word pair and were asked to create a self-referential mental image for each word pair presented. They were subsequently asked to rate the personal meaningfulness of the image, on a scale of 1 to 5 (with 1 being *'not meaningful'* and 5 being *'very meaningful'*). Once all 42 word pairs had been presented, there was a 5-minute delay period, during which time participants completed the trail making task (Version B) (Lezak, 1995). This task involved participants drawing a single, unbroken line sequentially from number to letter (e.g. drawing a line from 1 to A and then 2 to B, and so on). Participants' were told that they had 5 minutes to try to complete as much of the task as possible. Following the delay, participants were presented with a cue word and asked to recall aloud the corresponding target word. Participants' responses were marked by the author.

Because the main study involved assessing memory using both cued recall and word fragment completion tasks, it was important to ensure that memory for positive and depression-relevant words did not differ across the type of memory task. Therefore, a word fragment completion task was created by the author. The word fragment completion task involved participants being presented with fragments of all of the forty two target words they had seen previously. Each fragment contained some letters and some blank spaces. Participants were given a sheet of paper with all the fragment words (including blanks spaces), and were asked to fill in the blanks to make the whole word, when they saw the fragment on the screen. Participants were informed that all the fragments were words that had been seen by them previously.

The cued recall test revealed that overall neutral word pairs ($M = 56\%$, $SD = 0.3$) were better remembered than both positive ($M = 35\%$, $SD = 0.2$) and depression-relevant word pairs ($M = 36\%$, $SD = 0.2$); positive $t(39) = 4.5$ $p < 0.01$; depression-relevant $t(39) = 3.4$ $p < 0.01$. However, there were no significant differences in the recall of positive and depression-relevant word pairs, $t(39) = 0.8$ $p > 0.05$. Individual chi-squares looking at the relationship between recall of positive and depression-relevant word pairs, showed that positive and depression-relevant word pairs were equally well remembered for 37 cue words. However, for 5 cue words, participants recalled significantly more of one valenced associated target word than the other.

The independent test revealed that there were overall no significant differences between the recall of positive, depression-relevant and neutral word pairs; positive-neutral $t(39) = 0.5$ $p > 0.05$; depression-relevant-neutral $t(39) = 0.1$ $p > 0.05$; positive-depression-relevant $t(39) = 0.3$ $p > 0.05$. Furthermore, individual chi-squares looking at the relationship between recall of positive and depression-relevant word pairs showed that positive and depression-relevant word pairs were equally well remembered for 40 cue words.

5 of the 42 word pairs were excluded from the main study because results revealed significant differences between recall of positive and depression-relevant words on the cued recall and the independent memory tests. Furthermore, because only 36 cues were required, and positive word pair ratings were still rather low in comparison to neutral ratings, one word pair with the lowest positive rating was also excluded from the main study. A full outline of the pilot study including full details of the procedure and the analysis conducted can be found in Appendix VIII.

The 36 word pairs (see Appendix XII) used in the main study were divided into 6 sets of 6 nouns, each with each noun being accompanied by either a positive adjective or a depression-relevant adjective (e.g. *'helpless baby'*, *'happy memory'*). This resulted in three sets of words paired with positive adjectives and three sets of words paired with depression-relevant adjectives. Subsequently 3 sets of the 6 word pairs were assigned to the suppression phase (0, 2, 8) and 3 sets of the 6 word pairs were assigned to the respond phase (0, 2, 8). These pairings were fully counterbalanced. An additional set of 10 word pairs (see Appendix XXII) were produced, each featuring a noun accompanied by a neutral adjective. These were included to avoid primacy or recency effects. For the aided suppression condition, substitute (neutral) words associated with the original nouns were used (e.g. *'big baby'*, *'lasting memory'*).

5.2.3.2. Assessment of mood and general intellectual function

In line with Study 2, the Beck Depression Inventory II (BDI-II; Beck et al, 1996) was used to allocate participants into dysphoric and non dysphoric groups, and the Spielberger State-Trait Anxiety Inventory (STAI; Spielberger et al, 1983) was used to control for anxiety. Furthermore, the National Adult Reading Test (NART; Nelson & Williamson, 1991) was used to measure participant's general intellectual function (see Chapter 2, Sections 2.2 & 2.3, pages 33-39 for psychometric properties of the mood questionnaires and the NART and details of their administration).

5.2.3.3. Strategies questionnaire

The Strategies Questionnaire (Hertel & Calcaterra, 2005) was used so that participants could rate the extent to which they utilised a strategy to prevent words from entering awareness during the suppression phase. (See Chapter 4, Section 4.2.3.3, page 94 for more information on the strategies questionnaire and its administration).

5.2.4. Procedure

The procedure for the present study was exactly the same as Study 2 (see Chapter 4, Section 4.2.4, page 95). However, the only notable difference was the independent test that was used.

5.2.4.1. Independent test

The independent test in this study was exactly the same as in the pilot study above (page 126). The task involved participants being presented with a sheet of paper with fragments of all of the thirty six target words. Each trial began with a cross being displayed for 200ms. Subsequently the target fragment was presented for 400 ms. Participants were told to fill in the blanks when the word was presented on the screen. This was then followed by an inter-trial interval of 400ms, before the next trial began.

5.2.5. Scoring and Data Analysis

Age was analysed using a one-way between groups univariate analysis of variance. In addition, gender, marital status, occupation and education (i.e. level of education reached) were analysed using chi-square. Furthermore, to determine any group differences in general intellectual ability, National Adult Reading Test (NART) error scores were analysed using a one-way between groups univariate analysis of variance. In addition, data on BDI and STAI were also analysed using a one-way between-groups multivariate analysis of variance.

The principle dependent measures of interest were the percentage of words correctly recalled on the final cued recall test and the percentage of words remembered on the independent test. This were assessed using a 2 (group) x 2 (valence) x 2 (condition) x 2 (type of instruction) x 3 (repetition) mixed design ANOVA. Between-subject factors were group (dysphoric vs. non-dysphoric); condition (aided vs. unaided) and valence of cues for suppression (positive vs. depression relevant) and within-subject factors were the type of instruction during the suppression phase (suppress vs. respond) and the number of times the cues were presented (0, 2 or 8). The significance was set at the 5% level. Follow up analyses were conducted using one-way repeated measures ANOVA, independent and paired samples t-tests. Alpha levels for pairwise comparisons were adjusted in accordance to the Bonferroni correction method (see Keppel & Wickens, 2004).

5.3. Results

5.3.1. Participant Characteristics

Analysis of the participants' characteristics (see Table 5.1) demonstrate that dysphoric (D) and non-dysphoric (ND) groups did not differ significantly with respect to age, occupation, marital status, education or gender. Furthermore, the two groups did not differ significantly on the NART, $F(1, 71) = 1.1$, $p > 0.05$. However, the two groups did differ in terms of their depression (BDI-II) scores, with dysphoric participants scoring significantly higher on both measures of BDI than non-dysphoric participants; first measure of BDI, $F(1, 71) = 306.9$ $p < 0.05$; second measure of BDI, $F(1, 71) = 264.8$ $p < 0.05$. The two groups also differed in state and trait anxiety, with dysphoric individuals significantly more anxious than non-dysphoric individuals; state anxiety, $F(1, 71) = 17.7$ $p < 0.05$; trait anxiety, $F(1, 71) = 42.6$ $p < 0.05$.

<u>Table 5.1-</u> Mean performance indices and p values for general characteristics, the National Adult Reading Test (NART) and mood measures as a function of participant group *(standard deviations are presented in parentheses).*

	D Aided (n=18)	**D Unaided (n=18)**	**ND Aided (n=18)**	**ND Unaided (n=18)**	**p- value**
Age	19.11 (1.0)	20.06 (3.4)	22.28 (8.2)	22.39 (6.4)	p > 0.05
Gender	6M; 12F	5M; 13F	2M; 16F	4M; 16F	p > 0.05
NART	21.39 (5.4)	22.11 (3.4)	20.94 (7.0)	19.89 (5.1)	p > 0.05
STAI-S	41.50 (7.5)	39.67 (8.2)	30.39 (5.8)	33.83 (11.6)	p < 0.01
STAI-T	50.39 (7.2)	43.33 (8.7)	33.22 (6.3)	35.94 (8.1)	p < 0.01
BDI (1)	19.78 (6.1)	17.17 (2.4)	3.94 (1.8)	3.44 (1.8)	p < 0.01
BDI (2)	19.72 (6.8)	18.0 (3.7)	3.50 (1.7)	3.33 (1.7)	p < 0.01

M = Male F = Female; NART =Error score on the National Adult Reading Task; STAI-S = State anxiety subscale on the STAI; STAI-T = Trait anxiety subscale on the STAI; BDI (1) = First measure of the Beck Depression Inventory; BDI (2) Second Measure of the Beck Depression Inventory.

5.3.2. Memory for paired associates

<u>5.3.2.1. Final cued recall test</u>

Analysis revealed significant a main effect of instruction, with participants recalling more respond (M = 61.27, SD = 17.9) than previously-suppressed words (M = 54.17, SD = 22.8); $F(1, 71) = 5.7$ $p < 0.05$. Results also revealed a significant effect of condition, with participants in the unaided condition (M = 60.73, SD = 16.7) recalling significantly more words than participants in the aided condition (M = 54.71, SD = 18.3); $F(1, 71) = 5.1$ $p < 0.05$. Furthermore, a main effect of repetition was also found, $F(1, 71) = 51.9$ $p < 0.05$, with participants recalling more words presented two (M = 62.38, SD = 21.9) and eight times (M = 67.94, SD = 20.9) than words that had not been presented (i.e. baseline) ($M = 42.82$, $SD = 23.4$); 2 times $t(35) = 6.7$ $p < 0.02$; 8 times $t(35) = 7.9$ $p < 0.02$. Moreover, participants also recalled more words presented eight than two times, $t(35) = 3.0$ $p < 0.02$. However, results failed to find a main effect of group, $F < 1$. Furthermore, it is important to note that results also failed to find the expected group x instruction x repetition x condition interaction, $F(1, 71) = 1.0$ $p > 0.05$ (see Figures 5.1 & 5.2). Given the fact that this 4 way interaction was not significant, in order to make sense of the findings in relation to the hypotheses separate ANOVAs were conducted for both the dysphoric and non-dysphoric groups.

The hypothesis predicted that *"dysphoric individuals would be successful at suppressing in the aided condition"*. However, contrary to this prediction results failed to find a significant instruction x repetition x condition interaction, $F < 1$ (see Figure 5.1). Furthermore, no main effects of condition or instruction were observed; all tests $F < 1$. These findings suggest that dysphoric participants were not suppressing in the aided condition.

The hypothesis also predicted that *"non-dysphoric participants would successfully suppress emotional words in the aided condition"*. Consistent with this prediction results revealed a significant instruction x repetition x condition interaction, $F(1, 71) = 3.6$ $p < 0.05$ (see Figure 5.2). Furthermore, subsequent pairwise analysis revealed that non-dysphoric individuals recalled significantly less previously-suppressed words presented two ($M = 36.11$, $SD = 32.0$) and eight times ($M = 33.33$, $SD = 36.6$) than words that had not been suppressed (i.e. baseline) ($M = 52.78$, $SD = 27.6$); 2 times $t(17) = 2.0$ $p < 0.03$; 8 times $t(17) = 2.8$ $p < 0.03$. These findings suggest that non-dysphoric participants were successful at suppressing in the aided condition.

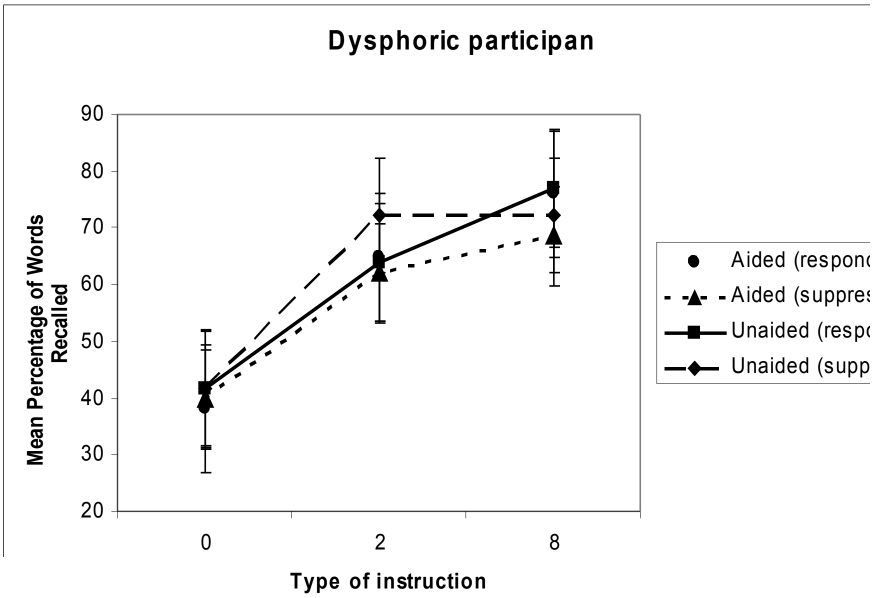

Figure 5.1. Illustrating the trend in recall of respond and previously-suppressed words by dysphoric participants in the aided and unaided conditions as a function of the number of cue presentations on the final cued recall test (error bars represent ± one standard error of the mean).

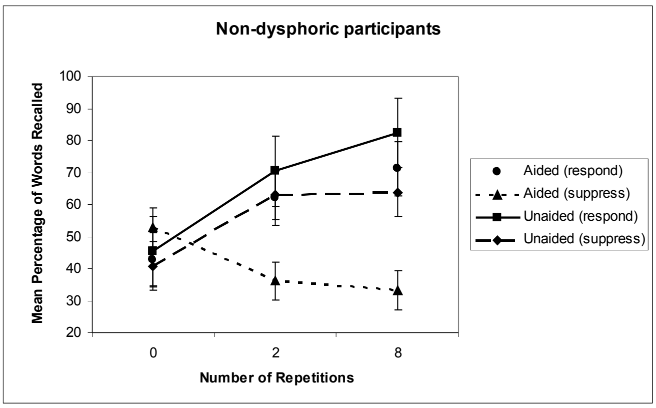

Figure 5.2. Illustrating the recall of respond and previously-suppressed words by non-dysphoric participants in the aided and unaided conditions as a function of the number of cue presentations on the final cued recall test (error bars represent ± one standard error of the mean).

The hypothesis predicted that *"in the unaided suppression condition the dysphoric group would recall a significantly higher percentage of previously-suppressed words than would the non-dysphoric group".* However, as noted above (page 132) results failed to find the expected group x instruction x repetition x condition interaction. Given the fact that there was a priori reason to expect that dysphoric individuals would recall significantly more previously-suppressed words than non-dysphoric individuals, a pairwise analysis was carried out which revealed that dysphoric participants ($M = 62.04$, $SD = 17.8$) were recalling more previously-suppressed words than non-dysphoric participants ($M = 54.01$, $SD = 25.8$). However, this effect failed to reach significance, $t(34) = 1.1$ $p > 0.05$.

Furthermore, it was also predicted that *"overall dysphoric participants in both the aided and unaided conditions would recall significantly more depression-relevant than positive previously-suppressed words."* However, contrary to this prediction results failed to find a significant instruction x valence interaction, $F < 1$. Rather the results revealed a main effect of valence with dysphoric participants overall, recalling significantly more depression-relevant ($M = 70.06$, $SD = 11.5$) than positive words ($M = 49.54$, $SD = 8.6$); $F(1, 71) = 36.0$ $p < 0.01$. These findings suggest that dysphoric individuals are not specifically impaired at suppressing depression-relevant material.

The hypothesis also predicted that *'forgetting would not increase with the number of times a memory was previously-suppressed'*. Consistent with this prediction results failed to find a significant instruction x repetition interaction for dysphoric participants, $F(1, 71) = 1.2$ $p < 0.05$. However, although a significant instruction x repetition interaction was observed for non-dysphoric participants, $F(1, 71) = 8.4$ $p < 0.01$ (see Figure 5.3), subsequent pairwise analysis revealed that there was no significant difference between the recall of previously-suppressed words presented two ($M = 58.85$, $SD = 35.4$) and eight times ($M = 50.93$, $SD = 37.6$); $t(35) = 0.2$ $p > 0.03$. Taken together, these findings suggest that forgetting does not increase with the number of times a memory is suppressed.

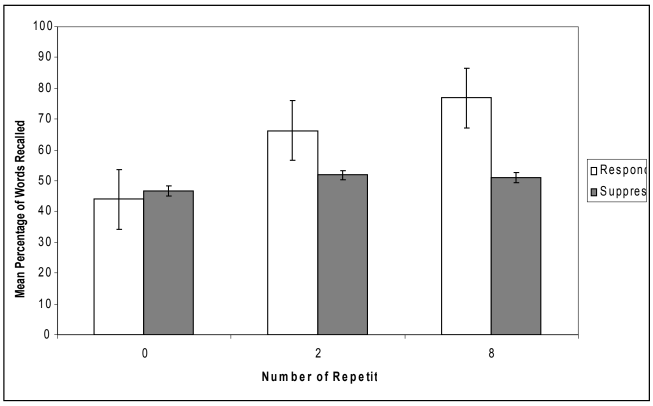

Figure 5.3. Illustrating the recall of respond and suppress words by non-dysphoric participants as a function of the number of cue presentations on the final cued recall test (error bars represent + one standard error of the mean).

<u>5.3.2.2. Independent test</u>

Analysis revealed significant a main effect of instruction, with participants recalling more respond ($M = 68.29$, $SD = 16.5$) than previously-suppressed words ($M = 56.17$, $SD = 17.1$); $F(1, 71) = 32.5$ $p < 0.01$. Results also revealed a significant effect of repetition, $F(1, 71) = 15.6$ $p < 0.05$, with participants recalling more words presented two ($M = 65.28$, $SD = 18.4$) and eight times ($M = 68.17$, $SD = 17.6$), than words that had not been presented (i.e. baseline) ($M = 53.24$, $SD = 23.3$); 2 times $t(35) = 3.6$ $p < 0.03$; 8 times $t(35) = 4.7$ $p < 0.03$. However, results failed to find a main effect of group, $F < 1$. Furthermore, results also failed to find the expected group x instruction x repetition x condition interaction, $F(1, 71) = 1.3$ $p > 0.05$. Therefore, separate ANOVA's were conducted for both the dysphoric and non-dysphoric groups.

The hypothesis predicted that *"dysphoric individuals would be successful at suppressing in the aided condition"*. However, contrary to this prediction results failed to find a significant instruction x repetition x condition interaction, $F < 1$ (see Figure 5.4). Furthermore, no main effect of condition was observed, $F < 1$. Taken together these findings suggest that dysphoric participants were not suppressing in the aided condition.

The hypothesis also predicted that *"non-dysphoric participants would successfully suppress emotional words in the aided condition"*. Consistent with this prediction results revealed a significant instruction x repetition x condition interaction, $F(1, 71) = 3.6$ $p < 0.05$ (see Figure 5.5). Furthermore, subsequent pairwise analysis revealed that non-dysphoric individuals in the aided condition recalled significantly fewer previously-suppressed words presented two ($M = 43.52$, $SD = 30.9$) and eight times ($M = 35.19$, $SD = 25.5$) than words that had not been suppressed ($M = 64.81$, $SD =$

23.5); 2 times t(17) = 2.1 $p < 0.03$; 8 times t(17) = 3.4 $p < 0.03$. These findings suggest that non-dysphoric participants were successful at inhibiting previously-suppressed words in the aided condition.

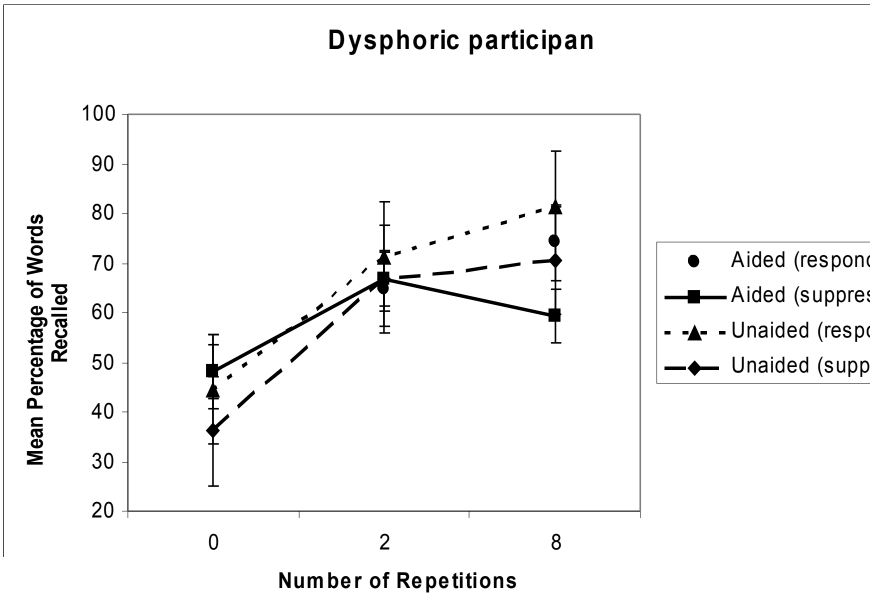

Figure 5.4. Illustrating the trend in recall of respond and previously-suppressed words by dysphoric participants in the aided and unaided conditions as a function of the number of cue presentations on the independent test (error bars represent ± one standard error of the mean).

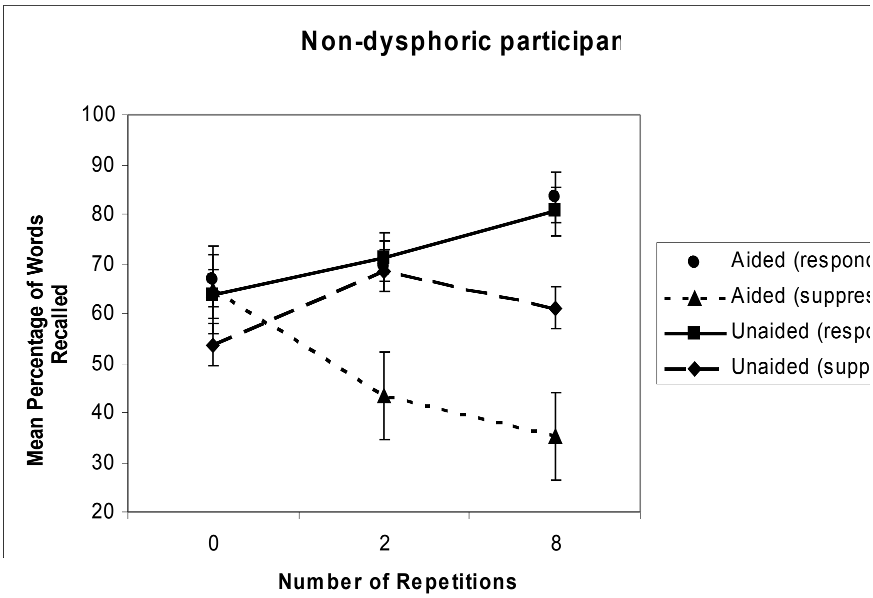

Figure 5.5. Illustrating the recall of respond and previously-suppressed words by non-dysphoric participants in the aided and unaided conditions as a function of the number of cue presentations on the independent test (error bars represent ± one standard error of the mean).

The hypothesis predicted that *"in the unaided suppression condition the dysphoric group would recall a significantly higher percentage of previously-suppressed words than would the non-dysphoric group"*. However, as noted above (page 136) results failed to find the expected group x instruction x repetition x condition interaction. These findings suggest that there were no significant differences in the recall of previously-suppressed words between dysphoric and non-dysphoric participants in the unaided condition.

Furthermore, it was also predicted that *"overall dysphoric participants in both the aided and unaided conditions would recall significantly more depression-relevant than positive previously-suppressed words."* However, contrary to this prediction results failed to find a significant instruction x valence interaction, $F(1, 71) = 1.4$ $p > 0.05$. Rather, the results revealed a main effect of valence with dysphoric participants overall, recalling significantly more depression-relevant ($M = 69.60$, $SD = 9.9$) than positive words ($M = 52.32$, $SD = 9.6$); $F(1, 71) = 29.4$ $p < 0.05$. Taken together, these findings suggest that dysphoric individuals are not specifically impaired at forgetting depression-relevant material.

The hypothesis also predicted that *'forgetting would not increase with the number of times a memory was previously-suppressed'*. Consistent with this prediction results failed to find a significant instruction x repetition interaction for dysphoric participants, F(1, 71) = 1.6 p > 0.05. However, a significant instruction x repetition interaction was observed for non-dysphoric participants, F(1, 71) = 8.7 p < 0.05 (see Figure 5.6). Furthermore, subsequent analysis revealed that although non-dysphoric participants were recalling less previously-suppressed words presented eight (M = 48.15, SD = 27.2) than two times (M = 56.02, SD = 30.9), this effect just failed to reach significance, t(35) = 1.9 p = 0.06.

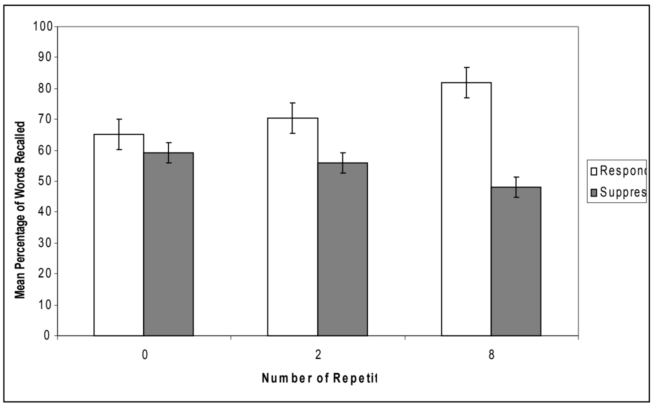

Figure 5.6. Illustrating the recall of respond and suppress words by non-dysphoric participants as a function of the number of cue presentations on the independent test (error bars represent + one standard error of the mean).

5.3.3. Compliance in the unaided condition

5.3.3.1. Calculating the compliance score

Findings revealed that neither dysphoric nor non-dysphoric participants were suppressing in the unaided condition. To further evaluate the lack of below baseline suppression in this condition, self report measures looking at compliance with suppression instructions were analysed, and a non-compliance factor was calculated (refer to study 2 Chapter 4, Section 4.3.3.1, page 107 for more information on how the non-compliance factor was calculated). This factor was included in a repeated measures design along a between factor of group (dysphoric vs. non-dysphoric), and within factors of instruction (respond vs. suppress) and repetition (0 vs. 2 vs. 8).

<u>5.3.3.2. Group differences in compliance</u>

Results revealed a significant instruction x non-compliance x group interaction, $F(1, 71) = 4.1$ $p < 0.05$, with subsequent analyses demonstrating that non-dysphoric non-compliant individuals ($M = 79.17$, $SD = 12.3$) recalled significantly more previously-suppressed words than non-dysphoric compliant individuals ($M = 46.83$, $SD = 24.2$) $t(35) = 2.5$ $p <0.03$. Furthermore, although dysphoric non-compliant participants ($M = 64.35$, $SD = 19.3$) also recalled more previously-suppressed words than dysphoric participants that complied with instructions ($M = 57.41$, $SD = 14.8$) this effect failed to reach significance; $t(16) = 0.8$ $p > 0.03$. No significant instruction x non-compliance x group interaction was found for the independent test; $F < 1$.

5.3.4. Thought substitution in the unaided condition

A correlation was carried out between scores on strategy question 4 *('kept myself from thinking about the original response word by thinking about something else')* and the size of instruction effect (i.e. the total number of respond nouns associated with cues presented 2 and 8 times, minus the total number of previously-suppressed nouns associated with cues presented 2 and 8 times, excluding all baseline measures). Results revealed a significant correlation between instruction effect and ratings on question 4, for the final cued recall test, $r(36) = 0.39$ $p < 0.05$. Subsequent analysis revealed that the non-dysphoric group showed a significant correlation between ratings on question 4 and the size of the instruction effect, $r(18) = 0.65$ $p < 0.01$.

However, there was no significant correlation between ratings on question 4 and the size of the instruction effect for the dysphoric group, $r(18) = 0.03$ $p > 0.05$.

The results demonstrated that non-dysphoric participants who reported a larger instruction effect (i.e. the difference between the recall of response and previously-suppressed words), thought about something else more frequently. Furthermore the instruction effect was not significantly correlated with non-compliance scores, $r(36) = 0.25$ $p > 0.05$, thus demonstrating that the use of a substitution strategy to account for successful suppression was not an artefact of whether participants complied with instructions.

5.3.5. Pearson correlations to investigate the differential impact of depression and co-morbid anxiety on suppression

A paired samples t-test revealed no significant differences between the first ($M = 11.08$, $SD = 8.2$) and second ($M = 11.14$, $SD = 8.7$) measure of the BDI; $p > 0.05$. To determine whether the first measure of BDI correlated with the second measure of BDI, a Pearson correlation was carried out, which revealed a highly statistically significant correlation between both measures of the BDI $r(72) = 0.96$ $p < 0.01$. Subsequently a mean BDI score was calculated for the two measures and a Pearson correlation was carried out on the mean measure of BDI and the total number of previously-suppressed words recalled.

5.3.5.1. Final cued recall test

The test revealed a significant positive correlation between mean BDI score and the number of previously-suppressed words recalled, $r(72) = 0.25$ $p < 0.05$. However, there was no significant correlation between anxiety (state and trait) and the number of previously-suppressed words recalled; state anxiety, $r(72) = 0.19$ $p > 0.05$; trait anxiety, $r(72) = 0.18$ $p > 0.05$.

5.3.5.2. Independent test

Pearson correlations also revealed a significant positive correlation between BDI and the number of previously-suppressed words recalled, $r(72) = 0.30$ $p < 0.05$. However, there was no significant correlation between anxiety (state and trait) and the number of previously-suppressed words recalled; state anxiety, $r(72) = 0.16$ $p > 0.05$; trait anxiety, $r(72) = 0.11$ $p > 0.05$. Taken together, these findings suggest that impaired forgetting of previously-suppressed words is specifically related to depression.

5.4. Discussion

The aim of the present study was to determine whether dysphoric individuals could intentionally forget emotional material using a thought substitution strategy. Furthermore, the study also investigated whether dysphoric individuals demonstrate mood-congruent impaired forgetting of previously-suppressed words. A key finding that emerged from the study was that dysphoric individuals were generally impaired in intentionally forgetting, regardless of condition, whereas non-dysphoric individuals were successful at suppressing words in the thought substitution condition.

5.4.1. Suppression in the aided condition

The hypothesis predicted *that "dysphoric individuals would be successful at suppressing in the aided condition."* Contrary to this prediction, results on the final cued recall test revealed that the dysphoric group were unsuccessful at suppressing material in the thought substitution condition. These results contradict findings obtained in Study 2, which found that dysphoric individuals were successful at suppressing material using a thought substitution strategy. Furthermore, the findings also contradict those obtained by Joormann et al (2009), which found that depressed individuals could be trained to intentionally forget emotional material using thought substitution. However, the findings are consistent with a large body of research which suggests that depressed and dysphoric individuals demonstrate altered patterns of intentional forgetting for emotional material (Hertel & Gerstle, 2003; Power, Dalgleish, Claudio, Tata & Kentish, 2000).

The findings are also consistent with Wegner's (1994) ironic control processes theory, which posits that depressed mood itself acts as a mental load, taking up cognitive resources that would otherwise be devoted to suppression. Furthermore, given the fact that emotional material is processed more elaborately than non-emotional material (Bjork, 1989; Payne & Corrigan, 2007), it is possible that in the present study depressed mood may have reduced capacity in dysphoric individuals, and coupled with a greater difficulty in inhibiting emotional words, resulted in impaired forgetting of previously-suppressed material.

The hypothesis also predicted that *"non-dysphoric individuals would successfully suppress emotional words in the aided condition."* Findings on the final cued test provided support for this hypothesis, and found that non-dysphoric individuals were successful at suppressing in the thought substitution condition. These results support previous findings obtained in Study 2, and those by Joormann et al (2009). Taken together, these results suggest that substituting a thought with something else that is meaningfully related to the cue for the unwanted memory, is an effective strategy to aid forgetting. Furthermore, the present results extend the findings of Study 2, and suggest that thought substitution is an effective strategy for forgetting emotional, as well as neutral material, but only in a normal mood.

5.4.2. Inhibitory mechanism in thought substitution

The independent test also showed a similar pattern of findings, with non-dysphoric individuals demonstrating successful forgetting and dysphoric individuals demonstrating impaired forgetting in the thought substitution condition. Findings that non-dysphoric individuals are successful at inhibiting previously-suppressed words in the thought substitution condition are consistent with those obtained in Study 2. These findings suggest that by using thought substitution, non-dysphoric participants can strategically control and adapt their thinking patterns using control processes to prevent the unwanted memory from entering consciousness, thus leading to successful inhibition.

Findings demonstrating that dysphoric individuals are impaired at forgetting previously-suppressed words in the thought substitution condition are inconsistent with findings obtained in Study 2. However, given the fact that the independent test is a measure of inhibition (Anderson & Green, 2001), these results are consistent with research that has demonstrated that depressed individuals' exhibit deficits in inhibitory processes (Domes, Winter, Schnell, Vohs, Fast & Herpertz, 2006). For example, Linville (1996) found that depressed individuals were less likely to inhibit distracting information on a lexical decision task than were non-depressed individuals. Furthermore, Joormann (2004) also found that individuals with a history of depression demonstrated reduced inhibition of emotional words.

5.4.3. Group differences in the thought suppression condition

The hypothesis also predicted that *"in the unaided suppression condition the dysphoric group would recall a significantly higher percentage of previously-suppressed words than would the non-dysphoric group"*. This hypothesis was only partially supported by the results obtained on the final cued recall test, which found that although dysphoric participants recalled more previously-suppressed words than did the non-dysphoric participants, this effect just fell short of being significant. Although the effect was non-significant, the finding that dysphoric participants recalled more previously-suppressed words than non-dysphoric participants is consistent with the findings obtained in Study 1 (Chapter 3, Section 3.3.3, page 71), and supports previous research which has also found impaired forgetting for emotional material in dysphoria (e.g. Hertel & Gerstle, 2003)

5.4.4. Forgetting of depression-relevant previously-suppressed words in dysphoric individuals

The prediction that *"dysphoric participants in both the aided and unaided conditions would recall significantly more depression-relevant than positive previously-suppressed words"* was not supported by the results on the final cued recall test, or from the analysis of the independent data. Rather, the present study found that dysphoric individuals were overall recalling significantly more depression-relevant than positive respond and previously-suppressed words. Taken together, these findings suggest that dysphoric individuals are not specifically impaired at suppressing depression-relevant material. Rather, this impairment is more general and for all emotional words.

Findings of overall enhanced recall of depression-relevant words are in line with the vast amount of data reporting mood-congruent memory biases in depression and dysphoria (Matt et al, 1992; Ridout et al, 2003; Ridout et al, 2009). Furthermore, the findings are also in line with Beck's (1972) content-specificity hypothesis. According to the hypothesis, depressive self-schemata predispose depressed individuals towards greater elaborative encoding of depression-relevant material leading to enhanced retrieval (see Beck & Perkins, 2001 for a review). Consistent with this hypothesis Murray, Whitehouse & Alloy (1999) found that dysphoric individuals recalled significantly more depression-relevant than positive material Taken together, these findings suggest that the tendency of dysphoric individuals to exhibit enhanced recall of depression-relevant material is a characteristic of elevated depression.

5.4.5. The effect of practice on suppression

The hypothesis that *"forgetting would not increase with the number of times a memory was previously-suppressed"* was supported by the results of the final cued recall test. These findings are consistent with previous findings obtained in Studies 1 and 2, and suggest that forgetting does not increase with the number of times a memory is previously-suppressed.

However, it is important to note that non-dysphoric participants were recalling fewer previously-suppressed words associated with cues presented 8 than 2 times on the independent test, although this effect just failed to reach significance. Given the fact that the present study used a word fragment completion independent test, it is possible that this task may be sensitive to practice effects in suppression.

5.4.6. Compliance in the unaided condition

Analyses of the use of strategies by dysphoric and non-dysphoric participants in the unaided condition revealed that non-compliant individuals recalled more previously-suppressed words than did compliant individuals in the final cued recall test. These findings are consistent with those obtained by Study 2, and suggest that participants attempting to keep the previously-suppressed words out of their mind demonstrated more successful suppression of these words, in comparison to non-compliant individuals.

However, it is important to note that there were no significant differences in the recall of previously-suppressed words between compliant and non-compliant individuals in the independent test. These findings are contrary to those obtained in Study 2 (Chapter 4, Section 4.3.3, page 108), which found that dysphoric and non-dysphoric non-compliant individuals recalled more previously-suppressed than dysphoric and non-dysphoric compliant individuals.

One explanation to account for the differential findings of this study and Study 2 may relate to variations in the processing requirements of the different independent tasks used in these studies (item-specific word stem vs. word fragment completion tasks). Research suggests that memory performance is best when the type of processing during learning matches the type of processing during testing. However, memory is significantly worse when there is a mismatch between the two types of processing

(Stenberg, Johansson & Rosen, 2006). Given the fact that both the think/no-think and the item specific word fragment completion tasks are conceptual tasks (i.e. involves analysing the semantic meaning of the target material), and the word fragment completion task is a perceptual task (i.e. involves analysing the physical features of the target word), it is possible that this mismatch between the types of processing, coupled with a lack of guidance on specific strategies to use to suppress material, may have resulted in poorer recall of the previously-suppressed words, regardless of whether or not participants attempted to keep these words out of their mind.

It is important to note that the findings from the present study also revealed that non-dysphoric participants who used a self-initiated thought substitution strategy (i.e. *'kept myself from thinking about the original response word by thinking about something else'*) in the unaided condition reported a bigger instruction effect (i.e. a bigger difference between the total number of respond and previously-suppressed words recalled). These findings are consistent with those obtained in Study 2 (Chapter 4, Section 4.3.4, page 108), and provide further support to the notion that focusing ones thoughts on something else that is meaningfully related to the cue that evokes the unwanted memory is an effective strategy to aid forgetting (Hertel & Calcaterra, 2005).

However, findings that there was no significant correlation between dysphoric participants that used a self-initiated strategy of thought substitution in the unaided condition and an instruction effect are inconsistent with the findings of Study 2 (Chapter 4, Section 4.3.4, page 108). Rather, the findings are consistent with research which suggests that depressed mood state interacts with the emotional content of material, which attenuates intentional forgetting effects (Minnema & Knowlton, 2008). Taken together, the findings suggest that self-initiated thought substitution of emotional material may be counterproductive in dysphoria, and actually enhance memory of the unwanted material.

5.4.7. Summary

In conclusion, the study found that non-dysphoric participants were successful at suppressing with the use of a thought substitution strategy. This pattern of findings was also observed in the independent test, suggesting that non-dysphoric participants had successfully inhibited the previously-suppressed words. The study also found that dysphoric participants were unsuccessful at suppressing, even with the use of a thought substitution strategy. However, contrary to expectations impaired forgetting was not limited to depression-relevant material. Rather, dysphoric participants demonstrated enhanced recall of depression-relevant respond and previously-suppressed words. Taken together, these findings suggest that group differences in suppression may only observed when the material used is emotional. Furthermore, the presence of between-group valence differences may be explained by the degree to which the words represented the concerns/thinking of the dysphoric and non-dysphoric groups.

CHAPTER SIX

Investigating the role of executive control on intentional forgetting of emotional material in dysphoria.

6.1. Introduction

6.1.1. Background

Although the findings from Study 2 revealed that dysphoric individuals were successful at suppressing neutral material using a thought substitution strategy, the findings from the Study 3 revealed that dysphoric individuals were significantly impaired in their ability to suppress to-be-forgotten emotional words. Given that previous research suggests that executive control processes are responsible for intentional forgetting (Anderson & Green, 2001; Levy & Anderson, 2008), the aim of the present study was to look at whether impaired suppression in dysphoria was the result of poor executive control.

According to the inhibitory control account, suppressing unwanted memories is a result of engaging executive control processes to prevent the unwanted thought from coming to mind (Anderson & Green, 2001). In line with this notion, it can be argued that individual differences in executive control ability might explain the variability in memory suppression (Levy & Anderson, 2002). If this is the case, then variables that influence the ability to engage executive control should be able to predict whether individuals can successfully suppress material.

One task used in previous studies (e.g. Dalgleish et al, 2007; Levy & Anderson, 2008) to examine individual differences in executive control is the operation span with words task (OSPAN; Turner & Engle, 1989). The OSPAN task is essentially a working memory task which requires participants to alternate between solving mathematical operations and trying to remember a series of unrelated words. The goal of the task is to try to recall as many words as possible, after a varying number of trials. In order to perform well on the task, participants must keep goal-relevant information active (i.e. the words for the recall test), whilst discarding goal-irrelevant material from working memory (i.e. the mathematical operations), an ability thought to be dependent upon executive control (Kane & Engle, 2002; Levy & Anderson, 2008).

Given the fact that research suggests that working memory capacity provides a good measure of executive control (Kane & Engle, 2002; Levy & Anderson, 2008), it is anticipated that differences in working memory function will be related to differences in suppression. In line with this view, Brewin & Beaton (2002) used the standard 'white bear' paradigm to look at thought suppression, and also included the operation span with words task (OSPAN; Turner & Engle, 1989) to measure working memory capacity in healthy non-depressed individuals. The study found that better performance on OSPAN was related to having fewer intrusions in the thought suppression condition, suggesting a specific association between individual differences in working memory capacity and attempts to inhibit unwanted thoughts. These findings were consistent with previous findings by Rosen & Engle (1998), who looked at individual differences in working memory capacity and performance on a paired-associates task, and found that greater working memory capacity, as measured by OSPAN, was related to more successful suppression of intrusive thoughts. Taken together, these findings suggest that there is a strong relationship between working memory capacity and suppression, with individuals with poorer working memory capacity demonstrating greater difficulty in suppression.

6.1.2. Research overview

Given that individuals with depression and dysphoria display impairments in executive function (Degl'Innocenti, Agren & Backman, 1998; Landro, Stiles & Sletvold, 2001; Rogers et al, 2004), it would seem plausible that the suppression deficits observed in dysphoric participants in Study 3 might be the result of poor executive control on the part of these individuals. Therefore, the purpose of the present study was to establish if changes in intentional forgetting observed in dysphoria are a consequence of impaired executive function, or whether it is the dysphoric condition itself which elicits such a deficit. To this end, dysphoric (BDI scores 15 or more) and non-dysphoric (BDI scores 0-5) participants were assessed on the think/no-think task from Study 3 and also completed a measure of working memory capacity, the operation span with words task (OSPAN; Turner & Engle, 1989). Participants in both groups (dysphoric & non-dysphoric) were further separated into subgroups (good vs. poor working memory function) based on their scores in the OSPAN task.

6.1.3. Experimental hypotheses

1. In line with findings obtained in Study 3, it was expected that dysphoric participants would recall a greater percentage of previously-suppressed words than would the non-dysphoric participants.

2. In line with findings obtained by Brewin & Beaton (2002), it was also expected that participants with poor working memory capacity would recall a greater percentage of previously-suppressed words than would participants with good working memory function.

3. Furthermore, in line with findings obtained in Study 3 and by Brewin & Beaton (2002), it was predicted that the non-dysphoric group with good working memory function would be the only group to demonstrate successful suppression, whereas the dysphoric group with poor working memory capacity would demonstrate the greatest recall of previously-suppressed words.

4. Findings obtained in Study 3 found that non-dysphoric individuals were forgetting more previously-suppressed words associated with cues presented 8 than 2 times (Chapter 5, Section 5.3.2.2, page 139) on the independent test. In line with this, it was expected that forgetting would increase with the number of times a memory was suppressed for the non-dysphoric group with good working memory function on the independent test.

6.2. Method

6.2.1. Design

A 4 (group) x 2 (instruction) x 2 (valence for suppression) x 3 (repetition) mixed factorial design was used. The between-group factors were group, WMF and valence for suppression, and the within-group factors were instruction and repetition. The independent variables were group (dysphoric–good working memory function (WMF) vs. dysphoric-poor WMF vs. non-dysphoric–good WMF vs. non-dysphoric-poor WMF), valence for suppression (positive vs. depression-relevant) and repetition (0, 2, 8). The dependent variables were the percentage of words recalled on the cued recall test and the percentage of words recalled on the independent test.

6.2.2. Participants

128 participants completed the BDI-II on two occasions, around 7-14 days apart (median number of days between the two sessions was 9). Participates were invited to take part in the main study based on their mean BDI scores, across the two occasions. Following recommended guidelines described by Kao, Dritschel & Astell (2006), participants with BDI scores of 5 or less were classified as non-dysphoric, and participants with BDI scores of 15 or more were classified as dysphoric. 7 participants (2M, 5F) were excluded from participating in the study, as their mean BDI scores were above 5 and below 15. This procedure resulted in two groups of participants, 60 dysphoric (23M, 37F; mean age = 21.83, SD = 4.9) and 61 non-dysphoric participants (20M, 41F; mean age = 22.67, SD = 5.4). These two groups were further divided into three subgroups based on their scores on the OSPAN working memory task. The data from only the highest and lowest scoring sub-groups is included in this study. Therefore, 20 dysphoric (11M, 9F; mean age = 23.65, SD = 7.5) and 20 non-dysphoric participants (4M, 16F; mean age = 20.40, SD = 1.7) with good working memory function and 20 dysphoric (6M, 14F; mean age = 22.10, SD = 5.2) and 20 non-dysphoric participants (8M, 12F; mean age = 21.95, SD = 3.8) with poor working memory function were selected to take part in the study according to the inclusion and exclusion criteria cited in Chapter 2 (Sections 2.4.2 & 2.4.3, pages 40-42).

6.2.3. Materials

6.2.3.1. Word pairs

A set of 36 adjective-noun pairs were used. These word pairs were identical to those used in Study 3 (refer to Chapter 5, Section 5.2.3.1, page 124 for a detailed coverage of the word pairs used).

6.2.3.2. Assessment of mood and general intellectual function.

The Beck Depression Inventory-II (BDI-II; Beck et al, 1996) was used to measure self-reported depression, and to allocate participants into dysphoric and non dysphoric groups. The Spielberger State-Trait Anxiety Inventory (STAI; Spielberger et al, 1983) was used to quantify the degree of state and trait anxiety exhibited by the participants, in order to allow the influence of this mood state on forgetting to be determined. The National Adult Reading Test (NART; Nelson & Williamson, 1991) was used to measure participants' general intellectual ability (see Chapter 2,Sections 2.2 & 2.3 pages 33-39) for psychometric properties of the mood questionnaires and the NART and details of their administration).

6.2.3.3. Executive Control Task

The operation span with words task (OSPAN; Turner & Engle, 1989) was chosen as a prototypical working memory capacity task. The OSPAN task requires participants to solve a series of maths operations, while trying to remember a series of unrelated words. Participants were shown one word string (e.g. 2 + 1 = 5? MAN) at a time. For each trial (see Figure 6.1) participants were asked to read aloud the word string and to perform a simple concurrent arithmetic operation, which involved verifying whether or not the answer to an operation was correct. Participants were subsequently asked to read aloud the to-be-recalled word. Immediately after the participant read the word, the next word string was presented. After the last operation in each trial, participants were presented with a set of three question marks centered on the screen and were asked to write down the correct order of the words that followed the operation strings. One trial consisted of a set of between two and five operation strings. After three practice trials, each containing two operation strings, participants received the 12 experimental trials, three at each set size. The order of trials was arranged so that sets of different sizes were presented in a random order. Participants were given unlimited time to complete the task.

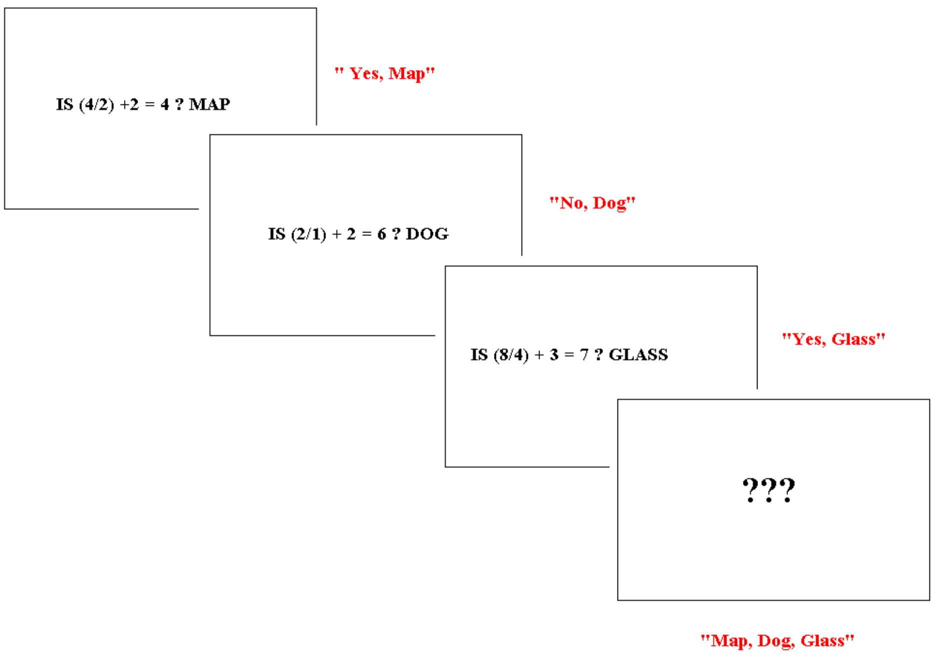

Figure 6.1. An example of one trial presented in the Operation span with words task.

Marks corresponding to the set size were allocated, only if all the words in a trial were remembered in the correct order and if all arithmetic strings had been correctly verified. For example, if there were three operation strings in a trial and the three words were all recalled in the correct order, and all arithmetic strings were correctly verified, a score of 3 was given for that trial. A total score was calculated by adding up individual trial scores (possible range 0-42).

6.2.4. Procedure

The study involved two testing sessions. In the first session participants were asked to complete the screening questionnaire (see Appendix I), BDI-II, and trait scale of the STAI (STAI-T). On the second testing session participants were asked to complete the NART, the OSPAN task, the think-no-think task, the BDI-II and the state scale of the STAI.

The procedure for the think/no-think task was exactly the same as Study 3 (see Chapter 5, Section 5.2.4, page 128) with one notable difference, there was no unaided thought suppression condition (i.e. all participants were assessed under the aided thought substitution condition). This was because dysphoric and non-dysphoric participants in the previous 3 studies failed to intentionally forget material in the unaided condition. Given the consistency in findings, it can be deduced that participants will not be successful at suppressing in the unaided condition. Therefore, this condition was omitted from the present forgetting task.

6.2.5. Scoring and Data Analysis

To determine whether there were any group differences, participants' demographic characteristics were analysed. Age was analysed using a one-way between groups univariate analysis of variance. In addition, gender, marital status, occupation and education (i.e. level of education reached) were analysed using chi-square. Furthermore, to determine if there were group differences in general intellectual ability, the National Adult Reading Test (NART) error scores were analysed using a one-way between groups univariate analysis of variance. In addition, data on BDI and STAI were analysed using a one-way between-groups multivariate analysis of variance.

The dependent measures of interest were the percentage of words correctly recalled on the cued recall test and the percentage of words recalled on the independent test. These were assessed using 4 (group) x 2 (valence) x 2 (instruction) x 3 (repetition) mixed ANOVA. Between-subject factors were group (dysphoric good working memory function (WMF) vs. dysphoric poor WMF vs. non-dysphoric good WMF vs. non-dysphoric poor WMF) and valence of cues for suppression (positive vs. depression-relevant), and within-subject factors were the type of instruction during the suppression phase (suppress vs. respond) and the number of times the cues were presented (0, 2 or 8). The significance was set at the 5% level. Follow up analyses were conducted using one-way repeated measures ANOVA, independent and paired samples t-tests. Alpha levels for pairwise comparisons were adjusted in accordance to the Bonferroni correction method (see Keppel & Wickens, 2004).

6.3. Results

6.3.1. Participant Characteristics

The participants' demographic, mood and performance indices are presented in Table 6.1 below. Analysis of the participants characteristics demonstrate that the four groups did not differ significantly with respect to age, occupation, marital status, education or gender. Furthermore, the four groups did not differ significantly on NART error score, $F < 1$. The groups did differ significantly in terms of their depression (BDI-II) scores; first measure of BDI, $F(1, 79) = 276.9$ $p < 0.05$; second measure of the BDI, $F(1, 79) = 170.4$ $p < 0.05$, with dysphoric participants with both good and poor working memory function (WMF) scoring significantly higher on both measures of BDI than non-dysphoric participants with both good and poor WMF; all tests $p < 0.01$. However, there were no significant differences in depression scores between dysphoric participants with good WMF and dysphoric participants with poor WMF, all tests $p > 0.01$. Furthermore, there were also no significant differences in depression scores between non-dysphoric participants with good WMF and non-dysphoric participants with poor WMF; all tests $p > 0.01$. The four groups also differed in anxiety; state anxiety, $F(1, 79) = 9.4$ $p < 0.05$; trait anxiety, $F(1, 79) = 10.0$ $p < 0.05$, with dysphoric participants with both good and poor WMF scoring significantly higher on measures of state and trait than non-dysphoric participants with both good and poor WMF; all tests $p < 0.01$. However, there were no significant differences in anxiety scores between dysphoric participants with good WMF and dysphoric participants with poor WMF, all tests $p > 0.01$. There were also no significant differences in anxiety scores between non-dysphoric participants with good WMF and non-dysphoric participants with poor WMF; all test $p > 0.05$. Furthermore, as expected significant group differences were observed on the OSPAN task, $F(1, 79) = 371.4$ $p < 0.01$.

<u>Table 6. 1-</u> Mean performance indices and p values for general characteristics, the National Adult Reading Test (NART) and mood measures as a function of participant group ***(standard deviations are presented in parentheses).***

	Dysphoric		Non-dysphoric		
	Good WMF (n=20)	**Poor WMF (n=20)**	**Good WMF (n=20)**	**Poor WMF (n=20)**	**p- value**
Age	23.65 (7.5)	20.40 (1.7)	22.10 (5.2)	21.95 (3.8)	p > 0.05
Gender	11M; 9F	4M; 16F	6M; 14F	8M; 12F	p > 0.05
NART Errors	16.10 (6.0)	17.25 (7.8)	19.20 (9.3)	17.00 (6.6)	p > 0.05
STAI-S	43.90 (11.4)	41.50 (9.6)	34.60 (8.1)	30.00 (7.4)	p < 0.01
STAI-T	48.50 (10.7)	43.45 (8.8)	35.60 (9.7)	34.05 (9.1)	p < 0.01
BDI (1)	17.40 (2.5)	18.95 (3.1)	3.47 (1.7)	3.10 (1.6)	p < 0.01
BDI (2)	17.45 (3.4)	20.0 (4.8)	3.05 (1.7)	3.20 (1.7)	p < 0.01
OSPAN score	33.90 (3.7)	13.00 (2.0)	33.00 (2.8)	13.45 (2.0)	p < 0.01

WMF=Working Memory Function; M = Male, F = Female; NART = National Adult Reading; STAI-S = State anxiety scale; STAI-T = Trait anxiety scale; BDI (1) = First measure of the Beck Depression Inventory; BDI (2) = Second measure of the Beck Depression Inventory; OSPAN = Operation span with words task

6.3.2. Memory for paired associates

<u>6.3.2.1. Final cued recall test</u>

The results revealed a significant overall main effect of instruction, $F(1, 79) = 49.7$ $p < 0.05$, with participants recalling significantly more respond (M = 66.04, SD = 18.4) than previously-suppressed words (M = 48.47, SD = 20.5). Furthermore, an overall main effect of repetition was also found, $F(1, 79) = 16.9$ $p < 0.05$. Subsequent analysis revealed that participants recalled significantly more words presented two (M = 56.56, SD = 22.4) and eight times (M = 66.04, SD = 19.2) than baseline (M = 49.17, SD = 21.4), 2 times $t(79) = 2.4$ $p < 0.02$; 8 times $t(79) = 5.5$ $p < 0.02$. Furthermore, participants also recalled significantly more words presented eight than two times, $t(79) = 3.8$ $p < 0.02$. However, results failed to find an overall main effect of group or valence for suppression, all tests $F < 1$.

It was predicted that *"dysphoric participants would recall a greater percentage of previously-suppressed words than would the non-dysphoric participants"*. In line with this prediction, results revealed a significant instruction x group interaction, $F(1, 79) = 9.0$ $p < 0.05$. Subsequent pairwise analyses revealed that overall dysphoric participants (M = 55.69, SD = 20.5) recalled significantly more previously-suppressed words than non-dysphoric participants (M = 41.25, SD = 17.9); $t(78) = 3.4$ $p < 0.03$.

It was also predicted that *"participants with poor working memory capacity would recall a greater percentage of previously-suppressed words than would participants with good working memory function"*. In line with this prediction subsequent pairwise analysis revealed that participants with poor WMF (M = 55.14, SD = 19.9) recalled significantly more previously-suppressed words than participants with good WMF (M = 41.81, SD = 19.0); $t(78) = 3.1$ $p < 0.03$.

It was also predicted that *"the non-dysphoric group with good working memory function would be the only group to demonstrate successful suppression, whereas the dysphoric group with poor working memory capacity would demonstrate the greatest recall of previously-suppressed words."* Consistent with this prediction subsequent pairwise analysis revealed a significant group x instruction x repetition interaction, $F(1, 79) = 2.1$ $p < 0.05$. Subsequent pairwise analysis revealed that the non-dysphoric group with good WMF were recalling fewer previously-suppressed words presented twice ($M = 32.50$, $SD = 26.8$) and eight times ($M = 23.33$, $SD = 25.6$) than words that had not been suppressed ($M = 49.17$, $SD = 29.4$); 2 times $t(19) = 2.1$ $p < 0.01$; 8 times $t(19) = 2.5$ $p < 0.01$. However, subsequent pairwise analyses revealed that the dysphoric group with good WMF demonstrated no significant differences in the recall of previously-suppressed words presented twice ($M = 48.33$, $SD = 33.3$) and eight times ($M = 51.67$, $SD = 30.1$) than words that had not been suppressed ($M = 45.83$, $SD = 28.0$); 2 times $t(19) = 0.3$ $p > 0.01$ and 8 times $t(19) = 0.6$ $p > 0.01$, respectively. Furthermore, the non-dysphoric group with poor WMF also demonstrated no significant differences in the recall of previously-suppressed words presented twice ($M = 44.17$, $SD = 33.0$) and eight times ($M = 48.33$, $SD = 34.6$) than words that had not been suppressed ($M = 50.0$, $SD = 24.2$); 2 times $t(19) = 0.6$ $p > 0.01$; 8 times $t(19) = 0.2$ $p > 0.05$ respectively. However, results revealed that the dysphoric group with poor WMF were recalling significantly more previously-suppressed words presented twice ($M = 68.33$, $SD = 25.3$) and eight times ($M = 74.17$, $SD = 26.8$) than words that had not been suppressed ($M = 45.83$, $SD = 29.1$); 2 times $t(19) = 2.6$ $p < 0.01$; 8 times $t(19) = 3.5$ $p < 0.01$ respectively. Taken together, these findings suggest that the non-dysphoric group with good WMF demonstrated successful suppression, whereas the dysphoric participants with poor WMF demonstrated the greatest recall of previously-suppressed words (see Figure 6.2)

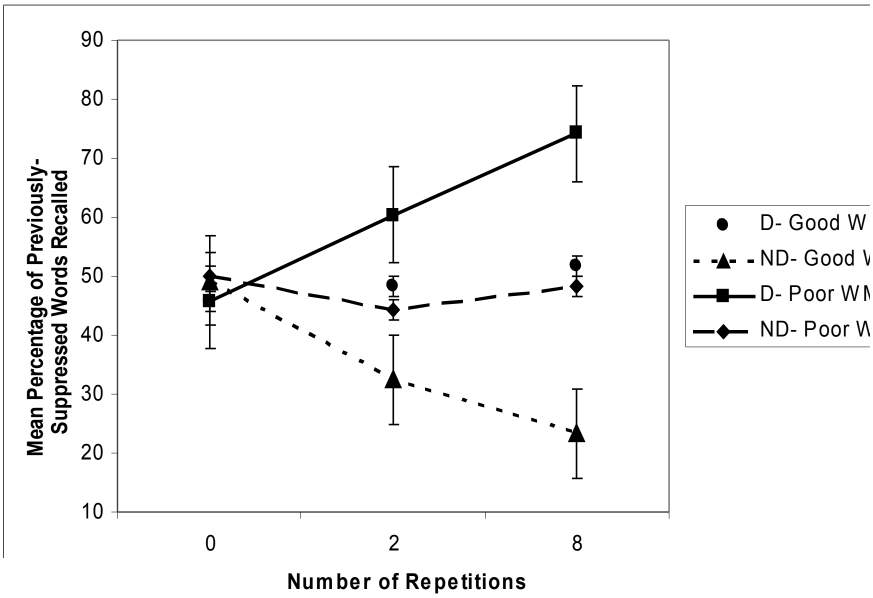

Figure 6.2. Illustrating differences in the mean percentage of previously-suppressed words recalled by dysphoric and non-dysphoric groups with good and poor WMF as a function of the number of repetitions on the final cued recall test (error bars represent ± one standard error of the mean).

<u>6.3.2.2. Independent test</u>

The results revealed a significant overall main effect of instruction, F(1, 79) = 25.9 p < 0.05, with participants recalling significantly more respond (M = 61.25, SD = 14.6) than previously-suppressed words (M = 51.25, SD = 17.3). Furthermore, an overall main effect of repetition was also found, F (1, 79) = 18.6 p < 0.05. Subsequent analysis revealed that participants recalled significantly more words presented two (M = 59.37, SD = 18.4) and eight times (M = 62.29, SD = 19.0) than baseline (M = 47.17, SD = 18.2), 2 times t(79) = 4.2 p < 0.03; 8 times t(79) = 5.4 p < 0.03. However, results failed to find an overall main effect of valence for suppression, F < 1.

It was predicted that *"dysphoric participants would recall a greater percentage of previously-suppressed words than would the non-dysphoric participants"*. In line with this prediction, results revealed a significant instruction x group interaction, $F(1, 79) = 11.6$ $p < 0.05$. Subsequent pairwise analyses revealed that overall dysphoric participants ($M = 57.50$, $SD = 16.9$) recalled significantly more previously-suppressed words than non-dysphoric participants ($M = 45.0$, $SD = 13.4$); $t(78) = 3.5$ $p < 0.03$.

It was also predicted that *"participants with poor working memory capacity would recall a greater percentage of previously-suppressed words than would participants with good working memory function"*. In line with this prediction, subsequent pairwise analysis revealed that participants with poor WMF ($M = 58.33$, $SD = 16.9$) recalled significantly more previously-suppressed words than participants with good WMF ($M = 44.17$, $SD = 14.6$); $t(78) = 4.0$ $p < 0.03$.

It was also predicted that *"the non-dysphoric group with good working memory function would be the only group to demonstrate successful suppression, whereas the dysphoric group with poor working memory capacity would demonstrate the greatest recall of previously-suppressed words."* Consistent with this prediction, subsequent pairwise analysis revealed a significant group x instruction x repetition interaction, $F(1, 79) = 4.1$ $p < 0.05$. Subsequent pairwise analysis revealed that the non-dysphoric group with good WMF were recalling fewer previously-suppressed words presented two ($M = 33.33$, $SD = 20.2$) and eight times ($M = 30.83$, $SD = 22.5$) than words that had not been suppressed ($M = 51.67$, $SD = 26.4$); 2 times $t(19) = 2.5$ $p < 0.01$; 8 times $t(19) = 2.9$ $p < 0.01$. Subsequent pairwise analyses revealed that the dysphoric group with good WMF were recalling more previously-suppressed words presented twice ($M = 59.17$, $SD = 21.9$) than words that had not been suppressed ($M = 44.17$, $SD = 21.1$); $t(19) = 2.9$ $p < 0.01$. However, the dysphoric group with good WMF demonstrated no significant differences in the recall of previously-suppressed words presented eight times ($M = 45.83$, $SD = 23.5$) than words that had never been suppressed; $p > 0.01$. Furthermore, the non-dysphoric group with poor WMF also demonstrated no significant differences in the recall of previously-suppressed words presented twice ($M = 56.67$, $SD = 28.3$) and eight times ($M = 53.33$, $SD = 31.8$) than words that had not been suppressed ($M = 44.17$, $SD = 15.6$); all tests $p > 0.01$. However, results revealed that the dysphoric group with poor WMF were recalling significantly more previously-suppressed words presented two ($M = 78.33$, $SD = 27.1$) and eight times ($M = 76.67$, $SD = 27.8$) than words that had not been suppressed ($M = 40.83$, $SD = 21.9$); 2 times $t(19) = 4.3$ $p < 0.01$; 8 times $t(19) = 4.9$ $p < 0.01$, respectively. Taken together, these findings suggest that only the non-dysphoric group with good WMF demonstrated successful suppression, whereas the non-dysphoric group with poor control demonstrated the greatest recall of previously-suppressed words (see Figure 6.3).

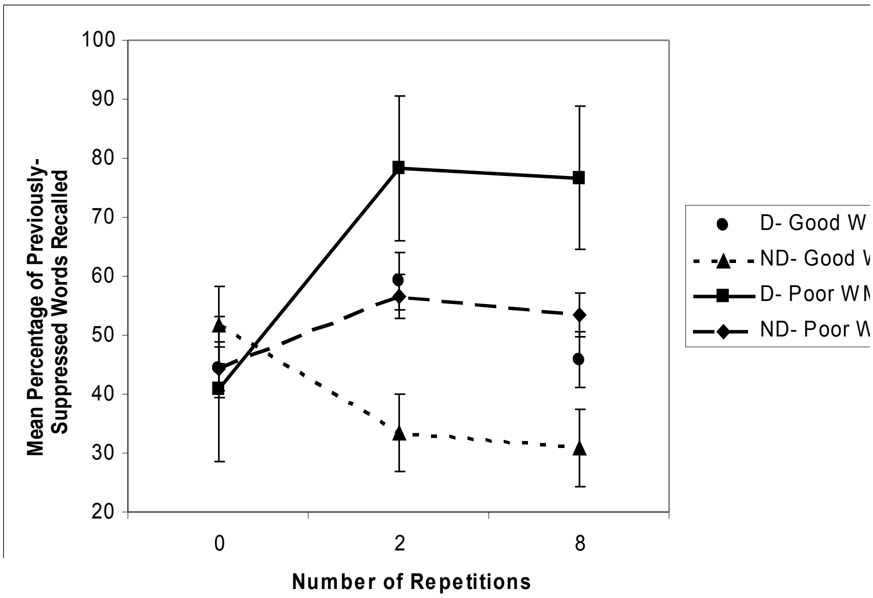

Figure 6.3. Illustrating differences in the mean percentage of previously-suppressed words recalled by dysphoric and non-dysphoric groups with good and poor WMF as a function of the number of repetitions on the independent test (error bars represent ± one standard error of the mean).

Furthermore, it was also predicted that *"forgetting would increase with the number of times a memory was suppressed for the non-dysphoric group with good WMF on the independent test."* However, subsequent pairwise analysis failed to find a significant difference in the recall of previously-suppressed words associated with cues presented 2 and 8 times, $p > 0.05$.

It is important to note that findings revealed a significant group x valence interaction, $F(1, 79) = 7.8$ $p < 0.05$. Subsequent pairwise analyses revealed that dysphoric participants with poor WMF recalled significantly more depression-relevant than positive respond and previously-suppressed words, $t(18) = 3.1$ $p < 0.01$. Furthermore, dysphoric participants with good WMF also recalled significantly more depression-relevant than positive respond and previously-suppressed words, $t(18) = 2.2$ $p < 0.01$.

Conversely, non-dysphoric participants with poor WMF recalled significantly more positive than depression-relevant respond and previously-suppressed words, $t(18) = 3.1$ $p < 0.01$. However, there was no significant difference in the recall of positive and depression-relevant respond and previously-suppressed words by the non-dysphoric group with good WMF, $p > 0.01$ (see Figure 6.4).

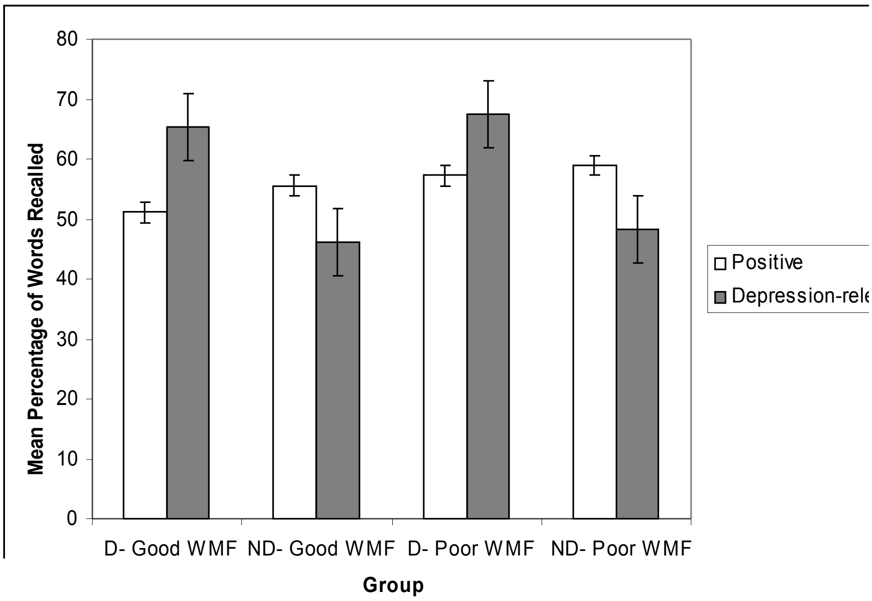

Figure 6.4. Illustrating group differences in the mean percentage of words recalled overall as a function of word valence on the independent test (error bars represent ± one standard error of the mean).

6.3.3. Pearson correlations to investigate the differential impact of depression and WMF on suppression

A paired samples t-test revealed no significant differences between the first ($M = 10.72$, $SD = 7.9$) and second ($M = 11.98$, $SD = 8.5$) measure of the BDI; $p > 0.05$. To determine whether the first measure of BDI correlated with the second measure of BDI, a Pearson correlation was carried out which revealed a highly statistically significant correlation between both measures of the BDI, $r(80) = 0.97$ $p < 0.01$.

Subsequently a mean BDI score was calculated for the two measures and a Pearson correlation was carried out on the mean measure of BDI and the total number of previously-suppressed words recalled. A Pearson correlation was also carried out on participants scores on the OSPAN task and the total number of previously-suppressed words recalled.

6.3.3.1. Final cued recall test

Results revealed a significant positive correlation between mean BDI score and the number of previously-suppressed words recalled, $r(80) = 0.37$ $p < 0.01$. Furthermore, results also revealed a significant positive correlation between OSPAN score and the number of previously-suppressed words recalled, $r(80) = 0.30$ $p < 0.01$. Partialling out the effects of OSPAN, results found a significant positive Pearson correlation between the mean measure of BDI and the number of previously-suppressed words recalled, $r(80) = 0.37$ $p < 0.01$. Furthermore, partialling out the effects of BDI, results found a significant positive Pearson correlation between OSPAN scores and the number of previously-suppressed words recalled, $r(80) = 0.30$ $p < 0.01$. It is also worth noting that no significant correlation was found between OSPAN and BDI, $p > 0.05$.

6.3.3.2. Independent test

Similar results were also obtained for the independent test. Results revealed a significant positive correlation between mean BDI score and the number of previously-suppressed words recalled, $r(80) = 0.41$ $p < 0.01$. Furthermore, results also revealed a significant positive correlation between OSPAN score and the number of previously-suppressed words recalled, $r(80) = 0.42$ $p < 0.01$. Partialling out the effects of OSPAN, results found a significant positive Pearson correlation between the mean measure of BDI and the number of previously-suppressed words recalled, $r(80) = 0.43$ $p < 0.01$. Furthermore, partialling out the effects of BDI, results also found a significant positive Pearson correlation between OSPAN scores and the number of previously-suppressed words recalled, $r(80) = 0.44$ $p < 0.01$. Again, as expected, no significant correlation was found between OSPAN and BDI, $p > 0.05$.

6.3.4. Pearson correlations to investigate the impact of anxiety on suppression

Pearson correlations were carried out to determine whether there was a relationship between anxiety and the number of previously-suppressed words recalled. Pairwise analyses revealed that there was no significant correlation between state and trait anxiety and the number of previously-suppressed words recalled for both the final cued recall test (state anxiety $r(80) = 0.16$ $p > 0.05$; trait anxiety $r(80) = 0.19$ $p > 0.05$) and the independent test (state anxiety $r(80) = 0.01$ $p > 0.05$; trait anxiety $r(80) = 0.12$ $p > 0.05$).

6.4. Discussion

The aim of the present study was to examine the role of executive control in intentional forgetting of emotional words in dysphoria. Given the fact that research suggests that working memory capacity is a good measure of executive control (Levy & Anderson, 2008), the study investigated whether findings of impaired suppression in Study 3 were due to individual differences in working memory function.

6.4.1. Group differences in dysphoria

The hypothesis predicted that *"dysphoric participants would recall a greater percentage of previously-suppressed words than would the non-dysphoric* *participants."* In line with this prediction, results revealed that dysphoric participants were recalling significantly more previously-suppressed words than non-dysphoric participants. Furthermore, findings also revealed a significant correlation between BDI scores and the number of previously-suppressed words recalled. These findings were obtained on both the final cued recall test and the independent test. The findings are consistent with previous findings reported in Studies 1 and 3 (Chapters 3 and 5), which also found that dysphoric individuals were recalling significantly more previously-suppressed words than non-dysphoric individuals.

6.4.2. Group differences in executive control

The hypotheses also predicted that *"participants with poor working memory capacity would recall a greater percentage of previously-suppressed words than would participants with good working memory function."* This hypothesis was supported by the results of both the final cued recall test and the independent test, which found that individuals with poor control were recalling significantly more previously-suppressed words than individuals with good control. Furthermore, findings also revealed a significant relationship between OSPAN scores and the number of previously-suppressed words recalled. These findings are consistent with Anderson and Green's (2001) executive deficit hypothesis, which suggests that unwanted memories are suppressed by engaging executive control mechanisms to prevent the unwanted thought coming to mind. Furthermore, Pearson correlations also suggest that individual differences in executive control ability correspond to differences in memory suppression.

The findings are also consistent with Brewin and Beaton (2002), who found that better performance on the OSPAN was related to having fewer intrusions in the thought suppression condition. Furthermore, the findings are consistent with previous research which has also found that participants with low working memory capacity demonstrate enhanced recall of previously-suppressed material (Engle, 2002; Rosen & Engle, 1998). Taken together, these findings suggest that natural variations in cognitive control may explain why some people are less able than others to control intrusive thoughts.

6.4.3. Intentional forgetting in the non-dysphoric good WMF group

The hypothesis predicted that *"the non-dysphoric group with good working memory function would be the only group to demonstrate successful suppression, whereas the dysphoric group with poor working memory capacity would demonstrate the greatest recall of previously-suppressed words."* This hypothesis was supported by the results of both the cued recall and independent tests. The findings are consistent with previous research, which has also found that non-depressed individuals with good working memory capacity are successful at suppressing unwanted memories. For example, Rosen and Engle (1998) found that individuals, who scored higher on a working memory controlled attention task, were better able to suppress unwanted information than those who scored low on the same measure.

Given that research proposes that executive control is engaged to suppress unwanted information (Anderson & Green, 2001), and working memory capacity is a good measure of executive control (Levy & Anderson, 2008), the present findings suggest that individual differences in executive control play a key role in intentional forgetting, and indicate that differences in executive control are an important element in accounting for the variability in memory suppression. Thus, people differ in their ability to suppress unwanted memories because of differences in executive control.

6.4.4. Impaired intentional forgetting by dysphoric participants with good and poor WMF

Findings that the dysphoric group with poor working memory capacity recalled the greatest number of previously-suppressed words, suggests that factors other than executive control, may contribute to impaired memory suppression in dysphoric individuals. This notion is further supported by findings that the dysphoric group with good WMF were also unsuccessful at suppression, and instead demonstrated equivalent recall of baseline and previously-suppressed words. One potential factor which may account for impaired suppression is negative mood. Numerous studies have shown that individuals experience unwanted intrusive thoughts that are similar in content to those found in clinical disorders, such as depression and PTSD (Brewin & Smart, 2005; Clark, 1992; Freeston, Ladouceur, Thibodeau & Gagnon, 1991). Furthermore, these intrusive thoughts are associated with greater negative affect (Purdon & Clark, 1993) with negative mood making it harder to suppress unwanted thoughts (Howell & Conway, 1992). Thus, it is possible that negative mood state may also contribute to impaired suppression. This is further supported by findings from the present study, which revealed that individual differences in depression correspond to differences in memory suppression.

6.4.5. The effect of practice on suppression

The hypothesis that *"forgetting would increase with the number of times a memory was previously-suppressed for the non-dysphoric group with good WMF on the* *independent test"* was not supported by the results of the present study. Rather, the findings were consistent with those obtained in Study 2, and suggest that forgetting does not increase with the number of times a memory is suppressed.

6.4.6. Enhanced recall of mood-congruent material in dysphoria

Findings revealed that dysphoric participants with both good and poor WMF were recalling significantly more depression-relevant respond and previously-suppressed words in the independent test. These findings are consistent with those obtained in Study 3, which also found that dysphoric individuals demonstrated enhanced memory for depression-relevant words. Furthermore, the findings are also consistent with research which has found that depressed individuals exhibit a bias for sad stimuli (Bellew & Hill, 1990; Watkins, Mathews, Williamson & Fuller, 1992), suggesting that enhanced processing biases for negative information are specific to depression-relevant material.

6.4.7. Methodological considerations

It is important to note that research suggests that performance on the OSPAN task is dependent upon executive control (Rosen & Engle, 1998). This is consistent with the findings of the present study in which OSPAN appears to engage executive control. However, it is possible that OSPAN could more strongly engage in executive control. In the present study participants had unlimited time to complete the mathematical equations. Research suggests that executive control demands increase when participants have less time to solve the equations and memorise the words (Barrouillet et al, 2007). Therefore, future research could provide participants with a time limit to complete the mathematical equations and examine the effects of an even greater demand on executive control on suppression.

Furthermore, it is also noteworthy that all the participants in the present study were presented with the OSPAN task and were subsequently given the forgetting task. Although participants were not given any feedback in regards to their performance on the OSPAN task, it is still possible that participants may have been aware if they responded incorrectly on any mathematical equations. Furthermore, it is also possible that poor memory for words in the recall phase of OSPAN, may have had a detrimental effect on participants' performance on the subsequent forgetting task. Therefore, future research should counterbalance presentation of the OSPAN and forgetting task to eliminate this confound.

Although the present findings suggest that poor working memory capacity is related to impaired intentional forgetting, it is possible that other mental events associated with poor working memory capacity may adversely affect intentional forgetting, and thus be responsible for impaired suppression. For example, research has found that individuals with higher levels of intrusive and avoidant thinking demonstrate poor WMF (Klein & Boals, 2001). Therefore, it is possible that an intrusive and avoidant thinking style may be responsible for impaired suppression. Future research could investigate the impact of this factor by looking at intentional forgetting in individuals with good and poor WMF, with and without an intrusive and avoidant thinking style.

6.4.8. Summary

Taken together, the findings suggest that individual differences in the ability to suppress unwanted memories can to some degree, be explained by differences in executive control. Indeed, results indicate that executive control deficits, as measured by OSPAN cause deficiencies in memory suppression. However, the fact that dysphoric participants with good WMF also showed impaired forgetting, suggests that factors, other than poor control, may also contribute to memory suppression. However, it is unclear whether it is depressed mood state or another symptom of dysphoria which is responsible for the impaired forgetting effects observed.

CHAPTER SEVEN

Investigating the role of induced mood on intentional forgetting of emotional words.

7.1. Introduction

7.1.1. Background

Study 1 found that dysphoric individuals were impaired at intentionally forgetting emotional material. Study 2, using a thought substitution strategy, found that dysphoric individuals were successful at intentionally forgetting neutral material. However, Studies 3 and 4 found that even with the use of a thought substitution strategy, dysphoric individuals were impaired at forgetting emotional words. In order to determine whether impaired forgetting was due to poor executive control, Study 4 examined the role of executive control on intentional forgetting, and found that the non-dysphoric group with good WM function were the only group to demonstrate successful suppression, as they recalled significantly fewer of the previously-suppressed words than baseline words (presented only at the learning phase). These findings suggest that individual differences in the ability to suppress unwanted memories can to some degree, be explained by differences in WM function. However, the fact that dysphoric individuals were significantly worse at suppressing than their non-dysphoric counterparts, even when they had good executive control suggests that other factors may also contribute to memory suppression. Furthermore, the fact that dysphoric individuals with good executive control demonstrated impaired forgetting, suggests that the presence of dysphoric mood state may undermine the effectiveness of thought suppression efforts. Thus, suppressing emotional material in the midst of a dysphoric mood may heighten subsequent accessibility of the to-be-forgotten material.

This notion is consistent with research examining the effects of negative mood on suppression, which has found that an increased number of intrusions during thought suppression are associated with greater negative affect (Freeston, Ladouceur, Thibodeau & Gagnon, 1992; Purdon & Clark, 1993). These studies reported that negative mood appeared to make it more difficult for participants to suppress unwanted thoughts (see Chapter 1, Section 1.7.6, page 27). For example, Beevers and Meyer (2008) examined suppression of negative thoughts in individuals that had undergone a mood induction, to produce either a negative or neutral mood. The study involved participants being instructed to either suppress negative thoughts during a writing task or were given no suppression instructions during the task. The authors found that individuals in a negative mood that were given suppression instructions, recalled significantly more negative thoughts than did participants in a neutral mood and participants given no suppression instructions. These findings suggest that attempts to suppress negative thoughts whilst in a negative mood heighten accessibility of the to-be-suppressed thoughts.

Furthermore, a recent study by Minnema and Knowlton (2008) looked at forgetting of emotional material in healthy non-depressed individuals. The study used a directed forgetting list method paradigm, and found that participants with higher negative mood ratings on the Positive Affect/Negative Affect Scale (PANAS) exhibited less directed forgetting of negative, rather than positive or neutral words. These findings suggest that negative mood may contribute to difficulty in inhibiting negative material. Furthermore, the findings suggest that negative mood may attenuate directed forgetting effects for negative material.

Taken together, the above findings may help explain why depressed and dysphoric individuals are impaired in their ability to suppress thoughts (Wenzlaff, Wegner & Roper, 1988), as negative mood state may have a detrimental effect on an individual's ability to suppress irrelevant information, which may be responsible for impaired forgetting. However, it is important to note that the previous study (Study 4), as well as Hertel and Gerstle's (2003) study, compared sub-clinical participants who reported naturally occurring elevations in depressed mood with non-dysphoric healthy participants. It is possible that individuals may exhibit elevated scores on depression inventories for a number of different reasons (Vrendenberg, Flett & Krames, 1993), therefore any observed effects on memory might not be attributable to the mood of the individual per se, but to some other factor. Thus, it is difficult to determine whether the observed group differences in intentional forgetting are associated with mood states, or with group differences in more enduring personality traits.

One way to address this issue would be to investigate intentional forgetting of emotional words in healthy individuals (screened for past and/or present depression), who have undergone either, a positive or negative mood induction. If the previous findings of impaired intentional forgetting in dysphoria are due to differences in mood, then it would be expected that participants in an induced negative mood would show impaired suppression.

7.1.2. Research overview

The primary objective of the present study was to use a mood induction technique to investigate whether changes in mood state would alter participant's ability to intentionally forget information. As no study has been carried out looking at intentional forgetting using a specific thought substitution strategy and experimentally induced mood, the proposed study represented an important addition to the current literature on intentional forgetting.

50 non-dysphoric, non anxious and never depressed participants took part in the study. In order to ensure that there were no group differences on the forgetting task prior to the MI procedure, all participants underwent the experimental task from Study 4 (Chapter 6, Section 6.2.4, page 158). 25 participants were pseudo randomly assigned to undergo a positive MI, and 25 participants were pseudo randomly assigned to undergo a negative MI, using autobiographical memory focus reinforced with happy or sad music, respectively. Following a mood check to confirm the effectiveness of the MI procedure, participants were given a parallel version of the forgetting task. The protocol for the forgetting task remained the same as above, but differed only in terms of the words that were presented.

7.1.3. Experimental hypotheses

1. In line with findings obtained by Beevers and Meyer (2008), it was expected that participants that undergo a negative mood induction would recall significantly more of the previously-suppressed words than would participants that undergo a positive mood induction. This pattern would only be observed in the think-no-think task completed after the MI procedure.

2. In line with findings obtained by Minnema and Knowlton (2008), it was expected that participants that undergo a negative mood induction would recall significantly more depression-relevant than positive previously-suppressed words, whereas participants that undergo a positive mood induction would recall significantly more positive than depression-relevant previously-suppressed words.

7.2. Method

7.2.1. Design

A 2 (group) x 2 (valence for suppression) x 3 (repetitions) mixed factorial design was used. The between-group factors were group and valence for suppression, and the within-group factors were instruction and repetition. The independent variables were group (positive vs. negative induced mood state), valence for suppression (positive vs. depression-relevant), and the number of repetitions (0, 2, 8). The dependent variables were the mean percentage of targets recalled on the cued recall test and the mean percentage of words correctly recalled on the independent test.

7.2.2. Participants

64 participants were selected to take part in the study, according to the inclusion and exclusion criteria cited in Chapter 2 (Sections 2.4.2 & 2.4.3, pages 40-42). These participants completed the Beck Depression Inventory II (BDI-II) on two occasions to determine group allocation (median number of days between the two tests = 10). Participants were asked to take part in the study based upon their mean BDI scores. It was important that prior to the MI procedure participants were equivalent in mood to the non-dysphoric control groups of the previous studies, therefore participants with BDI scores greater than 5 were excluded from participating in the study. 14

participants (4M, 10F) were excluded based on this criterion. The remaining 50 participants were included in the current study and were pseudo randomly allocated to the positive or negative MI procedure. Thus, 25 participants (9M, 16F; mean age = 21.56; SD = 3.1) underwent a positive mood induction (MI) and 25 participants (10M, 15F; mean age = 20.48; SD = 2.3) underwent a negative MI. Furthermore, in each group, half the participants were pseudo randomly assigned to suppress positive words associated with neutral cues, and respond to depression-relevant words associated with neutral cues, whilst the other half of the group suppressed depression-relevant words associated with neutral cues, and responded to positive words associated with neutral cues.

7.2.3. Materials

7.2.3.1. Word Pairs

Sixty adjective noun pairs were used in the present study. Thirty six adjective noun pairs previously compiled for Study 3 (see Chapter 5, Section 5.2.3.1, page 124) were used. However, the remaining twenty four adjective-noun pairs were drawn from a larger set of words compiled during a second pilot study by the author (see Appendix XV for a full outline of the pilot study). The pilot study involved pairing thirty cue words with positive, depression-relevant and neutral adjectives (positive and depression-relevant words were taken from John, 1988), to create ninety word pairs.

This pilot study followed the exact same procedure as the earlier pilot study discussed in Study 3 (for more information on the procedure of the pilot study see Chapter 5, Section 5.2.3.1, page 124), but differed only in terms of the words that were used. 40 participants (9M, 31F; mean age = 20.73; SD = 1.4) were asked to rate how emotional the word pairs were. They were subsequently asked to learn a series of word pairs. Memory for the word pairs was assessed using a cued recall test and an independent test.

Results of the pilot study revealed that participants rated positive word pairs (M = 3.92, SD = 0.3) as being significantly more positive than neutral word pairs (M = 3.13, SD = 0.4; $t(39)$ =7.6 $p < 0.001$), whilst depression-relevant word pairs (M = 1.91, SD = 0.3) were rated as being significantly more negative than neutral word pairs, $t(39)$ =11.3 $p < 0.001$. The cued recall test revealed that neutral word pairs (M = 51%, SD 0.2) were better remembered than both positive (M = 39%, SD = 0.2; $t(39)$ =3.0 $p < 0.001$) and depression-relevant word pairs (M = 32%, SD = 0.1; $t(39)$ =4.7 $p < 0.001$). However, there were no significant differences in the recall of positive and depression-relevant word pairs, $p > 0.05$. Individual chi-squares looking at the relationship between recall of positive and depression-relevant word pairs, showed that positive and depression-relevant word pairs were equally well remembered for twenty four cue words.

However, for 6 cue words, participants recalled significantly more of one valenced associated target word than the other. The results of the independent test revealed an identical pattern of memory for the word pairs, with participants recalling significantly more neutral (M = 53%, SD = 0.2) than positive (M = 33%, SD = 0.1; $t(39)$ = 6.0 $p < 0.001$) or depression relevant words (M = 32%, SD = 0.1; $t(39)$ = 7.1 $p < 0.001$). Furthermore, individual chi-squares looking at the relationship between recall of positive and depression-relevant word pairs, showed that positive and depression-relevant word pairs were equally well remembered for all thirty cue words. The 6 cues which revealed significant differences between positive and depression-relevant words in the cued recall test were excluded and only the remaining twenty four cues were used as material for Study 5. A full outline of the pilot study including full details of the procedure and the analysis conducted can be found in Appendix XV.

Each think-no think task involved one list of the thirty adjective noun pairs. Each word list was divided into 6 sets of 5 nouns each, with each noun being accompanied by either a positive adjective or a depression-relevant adjective (e.g. '*helpless* *baby*', '*happy* *memory*'). This resulted in three sets of words paired with positive adjectives and three sets of words paired with depression-relevant adjectives. These pairings were fully counterbalanced. Furthermore, 20 additional nouns accompanied by neutral adjectives were also used. 10 of these words were used for the first forgetting task and the remaining 10 were used for the second forgetting task. For the suppression condition new words (neutral) associated with the cue words were used (e.g. '*big* baby', '*lasting* memory') (see Appendix XIX for word pairs).

7.2.3.2. Assessment of Mood and General Intellectual Ability

The Beck Depression Inventory-II (BDI-II; Beck et al, 1996) was used to screen out participants with elevated levels of depression. The Spielberger State-Trait Anxiety Inventory (STAI; Spielberger et al, 1983) was used to control for anxiety. Visual Analogue Scales (VAS) were used to measure changes in current mood state. The National Adult Reading Test (NART; Nelson & Williamson, 1991) was used to measure participant's general intellectual function. (See Chapter 2, Sections 2.2 & 2.3, pages 33-39) for psychometric properties of the mood questionnaires and the NART and details of their administration)

7.2.3.3. Mood Induction Procedure

Depressed and happy moods were induced using autobiographical memory focus (Ridout, Noreen & Johal, 2009), with a musical mood induction playing in the background (Clark & Teasdale, 1985). The autobiographical memory mood induction requires participants to come on the day of testing, prepared with a self-generated memory of an event from their past, when they were very sad and one when they were very happy. Whilst listening to mood-congruent music, participants were given four minutes to think about the relevant memory (depending on condition) in as much detail as possible, focusing on how they felt at the time. The purpose of these instructions was to maximise participants' subjective experience of sadness or happiness. In order to check the effectiveness of the MI, participants were given the VAS to complete. To induce a depressed mood, participants thought about the sad memory whilst listening to Prokofiev's 'Russia under the Mongolian Yoke', recorded at half-speed (Au Yeung, Dalgleish, Golden & Schartau, 2006; Clark & Teasdale, 1985), and to induce a positive mood, participants thought about a happy memory whilst listening to an excerpt of Beethoven's Moonlight Sonata no. 2 (Ridout et al, 2009). This procedure been shown to generate large increases in depressed mood that can be reproduced over multiple occasions (Eich, Macaulay & Ryan, 1994; Hernandez, Vander Wal & Spring, 2003; Ridout et al, 2009).

7.2.4. Procedure

The study involved two testing sessions. In the first session, participants were given the screening questionnaire (see Appendix I for the screening questionnaire), BDI and trait scale of the STAI (STAI-T) to fill in. In the second testing session participants were asked to complete the state scale of the STAI (STAI-S), BDI and NART.

Participants were also instructed to complete the first VAS. Participants were then given the forgetting task. The procedure for the task was exactly the same as Study 4 (see Chapter 6, Section 6.2.4, page 158). However, the only notable difference is that 30 word pairs were presented, instead of 36. This resulted in 164 trials presented in the think/no-think phase of the task.

On completion of the task, participants underwent the MI. In order to confirm the effectiveness of the MI procedure, participants were subsequently asked to complete another VAS. They were then given the second think/no-think task to complete. This task used exactly the same protocol as the forgetting task above, but differed in the words that were presented. Word list presentation was fully counterbalanced so that half the participants were pseudo randomly assigned word list 1 in the first forgetting task, whilst the other half of the participants were assigned word list 2 in the first forgetting task.

In order to ensure that the induced mood state persisted throughout the course of the think/no-think task, on its completion participants were asked to complete another VAS. At the end of the experiment participants were debriefed and those participants that had undergone a negative MI underwent a positive MI, until their mood was restored to a normal contented state. To ensure the positive MI was successful a final VAS was completed.

7.2.5. Scoring and Data Analysis

To determine whether there were any group differences, participants' demographic characteristics were analysed. Age was analysed using a one-way between groups univariate analysis of variance. In addition, gender, marital status, occupation and education (i.e. level of education reached) were analysed using chi-square. Furthermore, to determine any group differences in neuropsychological functioning, National Adult Reading Test (NART) error scores were analysed using a one-way between groups univariate analysis of variance. In addition, data obtained on self-reported mood measures of BDI and STAI were analysed using a one-way between-groups multivariate analysis of variance.

To determine the effectiveness of the mood induction upon self-reported mood, participant scores were analysed on each measure of the VAS (sadness, anxiety and fatigue) using a 2 (group) x 3 (time of rating) mixed design ANOVA. The between-subject factor was group (positive mood induction vs. negative mood induction) and the within-subject factor was the time of rating (before mood induction vs. after mood induction vs. after task and mood induction)

The principle dependent measures of interest were the percentage of words correctly recalled on the cued recall test and the independent test on the forgetting task prior to and after the mood induction. This was assessed using a 2 (group) x 2 (valence) x 2 (instruction) x 3 (repetition) mixed design ANOVA. Between-subject factors were group (positive mood induction vs. negative mood induction) and valence of cues for suppression (positive vs. depression relevant) and within-subject factors were the type of instruction during the suppression phase (suppress vs. respond) and the number of times the cues were presented (0, 2 or 8). The significance was set at the 5% level. Follow up analyses were conducted using one-way repeated measures ANOVA, independent and paired samples t-tests. Alpha levels for pairwise comparisons were adjusted in accordance to the Bonferroni correction method (see Keppel & Wickens, 2004).

7.3. Results

7.3.1. Participant Characteristics

Analysis of the participants' characteristics (see Table 7.1) demonstrated that the positive and negative mood induction groups did not differ significantly with respect to age, occupation, marital status, education or gender. The two groups also did not differ in general intellectual ability (estimated from the NART error score), $F < 1$. Furthermore, the two groups did not differ significantly in terms of their depression (BDI-II) or state and trait anxiety (STAI-S & STAI-T) scores; all tests $F < 1$.

<u>Table 7.1-</u> Mean performance indices and p values for general characteristics, the National Adult Reading Test (NART) and mood measures as a function of participant group ***(standard deviations are presented in parentheses).***

	Positive MI (n = 25)	Negative MI (n = 25)	p- value
Age	21.56 (3.1)	20.48 (2.3)	$p > 0.05$
Gender	9M; 16F	10M; 15F	$p > 0.05$
NART Errors	14.76 (3.8)	15.12 (3.8)	$p > 0.05$
STAI-S	32.80 (11.2)	35.32 (9.8)	$p > 0.05$
STAI-T	33.08 (11.2)	37.36 (9.0)	$p > 0.05$
BDI (1)	3.24 (1.9)	3.64 (1.3)	$p > 0.05$
BDI (2)	3.40 (1.9)	3.84 (1.7)	$p > 0.05$

M = Male F = Female; NART = National Adult Reading Test; STAI-S = State anxiety scale; STAI-T = Trait anxiety scale; BDI (1) = First measure of Beck Depression Inventory; BDI (2) = Second measure of Beck Depression Inventory

7.3.2. Effectiveness of Mood Induction

Analysis of the VAS scores revealed that there was a significant time x group (i.e. mood induction (MI)) interaction for sadness, $F(1, 49) = 80.5$ $p < 0.05$. Subsequent analysis revealed that the positive (M = 22.70, SD = 12.0) and negative MI groups (M = 20.88, SD = 11.7) did not differ on their baseline sadness, $t(24) = 0.5$ $p > 0.02$. However, post MI, the negative MI group scored significantly higher on sadness (M = 56.25, SD = 16.7) than did the positive group (M = 9.86, SD = 8.3); $t(24) = 12.4$ $p < 0.02$. Furthermore, this difference was still evident at the end of the second forgetting task, with the negative MI group (M = 48.04, SD = 20.8) scoring significantly higher on sadness than the positive group (M = 11.84, SD = 12.6); $t(24) = 7.4$ $p < 0.02$.

Analysis of the VAS also revealed that there was a significant time x group interaction for anxiety, $F(1, 49) = 20.3$ $p < 0.05$. Subsequent analysis revealed that the positive ($M = 26.46$, $SD = 22.6$) and negative ($M = 25.66$, $SD = 14.1$) groups did not differ on their baseline anxiety, $t(24) = 0.2$ $p > 0.02$. However, post MI, the negative group scored significantly higher on anxiety ($M = 46.98$, $SD = 18.8$) than did the positive group ($M = 17.28$, $SD = 13.7$); $t(24) = 6.4$ $p < 0.02$. Furthermore, this difference was still evident at the end of the second forgetting task, with the negative group ($M = 49.42$, $SD = 18.7$) scoring significantly higher on anxiety than the positive group ($M = 19.77$, $SD = 13.9$); $t(24) = 6.4$ $p < 0.02$.

However no significant main effects of time ($F(1, 49) = 1.4$ $p > 0.05$) or group ($F(1, 49) = 0.002$ $p > 0.05$) or interaction effects of time and group ($F(1, 49) = 1.4$ $p > 0.05$) were found for the measure of fatigue.

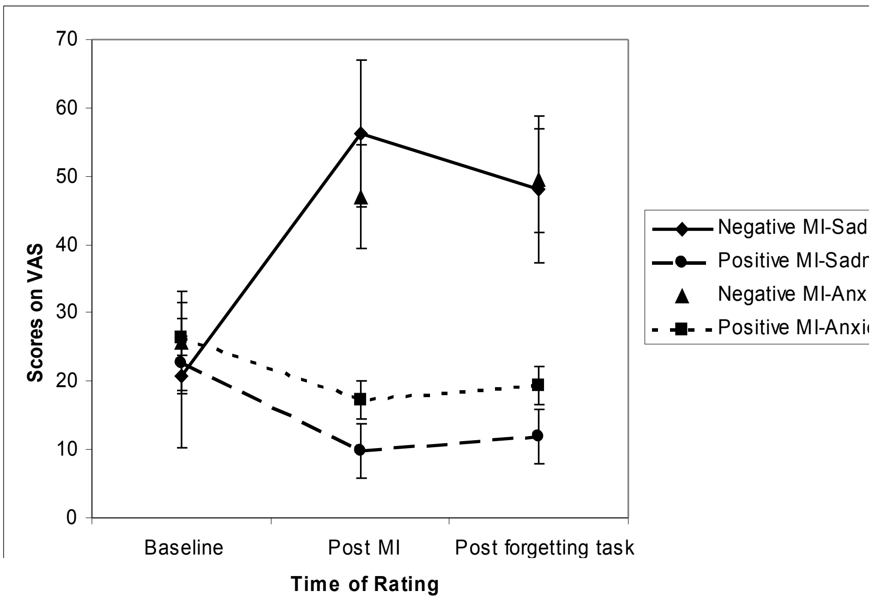

Figure 7.1. Illustrating the effectiveness of MI on the measures of sadness and anxiety for positive and negative MI groups (error bars represent ± one standard error of the mean).

7.3.3. Memory for paired associates prior to mood induction

7.3.3.1. Cued recall test

Findings revealed that there was no main effect of group ($F(1, 49) = 1.0$ $p > 0.05$) and group did not enter into any significant interactions; group x instruction x repetition $F(1, 49) = 0.2$ $p > 0.05$; group x instruction x valence $F(1, 49) = 2.7$ $p > 0.05$ However, results did reveal a significant instruction x repetition interaction $F(1, 49) = 43.2$ $p < 0.05$. Subsequent analyses revealed that participants recalled significantly fewer previously-suppressed words presented two times ($M = 29.20$, $SD = 25.9$) than baseline ($M = 40.0$, $SD = 24.9$); $t(49) = 2.2$ $p < 0.03$. Furthermore, participants also recalled significantly fewer previously-suppressed words presented eight times $M = 27.20$, $SD = 25.5$) than baseline, $t(49) = 2.8$ $p < 0.03$. Taken together, these findings suggest that participants were successful at forgetting previously-suppressed words.

7.3.3.2. Independent test

Findings revealed that there was no main effect of group ($F(1, 49) = 0.3$ $p > 0.05$) or any group interactions; group x instruction x repetition $F(1, 49) = 0.3$ $p > 0.05$; group x valence $F(1, 49) = 0.3$ $p > 0.05$. However, results did reveal a significant instruction x repetition interaction $F(1, 49) = 50.8$ $p < 0.05$, with subsequent analyses revealing that participants recalled significantly fewer previously-suppressed words presented two times ($M = 38.0$, $SD = 19.9$) than baseline ($M = 53.0$, $SD = 22.7$); $t(49) = 3.1$ $p < 0.03$. Furthermore, participants also recalled significantly fewer previously-suppressed words presented eight times $M = 33.60$, $SD = 21.5$) than baseline, $t(49) = 4.1$ $p < 0.03$. Taken together, these findings suggest that participants were successfully inhibiting previously-suppressed words.

7.3.4. Memory for paired associates after mood induction

<u>7.3.4.1. Cued recall test</u>

The results revealed a significant overall main effect of instruction, $F(1, 49) = 54.6$ $p < 0.05$, with participants recalling significantly more respond ($M = 71.60$, $SD = 13.7$) than previously-suppressed words ($M = 50.27$, $SD = 17.5$). The results also revealed an overall main effect of group, $F(1, 49) = 14.3$ $p < 0.05$, with the negative MI group ($M = 65.87$, $SD = 9.8$) recalling significantly more words than the positive MI group ($M = 56.0$, $SD = 10.3$). Furthermore, an overall main effect of repetition was also found, $F(1, 49) = 43.2$ $p < 0.05$, with subsequent analyses revealing that participants recalled significantly more words presented two ($M = 62.40$, $SD = 16.1$) and eight times ($M = 71.80$, $SD = 17.9$) than baseline ($M = 48.40$, $SD = 16.0$); 2 times $t(49) = 5.0$ $p < 0.02$; 8 times $t(49) = 6.9$ $p < 0.02$. Moreover, participants also recalled significantly more words presented eight than two times, $t(49) = 3.6$ $p < 0.02$. However, results failed to find an overall main effect of valence for suppression, $F < 1$.

It was predicted that *"participants that undergo a negative mood induction would recall significantly more of the previously-suppressed words than would participants that undergo a positive mood induction."* In line with this prediction results revealed a significant instruction x group interaction, $F(1, 49) = 4.7$ $p < 0.05$. Further analyses revealed that although there was no significant difference in the recall of respond words between the positive ($M = 69.87$, $SD = 13.6$) and negative MI groups ($M = 73.33$, $SD = 13.9$); $t(24) = 0.9$ $p > 0.03$, participants in the negative MI group ($M = 58.40$, $SD = 12.1$) recalled significantly more previously-suppressed words than did participants in the positive MI group (M = 42.13, SD = 18.4); t(24) = 3.7 p < 0.03 (see Figure 7.2).

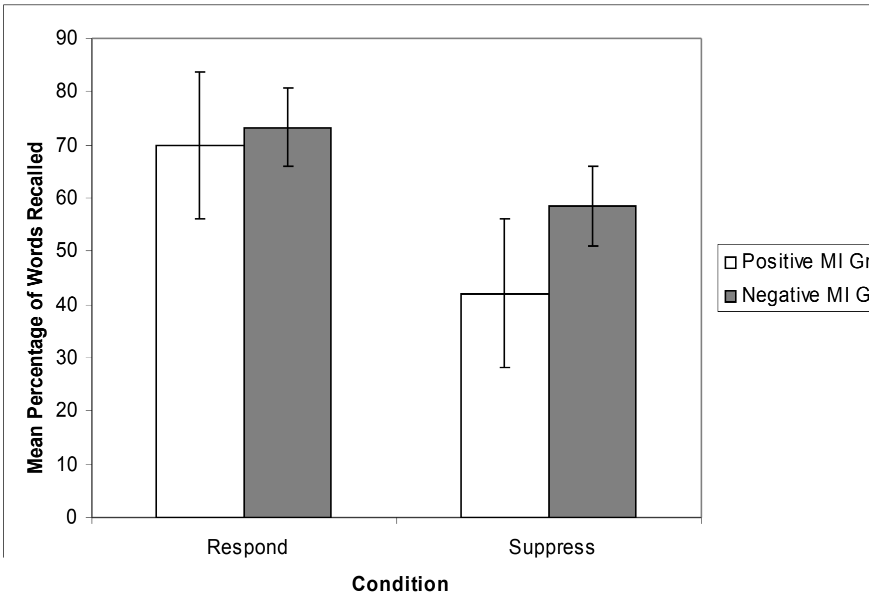

Figure 7.2. Mean percentage of respond and previously-suppressed recalled by the two MI groups on the final cued recall test (error bars represent ± one standard error of the mean).

It is important to note that results also revealed a significant group x instruction x repetition interaction, F(1, 49) = 9.8 p < 0.05. Subsequent analyses revealed that the positive MI group recalled significantly fewer of the words that had been suppressed twice than words that had not been suppressed, t(24) = 2.2 p < 0.01. Likewise, they recalled significantly fewer words that had been suppressed eight times than words that had not been suppressed, t(24) = 2.9 p < 0.01. Conversely, the negative MI group recalled significantly more of the words that had been suppressed eight times than words that had not been suppressed, t(24) = 3.5 p < 0.01. Similarly, they recalled more of the words that had been suppressed twice than words that had not been suppressed. However, this difference failed to reach significance t(24) = 1.3 p = 0.22.

Taken together these findings demonstrate that the positive MI group were successful at suppression, however the negative group were significantly impaired at forgetting emotional material (see Figure 7.3)

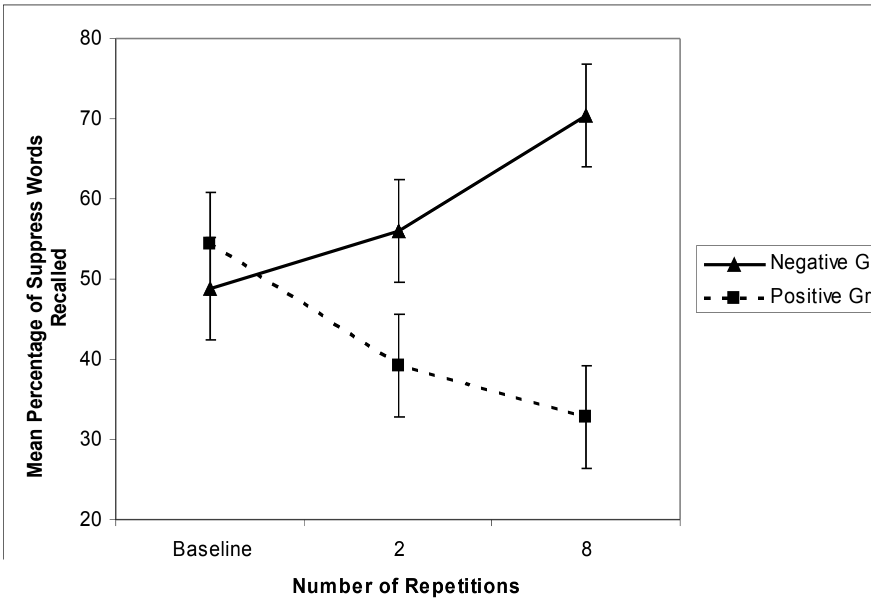

Figure 7.3. Mean percentage of previously-suppressed words recalled by the two MI groups on the final cued recall test as a function of the number of times the words were suppressed during training (error bars represent ± one standard error of the mean).

It was also predicted that *"participants that undergo a negative mood induction would recall significantly more depression-relevant than positive previously-suppressed words, whereas participants that undergo a positive mood induction would recall significantly more positive than depression-relevant previously-suppressed words."* Consistent with this prediction, results revealed a significant group x valence x repetition interaction for previously-suppressed words recalled, $F(1, 49) = 13.8$ $p < 0.05$. Subsequent pairwise analysis revealed that there were no overall significant differences in the recall of positive and depression-relevant previously-suppressed words recalled by the positive MI group, $p > 0.01$. However, the positive MI group recalled significantly more positive than depression-relevant previously-suppressed words presented eight times, $t(23) = 4.6$ $p < 0.01$. Furthermore, although the positive MI group recalled more positive than depression-relevant previously-suppressed words presented twice, this effect just failed to reach significance, $t(23) = 1.9$ $p = 0.07$ (see Figure 7.4).

Subsequent pairwise analysis revealed that there were no overall significant differences in the recall of positive and depression-relevant previously-suppressed words recalled by the negative MI group, $p > 0.01$. Furthermore, there was also no significant differences in the recall of positive and depression-relevant previously-suppressed words presented two times, $t(23) = 0.9$ $p > 0.01$. However, the negative MI group recalled significantly more depression-relevant than positive previously-suppressed words presented eight times, $t(23) = 5.2$ $p < 0.01$ (see Figure 7.5). There were however, no main effects of valence or group or any interaction effects for the recall of respond words; all tests $p > 0.01$.

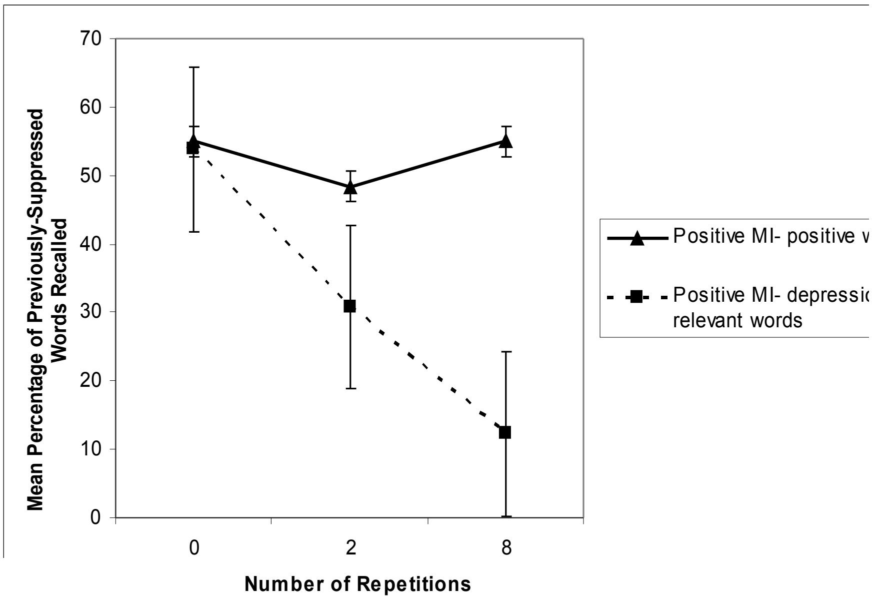

Figure 7.4. Mean percentage of positive and depression-relevant previously-suppressed words recalled by the positive MI group on the final cued recall test as a function of the number of cue presentations (error bars represent ± one standard error of the mean).

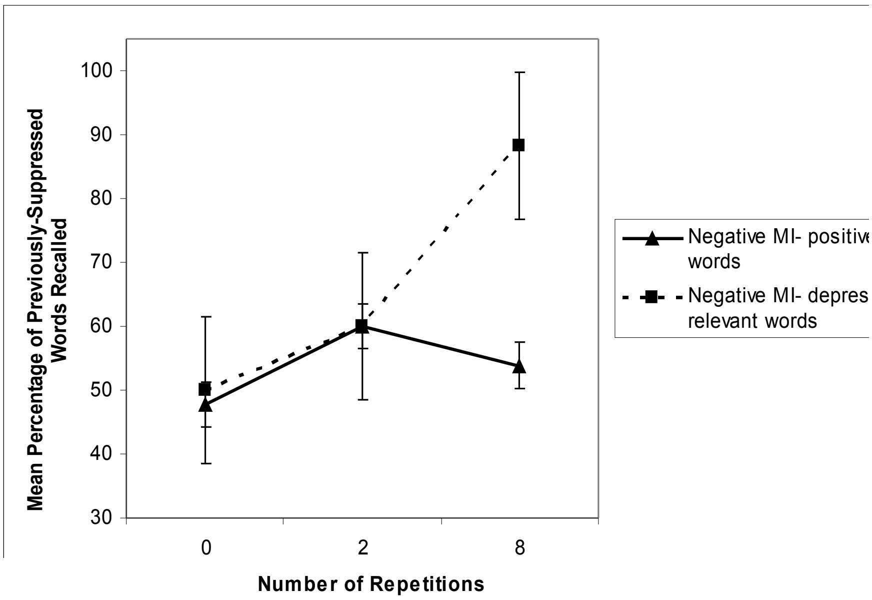

Figure 7.5. Mean percentage of positive and depression-relevant previously-suppressed words recalled by the negative MI group on the final cued recall test as a function of the number of cue presentations (error bars represent ± one standard error of the mean).

7.3.4.2. Independent test

The results revealed an overall main effect of instruction, $F(1, 49) = 42.5$ $p < 0.05$, with participants recalling significantly more respond ($M = 69.60$, $SD = 12.9$) than previously-suppressed words ($M = 54.0$, $SD = 19.0$). The results also revealed an overall main effect of group, $F(1, 49) = 8.2$ $p < 0.05$, with the negative MI group ($M = 66.53$, $SD = 13.9$) recalling significantly more words than the positive MI group ($M = 57.07$, $SD = 10.1$). Furthermore, an overall main effect of repetition was also found, $F(1, 49) = 14.8$ $p < 0.05$, with subsequent analyses revealing that participants recalled significantly more words presented two ($M = 62.40$, $SD = 13.8$) and eight times ($M = 69.20$, $SD = 18.4$) than baseline ($M = 53.80$, $SD = 22.1$); 2 times $t(49) = 2.6$ $p < 0.02$; 8 times $t(49) = 4.1$ $p < 0.02$. Moreover, participants also recalled significantly more words presented eight than two times, $t(49) = 2.9$ $p < 0.02$. However, no main effect of valence for suppression was found, $F < 1$.

It was predicted that *"participants that undergo a negative mood induction would recall significantly more of the previously-suppressed words than would participants that undergo a positive mood induction."* In line with this prediction results revealed a significant instruction x group interaction, $F(1, 49) = 19.8$ $p < 0.05$. Pairwise comparisons revealed that although there was no significant difference in the recall of respond words between the positive MI ($M = 70.13$, $SD = 11.7$) and the negative MI group ($M = 69.07$, $SD = 14.3$); $t(24) = 0.3$ $p > 0.03$, participants in the negative MI group ($M = 64.0$, $SD = 18.3$) recalled significantly more previously-suppressed words than participants in the positive MI group ($M = 44.0$, $SD = 14.0$); $t(24) = 4.3$ $p < 0.03$ (see Figure 7.6).

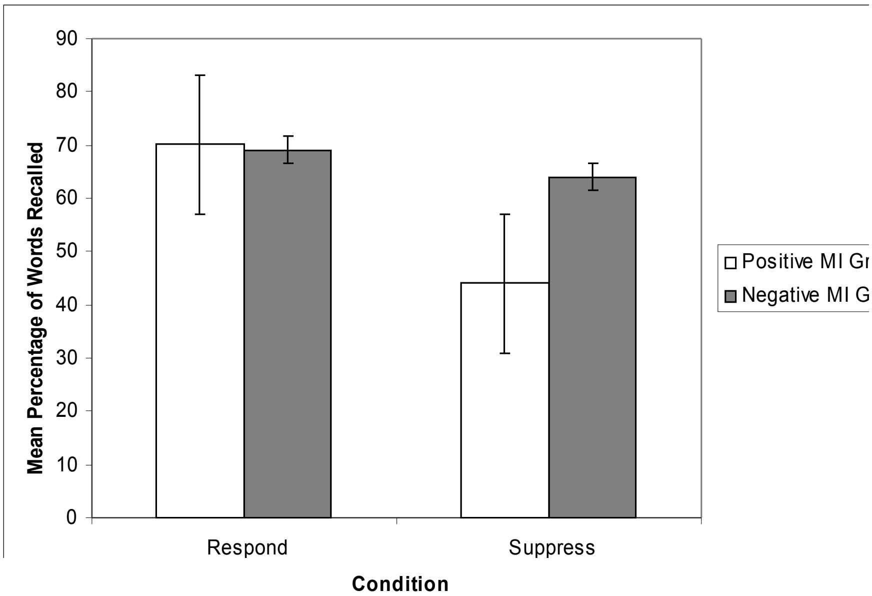

Figure 7.6. Mean percentage of respond and previously-suppressed recalled by the two MI groups on the independent test (error bars represent ± one standard error of the mean).

It is important to note that results also revealed a significant group x instruction x repetition interaction, $F(1, 49) = 17.0$ $p < 0.05$. Subsequent analyses revealed that the positive MI group recalled significantly fewer words that had been suppressed twice than words that had not been suppressed; $t = 4.9$ $p < 0.01$. Furthermore they recalled significantly fewer of the words that had been suppressed eight times than words that had not been suppressed; $t = 8.1$ $p < 0.01$. Conversely, the negative MI group recalled significantly more of the words that had been suppressed twice and eight times than words that had not been suppressed; $t = 2.9$ $p < 0.01$ and $t = 3.2$ $p < 0.01$ respectively (see Figure 7.7). Taken together these findings demonstrate that the positive group were successful at suppression, whereas the negative group were significantly impaired at forgetting.

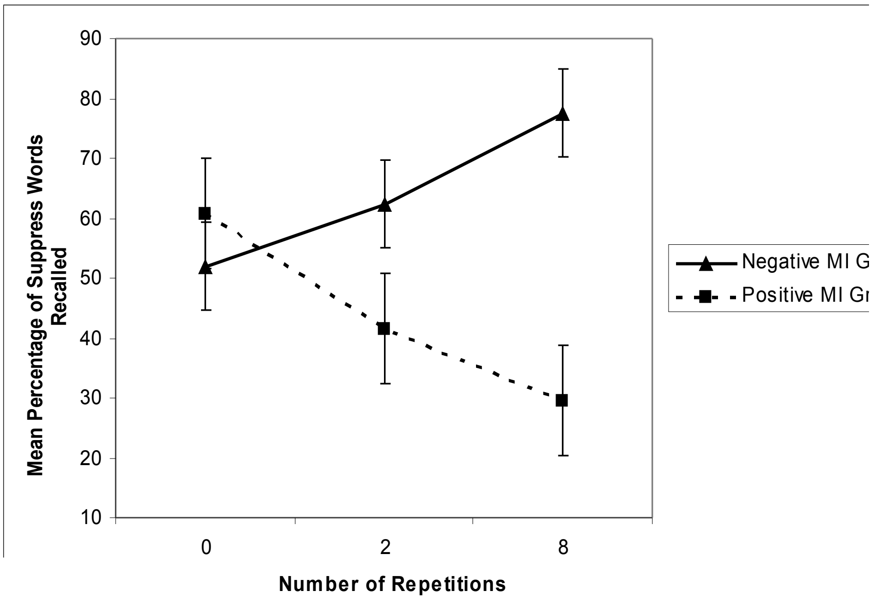

Figure 7.7. Illustrating group differences in mean percentage of targets recalled as a function of the number of cue presentations for suppression on the independent test (error bars represent ± one standard error of the mean).

It was also predicted that *"participants that undergo a negative mood induction would recall significantly more depression-relevant than positive previously-suppressed words, whereas participants that undergo a positive mood induction would recall significantly more positive than depression-relevant previously-suppressed words."* However, results failed to find a significant group x valence x repetition interaction for previously-suppressed words recalled, $p > 0.05$.

Interestingly, results did reveal a significant group x valence interaction for previously-suppressed words recalled, $F (1, 49) = 6.2$ $p < 0.05$. Subsequent paiwise analysis revealed that there was no significance difference between positive and negative MI groups in their recall of positive previously-suppressed words, $p > 0.03$. However, results did reveal that the negative MI group recalled significantly more depression-relevant previously-suppressed words than the positive MI group, t(23) = 8.4 p < 0.03 (see Figure 7.8).

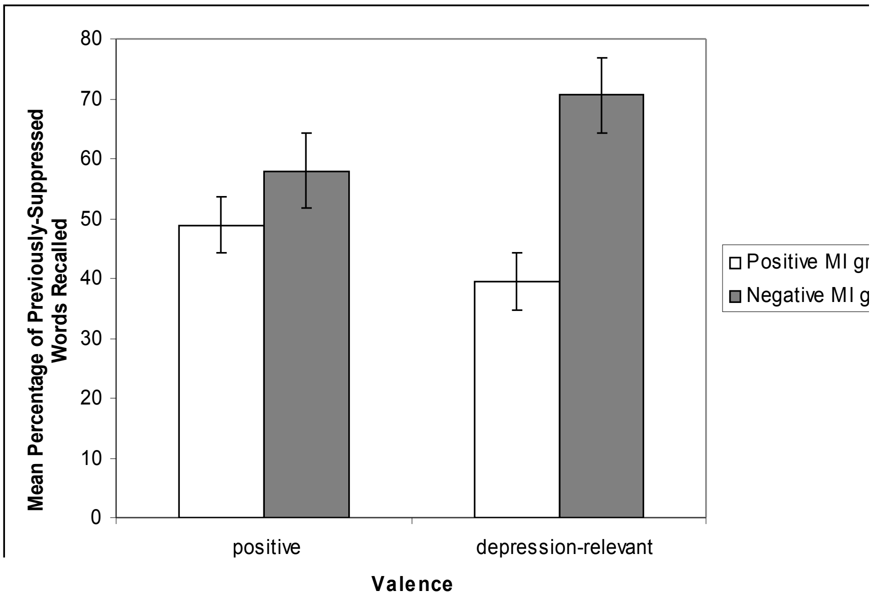

Figure 7.8. Illustrating group differences in the mean percentage of previously-suppressed words recalled as a function of word valence on the independent test (error bars represent ± one standard error of the mean).

7.3.5. Pearson correlations to investigate the differential impact of sad mood and anxiety on suppression

A paired samples t-test revealed no significant differences between the second sadness measure of VAS (after the mood induction) (M = 33.06, SD = 26.8) and the third sadness measure of VAS (after mood induction and forgetting task) (M = 29.94, SD = 25.0); p > 0.05. In order to determine whether the induced mood persisted throughout the task, a Pearson correlation was carried out between the second sadness measure of VAS and the third sadness measure of VAS, which revealed a highly statistically significant correlation between both measures of sadness on the VAS, r(50) = 0.88 p < 0.01. Subsequently a mean sadness score was calculated for the two measures, and a

Pearson correlation was carried out on the mean measure of sadness and the total number of previously-suppressed words recalled.

A paired samples t-test also revealed no significant differences between the second anxiety measure of VAS ($M = 32.13$, $SD = 22.1$) and the third anxiety measure of VAS ($M = 34.43$, $SD = 22.3$); $p > 0.05$. Furthermore, Pearson correlation revealed a highly statistically significant correlation between both measures of anxiety on the VAS, $r(50) = 0.81$ $p < 0.01$. Subsequently a mean anxiety score was calculated for the two measures and a Pearson correlation was carried out on the mean measure of anxiety and the total number of previously-suppressed words recalled.

7.3.5.1. Final cued recall test

The test revealed a significant positive correlation between mean sadness score and the number of previously-suppressed words recalled, $r(50) = 0.47$ $p < 0.01$. However, there was no significant correlation between anxiety score and the number of previously-suppressed words recalled, $r(50) = 0.24$ $p > 0.05$.

7.3.5.2. Independent test

The test revealed a significant positive correlation between mean sadness score and the number of previously-suppressed words recalled, $r(50) = 0.34$ $p < 0.05$. However, there was no significant correlation between anxiety score and the number of previously-suppressed words recalled, $r(50) = 0.21$ $p > 0.05$. Taken together, these findings suggest that impaired forgetting of previously-suppressed words is specifically related to sad mood.

7.4. Discussion

The aim of the present study was to determine if never-depressed participants in an induced sad mood would exhibit a similar impairment in intentional forgetting to participants with subclinical depression (dysphoria). To this end, two groups of never-depressed participants were allocated to two different mood induction conditions (positive vs. negative), and were assessed on the think-no think paradigm used in the previous Studies.

7.4.1. Findings prior to the mood induction task

7.4.1.1. Lack of group differences

Findings revealed that there was no significant group difference between positive and negative MI groups on the forgetting task prior to the mood induction, on both the cued recall test and the independent test. Rather, the results showed that both the positive and negative MI groups were recalling significantly less previously-suppressed words than baseline. These findings suggest that both the positive and negative MI groups were inhibiting previously-suppressed words equally well.

7.4.2. Findings after the mood induction task

7.4.2.1. Group differences in suppression

The hypothesis predicted that *"participants that undergo a negative mood induction would recall significantly more of the previously-suppressed words than would participants that undergo a positive mood induction."* This hypothesis was supported by the findings from the cued recall test, which revealed that the negative MI group recalled significantly more previously-suppressed words than the positive MI group. Furthermore, findings also revealed that although the positive MI group was successful at suppression, the negative group was impaired at forgetting previously-suppressed words. These findings are consistent with research which suggests that impaired suppression is associated with greater negative affect (Freeston, Ladouceur, Thibodeau & Gagnon, 1992; Purdon & Clark, 1993).

Furthermore, the findings are consistent with previous research looking at the effects of negative mood on suppression. For example, Beevers & Meyer (2008) found that although individuals in an induced neutral mood were recalling less negative thoughts in comparison to the control condition, individuals in an induced negative mood were recalling significantly more negative thoughts. Moreover, the findings are also in line with the previous findings obtained. For example, Study 3 found that dysphoric individuals were impaired in their ability to forget emotional previously-suppressed words. Furthermore, Study 4 also found that regardless of executive control, dysphoric individuals were impaired in their ability to intentionally forget previously-suppressed emotional words. Taken together, the current findings extend previous research and suggest that dysphoric mood state undermines the effectiveness of thought suppression efforts and attenuates directed forgetting effects.

7.4.2.2. Mood-congruent recall of to-be-suppressed words

The hypothesis also predicted that "*participants that undergo a negative mood induction would recall significantly more depression-relevant than positive previously-suppressed words, whereas participants that undergo a positive mood induction would recall significantly more positive than depression-relevant previously-suppressed words.*" Findings from the cued recall test confirmed this hypothesis with results revealing that the positive MI group recalled significantly more positive than depression-relevant previously-suppressed words and the negative MI group recalled significantly more depression-relevant than positive previously-suppressed words.

These findings are consistent with previous findings obtained by Minnema and Knowlton (2008), who also found that negative mood impaired directed forgetting of negative material, whilst forgetting of positive material remained intact. Furthermore these findings are consistent with the mood-congruency hypothesis, which suggests that affective states increase the accessibility of mood congruent material (Bower, 1981). Taken together, these findings suggest the negative MI groups' facilitated ability to recall depression-relevant material is characteristic of negative mood.

It is important to note that findings of impaired forgetting of depression-relevant material in the negative MI group are inconsistent with previous findings reported in Studies 3 and 4, which failed to find valence-specific forgetting impairments in dysphoria. Rather, the previous studies found that dysphoric individuals were recalling significantly more depression-relevant respond and previously-suppressed words.

One explanation to account for these findings may relate to differences between naturally occurring sadness and induced sad mood. It is possible that individuals that experienced an induced negative mood were able to increase cognitive effort and attempt to improve their aversive mood by recalling positive, as well as depression-relevant words. However, because the suppression condition was more cognitively demanding, it is possible that negative mood state limited the amount of cognitive capacity that was available, and coupled with the negative content of depression-relevant words, undermined intentional forgetting efforts.

Furthermore, because dysphoric individuals are plagued by persistent sad mood (Joormann, 2004) and demonstrate increased elaboration and retrieval of negative material (Mathews & McLeod, 2005), this resulted in enhanced recall of mood-congruent material (Lyubomirsky, Caldwell & Nolen-Hoeksema, 1998). Thus, dysphoria is associated with enhanced recall of depression-relevant material, rather than impaired suppression of depression-relevant material. Taken together, these findings suggest that naturally occurring sad mood and induced sad mood may exert different effects on intentional forgetting.

7.4.2.3. Successful inhibition in the positive MI group

It is important to note that similar findings were also obtained on the independent test, which suggests that participants induced with a positive mood had successfully suppressed the to-be-forgotten material. These findings are consistent with research which has found that positive mood leads to improved performance on cognitive tasks (Isen, 1999; Hirt, Melton, McDonald & Harackiewucz, 1996), with positive mood facilitating efficient and thorough processing (Phillips, Smith & Gilhooly, 2002). Moreover, the findings are also consistent with the findings obtained in Study 3, and suggest that non-dysphoric participants can strategically control and adapt their thinking patterns, using control processes to prevent the unwanted memory from entering consciousness, thus leading to successful inhibition.

7.4.2.4. Impaired inhibition in the negative MI group

Furthermore, the finding that participants in an induced negative mood recalled significantly more of the previously-suppressed words than words that had not been suppressed is consistent with research which has examined the relationship between negative mood and inhibition of emotional material. For example, Joormann (2004) using a negative priming task looked at inhibition of emotional material in dysphoric participants, and found that participants with elevated depression scores failed to inhibit emotional material. Taken together, the present study findings suggest that the inhibitory deficit commonly observed in dysphoria is related to negative mood, with inhibition hampered under conditions of increased negative emotional state.

7.4.3. Methodological Considerations

The current study has a number of limitations. Firstly, the reported changes in mood state after the administration of the mood induction may have been influenced by demand characteristics (Polivy & Doyle, 1980). The mood induction procedure and the VAS scale were apparent in their aims. Therefore, it is plausible that participants could have rated their mood in line with what they thought was expected of them. However, it is important to note that the present study did use reliable methods of mood induction, which have robustly been found to induce moods (Liotti et al, 2002; Ridout, Noreen & Johal, 2009). Furthermore, research has found evidence of mood related changes in cortical activity using this method (Liotti et al., 2000; Liotti et al, 2002), providing support that autobiographical memory focus leads to valid changes in mood.

It is also conceivable that impaired forgetting of emotional material in induced mood could relate to other co-morbid factors. For example, participants that underwent the negative mood induction also reported significantly higher levels of anxiety than the positive group, which could have affected the findings and acted as a confounding variable. However, it is important to take into consideration that although all the previous studies (Studies 1-4) have found that dysphoric individuals were reporting significantly higher levels of anxiety than non-dysphoric individuals, these studies failed to find a significant correlation between anxiety and recall of previously-suppressed words. Furthermore, the present study did not find a significant correlation between mean anxiety score on the VAS and the total number of previously-suppressed words recalled, on both the final cued recall and independent tests. Rather, the results found a significant correlation between increased sad mood and the total number of depression-relevant previously-suppressed words recalled. Taken together, these findings provide strong support for the role of sadness on impaired forgetting, and suggest that sad mood attenuates directed forgetting effects.

Although the findings suggest that negative mood state impairs intentional forgetting, it is possible that negative mood state may actually reduce cognitive control, which subsequently impairs forgetting. Therefore, one change to the current study would be to test both positive and negative MI groups on the OSPAN task prior to, and after the mood induction, in order to establish if changes on OSPAN exist due to changes in mood state, and whether this is related to intentional forgetting.

It is important to note that as the two groups were tested on the forgetting task prior to the mood induction procedure (baseline condition) and showed no group differences on the task, this strongly supports the notion that group differences observed on the forgetting task after the mood induction procedure were the consequence of the changes in participant's mood. Furthermore, as mood was also assessed prior to, and after the forgetting task, this also provides strong support that induced mood had persisted throughout the forgetting task.

7.4.4. Summary

The study found that the impairment in intentional forgetting that has been reported in dysphoric participants can be instated in never-depressed participants by inducing a sad mood. There were no differences between the positive and negative groups on the forgetting task prior to the mood induction. After the mood induction procedure, the study found that only the positive group were successful at suppressing material. The negative group however, were significantly impaired in their ability to suppress emotional material. Mood congruent effects were also obtained, with the positive group recalling more positive previously-suppressed words and the negative group recalling more depression-relevant previously-suppressed words. These findings are consistent with previous research, and suggest that transient negative mood has a detrimental effect on cognitive processing and impairs an individual's ability to intentionally forget emotional material.

CHAPTER EIGHT

General Discussion

8.1. Introduction and overview

As outlined in Chapter one, it has consistently been demonstrated that depression is associated with enhanced retrieval and accessibility of negative memories (Lyubormirsky, Caldwell & Nolen-Hoeksema, 1998). Subsequently research has begun to investigate depressed individuals' ability to intentionally forget emotional memories. The main aim of this thesis was to build upon existing knowledge of intentional forgetting in dysphoria. In particular, the aim was to continue with research initiated by Hertel and Gerstle (2003) which, using the think/no-think paradigm (Anderson & Green, 2001), found that dysphoric individuals were significantly worse at suppressing to-be-forgotten words, than were non-dysphoric individuals. A further aim of this thesis was to investigate the use of a thought substitution strategy to aid forgetting. The present research further extended previous work by investigating specific factors that may be responsible for impaired forgetting in dysphoria. Furthermore, the studies presented in the thesis attempted to clarify the role of an inhibitory process in intentional forgetting.

The following Section (8.2) of this Chapter will consider the contribution of the findings obtained in this thesis, to the current understanding of intentional forgetting impairments associated with dysphoria. In light of these findings, the subsequent Section (8.3) will propose a model of intentional forgetting. Section 8.4 will discuss the implications of the current findings, in terms of depressed individuals normal functioning, and therapeutic interventions and treatments targeting depression. Section 8.5 will discuss general limitations of the current research. Section 8.6 proposes suggestions for further related research, and finally, Section 8.7 will summarise the findings obtained in this thesis, and discuss the contribution of the thesis to the existing knowledge of intentional forgetting in depressed states.

8.2. Summary of the main findings

8.2.1. The use of a thought substitution strategy in intentional forgetting

8.2.1.1. The use of a thought substitution strategy in intentional forgetting of neutral material in dysphoria

A key finding that emerged from this thesis was that thought substitution aids intentional forgetting of neutral material in dysphoria. Study 2 found that dysphoric and non-dysphoric individuals were successful at suppressing neutral material, when using a thought substitution strategy. Furthermore, Study 2 also found that individuals in the direct thought suppression condition that used a self-initiated thought substitution strategy were more successful at suppressing to-be-forgotten material, than individuals that did not use a thought substitution strategy. These findings are consistent with previous research (Hertel & Calcattera, 2005; Joormann et al, 2009), which has also found that using a thought substitution strategy aids intentional forgetting of neutral material. Taken together, these findings suggest that successful suppression of neutral material depends on the generation of alternative thoughts for both dysphoric and non-dysphoric individuals.

8.2.1.2. The use of a thought substitution strategy in intentional forgetting of emotional words in dysphoria

Another finding that emerged from this thesis was that thought substitution aids intentional forgetting of emotional material, but only when individuals are in a normal mood. Study 1 revealed that although non-dysphoric individuals were successful at suppressing emotional material using a thought substitution strategy, dysphoric individuals were significantly impaired. These findings were consistent with the findings obtained in Study 4, which also found impaired intentional forgetting of emotional material in dysphoric individuals in the thought substitution suppression condition. Moreover, the findings were also in line with the findings obtained in Study 5, which found that individuals in an experimentally induced negative mood were impaired at suppressing emotional words, using a thought substitution strategy. Taken together, these findings suggest that dysphoric individuals and those in a negative mood state are impaired at intentionally forgetting emotional material, even with the use of a thought substitution strategy.

8.2.2. The role of executive control on intentional forgetting of emotional material in dysphoria

A key finding that emerged from this thesis was the role of executive control in intentional forgetting of emotional material. Study 4 found that whilst non-dysphoric individuals with good executive control were successful at suppressing emotional material, non-dysphoric participants with poor executive control were significantly impaired. These findings are consistent with previous research which has also found that good executive control is related to having fewer intrusions during thought suppression (Rosen & Engle, 1998). However, the findings reported in Study 4 were contrary to those obtained in Study 1, which failed to find significant correlations between measures of inhibition and attentional control (i.e. Stroop, IDED, RNG), and recall of previously-suppressed words.

Furthermore, it is important to note that the findings obtained in Study 4, also revealed that dysphoric individuals with poor control demonstrated enhanced recall of previously-suppressed words. Moreover, dysphoric participants with good control were impaired at intentionally forgetting emotional material. Findings of impaired forgetting of emotional material in dysphoric individuals are consistent with the findings obtained in Studies 1 and 3, which both found impaired suppression of emotional words in dysphoria. The fact that dysphoric participants with good control were impaired at intentionally forgetting emotional material, suggests that factors, other than executive control may contribute to impaired memory suppression in dysphoria.

8.2.3. The role of negative mood state on intentional forgetting of emotional material

An important finding that emerged from this thesis was the role of a negative mood state on intentional forgetting of emotional material. Study 5 investigated whether experimentally induced changes in mood state would alter people's ability to intentionally forget emotional material, and found that individuals in a negative mood state were impaired at intentionally forgetting mood-congruent material. Findings of impaired forgetting in a negative mood state are in line with findings obtained in Studies 1, 3 and 4, which demonstrated that dysphoric individuals were impaired in their ability to intentionally forget emotional material. Furthermore, the findings are also in line with previous research which has found that impaired suppression is associated with greater negative affect (Freeston, Ladouceur, Thibodeau & Gagnon, 1992; Purdon & Clark, 1993), with negative mood making it more difficult to suppress unwanted memories. However, the fact that individuals in a negative mood state were impaired at intentionally forgetting mood-congruent material is contrary to the findings obtained in Studies 1, 3 and 4, which failed to find valence-specific forgetting impairments in dysphoria. Rather, these studies found that dysphoric individuals were recalling significantly more mood-congruent respond and previously-suppressed words. Taken together, these findings suggest that transient negative mood has a detrimental effect on cognitive processing, and impairs an individuals' ability to intentionally forget emotional material. Furthermore, the fact that individuals in a negative mood demonstrate impaired forgetting for mood-congruent material, suggests that naturally occurring sad mood and induced sad mood may exert different effects on intentional forgetting.

8.2.4. The role of inhibition in intentional forgetting

An important theme emerging from this thesis was that inhibition was the underlying mechanism responsible for intentional forgetting. Studies 2-5 used an independent test and found that non-dysphoric healthy individuals were successful at inhibiting emotional and neutral previously-suppressed words. Furthermore, Study 2 also found that dysphoric individuals were successful at inhibiting neutral material. Taken together, these findings suggest that intentional forgetting involves engaging executive control mechanisms to prevent unwanted material from coming to mind, by thinking about something else.

8.3. Proposed model of intentional forgetting in depressed states

8.3.1. Background

Based on the findings reported in this thesis, as well as existing literature a pragmatic model of intentional forgetting in depression is proposed, in order to understand why individuals in a depressed mood state are impaired at intentional forgetting. According to the model successful intentional forgetting involves two categories of mechanisms: (1) an activating mechanism, which involves selecting material related to the unwanted memory (i.e. the substitute memory) and (2) an inhibitory mechanism, which involves deactivating or inhibiting the unwanted memory. It is proposed that success or failure of intentional forgetting is determined by the involvement of these two mechanisms.

Activating mechanism

The activating mechanism is initiated by the intention to forget an unwanted memory. It is proposed that it does this by reactivating contents in memory that are related to the unwanted memory, without directly affecting the unwanted memory. Because the unwanted memory and the related memory share a common cue, they compete for retrieval. Therefore, when individuals are presented with a cue for the unwanted memory and instructed to recall the related memory (i.e. the substitute memory), the unwanted memory interferes with the retrieval of the related memory.

Inhibitory mechanism

The inhibitory mechanism is automatically activated to prevent the unwanted memory from interfering with the retrieval of the related memory. Executive control processes involve engaging inhibitory control mechanisms to inhibit the unwanted memory and prevent it from coming to mind, so that the related memory can be selectively retrieved. Thus, inhibition of the unwanted memory is achieved through inhibitory control mechanisms suppressing the unwanted memory, which is a source of interference. This is in line with the inhibitory control account (Anderson & Green, 2001), which suggests that unwanted memories are suppressed by engaging in executive control to prevent the unwanted thought from coming to mind. However, contrary to this account the present model proposes that in order to inhibit the unwanted memory, selective retrieval of a related memory is required.

According to the present model, in the think/no-think task, both the unwanted memory and the related memory compete with each other during the no-think phase. This competition necessitates the suppression of the unwanted memory, which in turn makes it less accessible at a later time. Thus, selection of the related memory and inhibition of the unwanted memory are intrinsically linked, with successful forgetting related to the activating mechanism directed towards generating alternative related thoughts, and the inhibitory mechanism suppressing the unwanted memory and impairing its later retrieval.

According to the model unsuccessful intentional forgetting in depressed states is due to deficiencies of the inhibitory mechanism, which result from poor executive control (i.e. individual differences in cognitive control) and negative mood state (i.e. makes inhibitory mechanism vulnerable to intrusive thoughts). Furthermore, the inhibitory mechanism is also hindered by the emotional content of the unwanted thought when individuals are in a depressed mood state. Evidence for the role of these three factors in impaired intentional forgetting in depressed states will be discussed in more detail in Section 8.3.3.

8.3.2. Evidence for the proposed model

8.3.2.1. Evidence for an activating mechanism

The current thesis provides evidence for the role of an activating mechanism in intentional forgetting. For example, Studies 2 and 3 found that healthy individuals, who were instructed to suppress the unwanted memory without recalling a substitute memory, were unsuccessful at intentional forgetting in the suppression condition. However, healthy individuals allocated to the thought substitution suppression condition, which involved selective retrieval of a related memory were successful at intentionally forgetting emotional and neutral material. Furthermore, Study 2 also found that individuals in the unaided thought suppression condition that used a self-initiated thought substitution were significantly better at suppressing words, than individuals that did not use a thought substitution strategy. Moreover, these findings were also consistent with previous research, which has found that thought substitution is an effective strategy in intentional forgetting (Hertel & Calcaterra, 2005; Hotta & Kawaguchi, 2009). Taken together, these findings provide support for the role of an activating mechanism, and suggest that selective retrieval of related material is a necessary condition to inhibit unwanted memories.

8.3.2.2. Evidence for an inhibitory mechanism

According to the model an inhibitory mechanism actively suppresses the unwanted memory from coming to mind. The role of an inhibitory control mechanism has been noted with several researchers proposing that impaired recall performance of previously-suppressed words requires an inhibitory mechanism that acts upon the memory representation of the unwanted word, deliberately impairing retention and keeping it out of consciousness (Anderson, 2003; Anderson, Green & McCulloch, 2000; Anderson & Spellman, 1995; Levy & Anderson, 2002).

If an inhibitory control mechanism suppresses the unwanted memory, it follows that later recall of the unwanted memory will be impaired on both the final cued recall test and the independent test, since it is the memory of the target word itself that is inhibited, rather than its association with the cue word (Anderson & Green, 2001). Consistent with this notion, Studies 2-5 found that non-dysphoric individuals were recalling significantly less previously-suppressed than never-suppressed (baseline) words on the final cued recall test and the independent test. Taken together, these findings suggest that the activating mechanism involves engaging an inhibitory mechanism to stop the retrieval of an unwanted memory.

It is important to note that some studies in the literature have found that individuals can successfully suppress material in a thought suppression condition, without using a thought substitution strategy (Anderson & Green, 2001; Anderson et al, 2004; Bergstrom, De Fockert & Richardson-Klavehn, 2009). However, these studies have failed to look at the strategies people use to prevent the unwanted thought from coming to mind. Thus, it is possible that participants may have employed self-initiated strategies of thought substitution in order to suppress the unwanted memory. Consistent with this notion, the findings from Study 2 revealed that individuals in the direct thought suppression condition that employed a self-initiated thought substitution strategy demonstrated increased suppression of previously-suppressed words than individuals that did not employ a thought substitution strategy. These findings are an important indicator of the effectiveness of thought substitution in suppression, and suggest that individuals may self-initiate the activating mechanism in order to successfully suppress the unwanted memory in the direct thought suppression condition.

8.3.3. Evidence of deficiencies in the inhibitory mechanism in depressed mood states

As noted above intentional forgetting in depressed states is due to deficiencies of the inhibitory mechanism, which result from one of three factors:

8.3.3.1. Negative mood state

The model proposes that negative mood impairs the inhibitory mechanism, which subsequently results in impaired intentional forgetting of emotional material. According to the model, negative mood state limits the amount of cognitive capacity that is available, and coupled with the emotionally valenced content of to-be-suppressed material, undermines intentional forgetting efforts. Evidence for the role of negative mood state on impaired intentional forgetting comes from Study 5, which found that participants induced in a negative mood state were impaired at intentionally forgetting emotional words. Furthermore, support also comes from the findings of Studies 3 and 4, which found that dysphoric individuals were significantly impaired at suppressing emotional words using a thought substitution strategy. Moreover, further evidence also comes from, Beevers & Meyer (2008) who found that individuals in a negative mood that were given suppression instructions recalled significantly more negative thoughts, than did participants in a neutral mood, and participants given no suppression instructions. These findings suggest that attempts to suppress negative thoughts, whilst in a negative mood heighten accessibility of the to-be-suppressed thoughts. Taken together, the findings suggest that inhibition is hampered under conditions of increased negative emotional state

8.3.3.2. Poor cognitive control

According to the model, poor executive control in dysphoria impairs the inhibitory mechanism, which subsequently results in enhanced recall of previously-suppressed material. The model proposes that individuals with poor control have difficulty in voluntarily engaging in controlled processes, in that attention must be devoted to relevant material and irrelevant material must be inhibited (Hertel, 2000; Hertel, 2004). This impairment in cognitive control enables habitual thinking, which subsequently impairs forgetting of previously-suppressed material. Thus, those individuals with poor control are more easily distracted by irrelevant thoughts or information, which results in impaired intentional forgetting. Support for this notion comes from the findings of Study 4, which found that whilst dysphoric individuals with good executive control demonstrated equivalent recall of previously-suppressed words in comparison to never-suppressed (baseline) words, dysphoric participants with poor control demonstrated enhanced recall of previously-suppressed words. Furthermore, support also comes from Bell & Anderson (in preparation), who found that individuals with higher working memory capacity, as measured by verbal and visual working memory span, showed larger inhibition effects than low span individuals. Taken together, these findings suggest that poor executive control has a detrimental effect on intentional forgetting in dysphoria, and subsequently makes dysphoric individuals more susceptible to interference from the unwanted memory, which in turn enhances the accessibility of the unwanted thought.

8.3.3.3. Emotional content of the unwanted memory

The model also proposes that the emotional content of the to-be-suppressed memory impairs the performance of the inhibitory mechanism, in individuals in a depressed mood state. Research suggests that emotional material captures attention more easily, and is processed more elaborately than non-emotional material (Hamann, 2001; Rolls, 2000). Because the memory representation of emotional material is stronger than non-emotional material, they are less susceptible to mechanisms of cognitive control and are thus, resistant to voluntary forgetting. Furthermore, because depressed individuals have difficulty in voluntarily engaging in controlled processes (Hertel, 2000), it is proposed that depressed mood, coupled with heightened encoding of emotional material results in greater recall of previously-suppressed material. This notion is supported by the findings of this thesis which found that dysphoric individuals were successful at suppressing neutral material, but demonstrated significant impairments in suppressing emotional material (refer to Studies 3 and 3). These findings suggest that suppression of emotional memories in a depressed mood state may be more susceptible to intrusive thoughts. Taken together, these findings suggest that the inhibitory mechanism is more effective for non-emotional than emotional memories in depressed states.

8.3.4. Model Predictions

(1) The model predicts that depressed individuals would be increasingly worse at suppressing than dysphoric individuals and individuals in a negative mood state.

According to the model because negative mood state impairs the inhibitory mechanism, and research suggests that increased negative mood is a debilitating symptom of depression (Joormann et al, 2009), it is therefore predicted that an increase in negative mood would further hinder the inhibitory mechanism, and thus result in impaired suppression.

(2) The model also predicts that individuals with poor executive control, such as older participants, will demonstrate impaired suppression. Given the fact that research suggests that there are age-specific changes in executive control (Verhaeghen & Cerella, 2002), with older individuals having poorer executive control than younger individuals, it is therefore predicted that older individuals will be significantly worse at suppressing than younger individuals.

8.3.5. Overview of the proposed model

In conclusion the model proposes that successful intentional forgetting relies on two mechanisms. An activating mechanism, which involves generating alternative thoughts related to the unwanted memory, and an inhibitory mechanism, which involves suppressing the unwanted memory and impairing its later retrieval. According to the model individuals in a depressed mood state demonstrate impaired intentional forgetting due to a dysfunctional inhibitory mechanism. Furthermore, the model proposes that negative mood state, poor executive control, and the emotional content of the unwanted memory, undermine the effectiveness of the inhibitory mechanism in individuals in a depressed mood state, thus resulting in impaired intentional forgetting of emotional material.

8.4. Implications of the current research

8.4.1. Implications for depressed individuals functioning

The findings reported in this thesis could have serious consequences on depressed individuals' everyday functioning. As previously discussed in the introduction (Chapter 1, Section 1.3, page 4), research suggests that depressed individuals are beset by the experience of unintentional and uncontrollable negative thoughts and memories which undermine their sense of well-being. These negative thoughts are considered to be the primary cause of depressed individual's unhappiness (Wenzlaff, 2002), with depressed individuals often attempting to counteract these negative thoughts by trying to suppress them. The findings from the current thesis however, suggest that thought suppression is not only futile, but also counterproductive. Furthermore, the findings suggest that even with the presence of effective distraction (i.e. recalling neutral substitute thoughts), dysphoric individuals are impaired in their ability to suppress depression-relevant material.

It is conceivable that impaired thought suppression in dysphoric individuals could act to maintain the ongoing depressive episode, and may even lead to more severe depression. For example, a depressed individual's failure to suppress negative thoughts that plague them may lead them to not only heighten the intensity and accessibility of the negative thought, but to also misattribute the lack of mental control to personal inadequacies (Wenzlaff, 2002). This in turn could lead to the renewal of mental control efforts, thus perpetuating a process that increases the persistence of unwanted thoughts over time, which subsequently act to reinforce or even worsen depressed mood. This is consistent with research which suggests that negative cognitions and depressed mood can form self-perpetuating cycles in which the reciprocal relationship leads to the maintenance and exacerbation of depressed mood (Teasdale & Barnard, 1993).

8.4.2. Implications for therapeutic interventions designed for depressed individuals

The findings reported in this thesis provide compelling evidence that impaired thought suppression contributes to the intrusive thoughts that are characteristic of depressed states. These findings have important implications on therapeutic interventions targeting depressed individuals' negative cognitions, and suggest that some techniques may actually have the unintended effect of increasing the accessibility of negative memories, by making the individual more aware of their occurrence. For example, 'thought stopping' has been used by therapists to reduce the frequency of maladaptive thoughts (Wolpe, 1973). This technique involves encouraging individuals to internally 'stop' whenever they begin to engage in negative thinking. However, because the technique encourages thought suppression it may actually promote an increase in the occurrence of the unwanted thought coming to mind.

To date, the standard view of therapeutic change has involved the direct modification of the negative memory representation (Brewin, 2006). However, recently it has been proposed that therapies, such as cognitive-behavioural therapy work by changing the accessibility of positive and negative memories, so that positive memories are more accessible and more likely to be retrieved than negative memories. This form of cognitive training involves altering the availability of positive and negative memories, which in turn increase depressed individuals' cognitive control (Brewin, 2006; Joormann et al, 2009). However, the findings from the studies reported in this thesis are somewhat contrary to this account, and instead suggest that increasing the accessibility of alternative memories (in this case, neutral memories) does not actually impair the availability of unpleasant memories themselves, presumably because these memories are deeply entrenched in depressed individuals and are not susceptible to suppression.

8.4.3. Treatment implications for depressed individuals

The research considered thus far highlights the implications of intentional forgetting impairments in depressed mood on current therapeutic interventions. An important finding emerging from Study 2 was that dysphoric individuals were successful at suppressing neutral material, using a thought substitution strategy. These findings are important as they suggest that non-emotional memories may be more susceptible to cognitive control mechanisms. Thus, it is proposed that a more active way of dealing with negative unwanted thoughts is to try to neutralise the content of the thought (for more information on neutralisation see Rachman, Shafran, Mitchell, Trant & Teachman, 1996). Once neutralisation has reduced the emotional effects of the unwanted thought, it may then be possible to suppress the memory using a thought substitution strategy

8.5. Limitations of the current research

Although this thesis provides new insights into the scope of intentional forgetting in depressed states, there are a number of limitations to the studies reported in the thesis which require note. One limitation arising is the high co-morbidity between depression and anxiety. Although participants in Studies 1-4 were primarily classified as being dysphoric, based upon their BDI scores, significant correlations did appear between depression scores and anxiety scores (STAI). Thus, it is not possible to attribute the impaired intentional forgetting effect found strictly as a characteristic of dysphoria. Furthermore, in Study 5, participants that underwent the negative mood induction also reported significantly higher ratings of anxiety, as well as sadness on the VAS. Thus, impaired intentional forgetting may not have been strictly characteristic of depressed mood state. In defence, it is noteworthy that findings from all the studies did reveal a significant correlation between depression scores and recall of previously-suppressed words when anxiety was partialled out. However, there was no correlation between anxiety and recall of previously-suppressed words when depression was partialled out. Furthermore, it is important to note that cognitive models of depression suggest that emotional disorders share a non-specific factor of negative affectivity (Mineka, Watson & Clark, 1998), thus this overlap is also seen in clinical practice. In addition, the stimuli used in Studies 1-5 were depressogenic and not threat-relevant. Given the fact that these studies (Studies 3 and 4) reported enhanced recall of depression-relevant respond and previously-suppressed words, provides compelling evidence that the presence of depressed mood state was a decisive component in the effects observed.

Another crucially contentious issue arising from the studies reported in this thesis is the use of neutral substitute words in the thought suppression condition. Previous research suggests that emotional material is better encoded (Canli et al, 2000; Rolls, 2000), and retrieved (Hamann, 2001) than neutral material. Thus, suggesting that memory representations of emotional material are stronger than representations of non-emotional material. According to the proposed model successful intentional forgetting arises when the inhibitory mechanism is recruited to inhibit the unwanted memory, in order to reduce interference and facilitate retrieval of the substitute memory. Given the fact that depression-relevant material is deeply entrenched in depressed individuals and is also more salient when in the corresponding mood, it is possible that neutral substitute words may not have created adequate interference to compete for retrieval, and thus may not have involved recruiting the inhibitory mechanism. This is consistent with findings obtained by Joormann et al (2009) who found that depressed individuals were successful at intentionally forgetting emotional material using a thought substitution strategy when emotional (i.e. positive and negative words) substitute words were provided.

However, it is important to note that both pilot studies carried out by the author looked at memory for both emotional and neutral word pairs, and found that overall participants had better memory for neutral than emotional word pairs. Furthermore, it is also noteworthy that findings from Study 2 revealed that although dysphoric individuals were successful at suppressing neutral words using a thought substitution strategy, they were still significantly worse at suppressing in comparison to the non-dysphoric group. Given the fact that the unwanted memories were neutral, this provides compelling evidence that depressed mood state has a detrimental effect on an individuals' ability to inhibit material, which becomes more apparent and progressively worse when the material is congruent to the individuals mood.

8.6. Future directions for research

8.6.1. Investigating the use of depression-relevant substitute memories

The findings reported in this thesis suggest that depressed mood state has a detrimental effect on an individual's ability to intentionally forget emotional material using a thought substitution strategy. However, as noted above it is conceivable that emotional substitute words may create greater interference than non-emotional words, which leads to increased suppression in dysphoric individuals. Although Joormann et al (2009) found this to be the case they essentially used negative word pairs. However, the findings reported in this thesis have revealed that depressed individuals show enhanced sensitivity to depression-relevant words. Therefore, future research could examine the use of depression-relevant substitute words on intentional forgetting, in order to determine whether impaired intentional forgetting in depression is independent of the content of distracting thoughts.

8.6.2. Investigating the effects of impaired suppression on depressive symptoms

The studies reported in this thesis involved training individuals to intentionally forget material and then examining their level of forgetting. The findings revealed that dysphoric individuals were significantly impaired in their ability to suppress emotional material. It is plausible that failure to suppress material may have had a detrimental effect on other aspects of depressive disorders, such as mood state or emotional vulnerability. Therefore, future research could examine whether training has an effect on mood state by asking participants to fill in a mood questionnaire after the task.

8.6.3. Investigating the long-term effects of suppression

The studies reported in this thesis demonstrate that healthy non-dysphoric individuals can successfully suppress material using a thought substitution strategy immediately after suppressing the unwanted material. However, it is unclear how long this intentional suppression effect persists. Therefore, in order to determine whether true forgetting has occurred, future research could investigate the long-term effects of suppression, to see whether thought substitution can lead to stable and durable forgetting. Furthermore, this thesis has also demonstrated that individuals induced in a negative mood state are impaired at intentionally forgetting depression-relevant material. Therefore, future research could also investigate whether impaired forgetting of depression-relevant to-be-suppressed words in induced negative mood persists long-term. Given the fact that depression is characterised by the frequent occurrence of negative thoughts and memories, this line of enquiry is very important and may provide further insight into the maintenance of depressed mood.

8.7. Summary & conclusions

The primary aim of this thesis was to extend previous research on intentional forgetting in depressed states. In particular, the aim was to determine whether dysphoric individuals were impaired in their ability to intentionally forget emotional material. The findings revealed that although the dysphoric individuals were significantly worse at suppressing than the non-dysphoric individuals, both groups were unsuccessful at direct thought suppression. These findings are consistent with a growing body of research, which suggests that direct thought suppression precipitates more preoccupation with the unwanted thought. A further aim of the current thesis was to investigate the use of a thought substitution strategy to aid forgetting. The findings from this thesis revealed that non-dysphoric healthy individuals were successful at intentionally forgetting material, using a thought substitution strategy. However, there is considerable support from the findings obtained in the thesis that dysphoric individuals are impaired in their ability to suppress emotional material. These findings suggest that dysphoric individual's impaired ability to suppress emotional words is a characteristic of elevated depression. This thesis also investigated specific factors that may be responsible for impaired forgetting in dysphoria. The findings reported in this thesis revealed that poor executive control contributed to impaired intentional forgetting. However, results also revealed that dysphoric individuals with good executive control were unsuccessful at suppression. Therefore, suggesting that factors other than executive control contribute to impaired intentional forgetting. The role of negative mood state on intentional forgetting was also investigated. The findings reported in this thesis revealed that transient negative mood state impaired intentional forgetting of depression-relevant material. Taken together, these findings suggest that poor executive control and negative mood state have independent detrimental effects on intentional forgetting of emotional material. An important theme emerging from the findings was the role of an inhibitory mechanism in intentional forgetting. The findings reported in this thesis suggest that indirect suppression (i.e. thought substitution) involves engaging an inhibitory control mechanism that contributes to successful intentional forgetting. Based upon the findings obtained in this thesis, as well as existing literature a new model of intentional forgetting in depressed states was proposed. According to the model intentional forgetting involves an activating mechanism which selects material related to the unwanted memory (i.e. the substitute memory), and an inhibitory mechanism, which involves deactivating the unwanted memory. The proposed model suggests that negative mood state, poor cognitive control, and the emotional content of the unwanted memory, undermine the effects of the inhibitory mechanism in depressed states which leads to impaired forgetting. The findings obtained in this thesis have clear implications on depressed individuals everyday functioning, and suggest that even with the presence of effective distraction (i.e. recalling neutral substitute thoughts), depressed individuals are impaired in their ability to suppress depression-relevant material. Taken together, the findings reported suggest that thought suppression is not only futile but also counterproductive in depressed individuals. Impaired intentional forgetting of emotional material may contribute to the maintenance of depressed mood and could potentially worsen ongoing depression.

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APPENDICES

CONTENTS

APPENDIX I

Screening questionnaire

PARTICIPANT CODE _________________ DATE _________________

DATE OF BIRTH _________________ SEX M / F

LEVEL OF EDUCATION _________________

In order to determine whether you are suitable to take part in the study I am going to ask you a few questions. The questions are of a personal nature. You do not have to answer them if you do not want to, but I would appreciate it if you could. Your answers will be kept anonymous by using a code number instead of your name.

Have you ever been treated (by a clinician, including your GP) for depression? YES/NO

If yes, when was the last time you were treated? _________________

Have you ever been treated (by a clinician, including your GP) for anxiety? YES/NO

If yes, when was the last time you were treated? _________________

Have you ever been treated (by a clinician, including your GP) for any other psychological conditions? YES/NO

If yes, please specify the condition _________________

If yes, when was the last time you were treated? _________________

Have you ever suffered a head trauma which resulted in loss of consciousness? YES/NO

If yes, did you have to go to the hospital for this? YES/NO

If yes, When was this? _________________

Are you currently on any prescribed medication? YES/NO

If yes, please specify the medication _________________

APPENDIX II

Words presented during the think no-think task in the study reported in Chapter 3.

Cue	Positive	Negative	Presentation Block
APPLE	DELICIOUS	POISONED	1
ARROW	CUPID’S	PIERCING	1
BIRD	MAJESTIC	WOUNDED	1
BOOK	EXCITING	DEPRESSING	1
BOTTLE	BABY	SHATTERED	1
BUTTER	HOMEMADE	RANCID	2
CABIN	PEACEFUL	ROTTING	2
CANE	CANDY	WHIPPING	2
CATTLE	CONTENTED	LOST	2
CHAIR	COZY	ELECTRIC	2
CLOCK	GRANDFATHER	DOOMSDAY	3
COTTAGE	ROMANTIC	GLOOMY	3
DOLL	BELOVED	DECAPITATED	3
DOLLAR	SILVER	DEVALUED	3
DRESS	WEDDING	FUNERAL	3
FACTORY	TOY	SHUT-DOWN	4
FROG	ANIMATED	PITIFUL	4
HARP	ANGELIC	MOURNFUL	4
HORSE	FREE-SPIRITED	INJURED	4
HOTEL	LUXURIOUS	CONDEMNED	4
JURY	MERCIFUL	VENGEFUL	5
KING	NOBLE	PATHETIC	5
LEOPARD	MAGNIFICENT	CAPTURED	5
OFFICER	HEROIC	MURDERED	5
PAPER	ESTEEMED	FAILING	5
PIANIST	TALENTED	UNTALENTED	6
PICTURE	FAMILY	INCRIMINATING	6
QUEEN	BENEVOLENT	WICKED	6
RIVER	TRANQUIL	FLOODING	6
SHOES	NEW	PINCHING	6

Continued

SINGER	EXCEPTIONAL	UNAPPRECIATED	7
SKIN	FLAWLESS	SLASHED	7
SOIL	FERTILE	INFESTED	7
STREET	CARNIVAL	FILTHY	7
TABLE	BANQUET	OPERATING	7
TICKET	BROADWAY	TRAFFIC	8
TOWER	ENCHANTING	GUN	8
VALLEY	PEACEFUL	DESOLATE	8
WHALE	RELEASED	HARPOONED	8
WOODS	MAGICAL	DEFORESTED	8

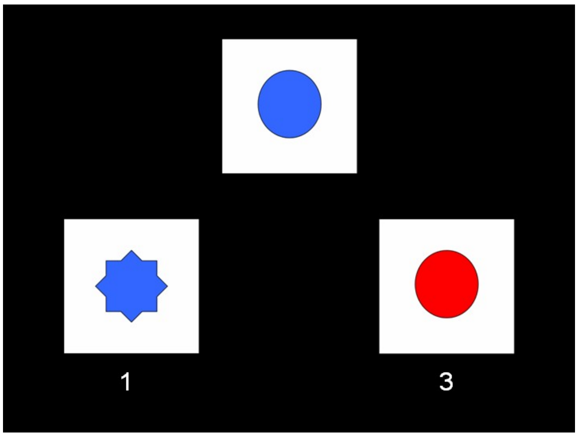
APPENDIX III

IDED Task Instructions

Participants are presented with three coloured shapes in a pyramid layout. One of the bottom blocks matches the top block for shape, the other matches the colour. Participants must decide which is the current match i.e. which bottom block matches the top block, by pressing the corresponding key. After participants have pressed a key a feedback display will appear either saying ‘correct’ or ‘incorrect’. If participants are correct then they have matched the blocks according to the correct criteria, however if participants are incorrect they must match according to the other criteria when the next set of blocks are presented.

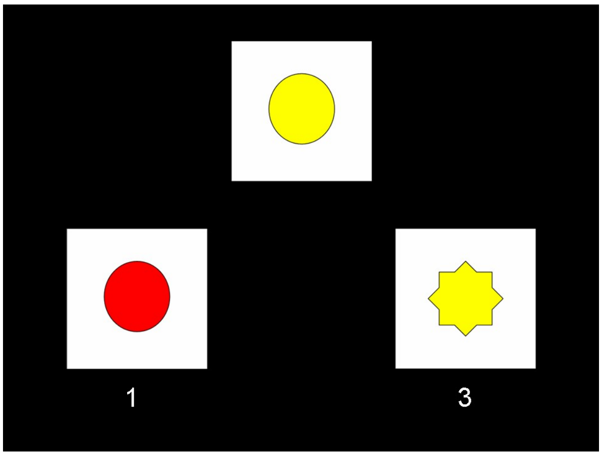
<u>Example of a trial</u>

If participants were presented with the following screen and decided to match according to **colour** they would press the ‘1’ key.



A feedback screen would then appear. If the feedback screen said incorrect then participants would know that the matching criteria is NOT colour.

Participants would then be presented with the next trial. This time, instead of matching for colour participants would match for **shape** and press the ‘1’ key



As this is the correct matching criteria a feedback screen would appear saying ‘correct’

The same criterion is used for several slides. Therefore, participants would continue to match according to the **shape** criteria, until the feedback screen says incorrect. Participants will then be presented with a series of other slides and have to choose which sorting criteria to use. It is the same criteria for several slides. If the feedback screen says incorrect then this means that the sorting criteria has changed and participants must work out again which criteria, colour or shape, to use, based on the feedback obtained.

APPENDIX IV

Inter-rater reliability for the National Adult Reading Test (NART)

In order to investigate the inter-rater reliability for NART, 13 participants' word pronunciation on the NART was scored by the principle researcher and an independent rater. Correlational analysis revealed that there was a significant correlation between the principle researcher and the independent raters' scoring of the NART, $r(13) = 0.9$ $p < 0.01$. Furthermore, analysis of the data revealed that the principle researcher ($M = 26.85$, $SD = 5.3$) and the independent rater ($M = 25.31$, $SD = 5.2$) did not differ significantly in their scoring of the NART, $t(11) = 1.9$ $p > 0.05$. Taken together, these findings demonstrate high inter-rater agreement in the scoring of NART.

APPENDIX V

Analysis of group differences in suppression for the study reported in Chapter 3

Although the study reported in Chapter 3 failed to find a significant group x instruction x repetition interaction, in order to decide on the number of repetitions to use in the following study (Chapter 4) pairwise analysis were carried out looking at group differences in suppression, as a function of the number of repetitions. Analysis revealed that dysphoric individuals (M = 79.67%, SD = 21.6) were recalling significantly more previously-suppressed words presented once than non-dysphoric individuals (M = 68.0%, SD = 23.6); $t(118) = 2.8$ $p < 0.01$. Furthermore, dysphoric individuals (M = 83.0%, SD = 20.8) were also recalling significantly more previously-suppressed words presented eight times than non-dysphoric individuals (M = 69.33%, SD = 25.1); $t(118) = 3.2$ $p < 0.01$. However, there were no differences between dysphoric (M = 78.67%, SD = 22.1) and non-dysphoric individuals' (M = 77.33%, SD = 21.6) recall of previously-suppressed words presented 16 times, $p > 0.05$.

APPENDIX VI

Neutral words presented during the TNT task in Chapter 4

Cue	Target	Substitute	Presentation block
WIDE	RIVER	TRUCK	1
AMATEUR	POET	BUILDER	1
LEATHER	SHOES	JOURNAL	1
UNDERGROUND	CELLAR	GALLERY	1
BRASS	HARP	BOTTLE	1
COTTON	DRESS	PAPER	1
THIN	BOOK	BANKER	2
BASE	CAMP	BOARD	2
FURNITURE	FACTORY	NAIL	2
HUMBLE	MONK	VALLEY	2
PORCELAIN	DOLL	GOBLET	2
SPOTTED	LEOPARD	APPLE	2
EXTRA	DOLLAR	WATER	3
SECURITY	OFFICER	VEHICLE	3
CARVED	CANE	SHIP	3
BROWN	BIRD	WHALE	3
AVERAGE	PERSON	BOULDER	3
FARM	HORSE	PAINTER	3
WOODEN	CHAIR	ARROW	4
OFFICE	WINDOW	MACHINE	4
STONE	COTTAGE	STREET	4
TYPED	LETTER	PROFILE	4
APPOINTED	JUDGE	ADMIRAL	4
BUS	TICKET	CORNER	4
PART-TIME	PIANIST	BOSS	5
LAMINATED	POSTER	TABLE	5
CAPITAL	CITY	CLOCK	5
GREEN	FROG	PLANT	5
RACING	HOUND	COSTUME	5
LOG	CABIN	TOWER	5
CLOTH	BANNER	SEAT	6
TEENAGE	STUDENT	SINGER	6
SLEEPING	MAMMAL	VILLAGE	6
CLEAN	HOTEL	ENGINE	6
YELLOW	BUTTER	PIPE	6
UNREMARKABLE	QUEEN	CATTLE	6

APPENDIX VII

Material used in the independent test in the study reported in Chapter 4

Target	**Semantic category**
RIVER	BODY OF WATER **R**____________
POET	OCCUPATION **P**____________
SHOES	FOOTWEAR **S**____________
CELLAR	ROOM **C**____________
HARP	INSTRUMENT **H**____________
DRESS	CLOTHING **D**____________
BOOK	PAST TIME **B**____________
CAMP	TEMPORARY DWELLING **C**____________
FACTORY	WORK PLACE **F**____________
MONK	OCCUPATION **M**____________
DOLL	TOY **D**____________
LEOPARD	ANIMAL **L**____________
DOLLAR	CURRENCY **D**____________
OFFICER	OCCUPATION **O**____________
CANE	PLANT **C**____________
BIRD	ANIMAL **B**____________
PERSON	HUMAN BEING **P**____________
HORSE	ANIMAL **H**____________
CHAIR	FURNITURE **C**____________
WINDOW	OPENING **W**____________
COTTAGE	BUILDING C____________
LETTER	METHOD OF COMMUNICATION **L**____________
JUDGE	LEGAL OFFICIAL **J**____________
TICKET	PROOF OF PAYMENT **T**____________
PIANTIST	OCCUPATION **P**____________
POSTER	ADVERT **P**____________
CITY	URBAN AREA **C**____________
FROG	ANIMAL **F**____________
HOUND	ANIMAL **H**____________
CABIN	BUILDING **C**____________
BANNER	SIGN **B**____________
STUDENT	OCCUPATION **S**____________
MAMMAL	ANIMAL **M**____________
HOTEL	LODGING **H**____________
BUTTER	FOOD **B**____________
QUEEN	RULER **Q**____________

APENDIX VIII

Pilot study for materials used in the study reported in experimental Chapter 5

Introduction

The aim of the study was to pilot out positive, depression-relevant and neutral word pairs that were subsequently used in the study reported in Chapter 5. Positive and depression-relevant words were used as target words whilst neutral words were used as substitute words in the modified think no-think task reported in Chapter 5. Initially rating data was collected on the 126 emotional and neutral word pairs. This was to determine how emotionally evocative word pairs were. In order to ensure that positive and depression-relevant words were equally well remembered participants underwent a memory task. It is important to note that only positive and depression-relevant words that were equally well remembered were used. This was to ensure that if any group differences in suppression did arise in the study reported in Chapter 5 then they could not be attributed to differences in memory for the words themselves.

In order to determine whether words had been successfully inhibited in the study reported in Chapter 5 an independent probe test was required to assess memory of the target words without any association with the cue words. The independent probe test involved participants being presented with fragments of all of the target words. The fragments contained some letters and some blank spaces. Participants were given a sheet of paper with all the fragment words (blanks spaces included) and were asked to fill in the blanks to make the whole word.

Method

Design

A one way (valence) analysis of variance design was used. For emotionality the independent variable was valence (positive vs. depression-relevant vs. neutral) and the dependent variable was participant ratings. For memory testing the independent variable was valence (positive vs. depression-relevant vs. neutral) and the dependent variable was the mean number of targets recalled on the cued recall and the independent probe memory tests.

Participants

20 participants (8 M; 12 F) (Mean age = 21.45, SD = 3.0) took part in rating the emotionality of word pairs. Furthermore, 40 participants (16 M; 24 F) (Mean age = 21.62, SD = 3.8) took part in the memory task. Participants were recruited via poster and electronic advertisements (full outline in Chapter 2, Section 2.4.1, page 39) and were selected to take part according to the inclusion and exclusion criteria cited in Chapter 2 (Sections 2.4.2. & 2.4.3. pages 40-42).

Materials

<u>Word pairs</u>

Positive and depression-relevant words were obtained from John (1988). 42 positive, 42 depression-relevant and 42 neutral words were used. Each positive, depression-relevant and neutral word was matched together by the experimenter with a noun. For example, *'loving'*, *'helpless'* and *'big'* were matched together with the noun *'baby'* to create *'loving baby'*, '*helpless baby'* and *'big baby'*. This was done for all the words so that 42 nouns were used to create 126 words pairs. Once word pairs had been created they were checked by an independent researcher.

Trail Making Task (version B) (Lezak, 1995).

The trail making task (version B) involves participants being presented with a piece of paper which contains a series of numbers and letters. Participants are instructed to draw a single line sequentially going from number to letter (e.g. drawing a line from 1 to A and then 2 to B and so on).

Independent probe test

The independent probe test involves participants being presented with a sheet of paper that contains fragments of all the forty two target words seen by them previously. The fragments contain some letters and some blank spaces. Participants are asked to fill in the blanks to make the whole word when they see the word fragment on the screen.

Procedure

Emotionality Ratings

The 126 word pairs were divided into three sets of 42 word pairs with each booklet containing one of the three sets. Each set consisted of the 42 nouns with one third of nouns accompanied by positive words, one third accompanied by depression-relevant words and the final third accompanied by neutral words. These pairings were fully counterbalanced. Booklets were prepared instructing participants to rate their emotional reaction to each word on a 5 point scale with 1 = *"extremely negative"* and 5 = *"extremely positive"*. Participants were given unlimited time to complete the booklets.

Memory task

Participants were tested individually in a quiet room. The experimental task was presented on a 15-in (height) *18-in (width) colour monitor with participants seated approximately 50cm from the screen. Each word pair was presented in black, (Times New Roman, font size 14) using non-capital letters on the screen for 600 milliseconds. Participants were asked to create a self-referential mental image for each word pair presented. For example, if the word pair was ‘sandy desert’ participants could ‘imagine walking on a sandy desert’. Participants were subsequently asked to rate the meaningfulness of the image on a scale of 1 to 5 (with 1 = *‘not meaningful’* and 5 = *‘very personally meaningful’*). Participants were given unlimited time to respond by pressing the key that corresponded to how meaningful the word pair was. This was then followed by a 600msec inter-trial interval.

Word pairs were presented in 6 randomised blocks of 7 pairs which included each word pair from the 7 sets. This resulted in 42 word pairs being presented. Furthermore, 2 additional neutral-filler word pairs were included at the beginning of the first block and two neutral-filler word pairs were included at the end of the final block which remained the same for all participants. These words were included to eliminate any primacy and recency effects.

Participants were then given 5 minutes to complete the trail making task (version B). After 5 minutes participants were given the cued recall and independent probe memory tests. Test order was counterbalanced so that half the participants were given the cued recall test first whilst the other half were given the independent test. In the cued recall test each cue word (e.g. ‘sandy’) was presented on the screen for a maximum time period of 5200ms. Participants were asked to recall aloud the corresponding target associated with the cue word as quickly as possible (e.g. ‘desert’). This was then followed by an inter-trial interval of 300ms before the next trial began. Responses were marked by the experimenter as participants responded.

In the independent probe test participants were presented with fragments of all of the forty two target words. Each trial began with a cross being displayed for 200ms. Subsequently the word fragment was presented for 400 ms. Participants were then told to fill in the blanks when the word was presented on the screen. This was then followed by an inter-trial interval of 400ms before the next trial began.

Data scoring and analysis

The measure of interest was participants’ valence ratings to determine how emotionally evocative word pairs were and participant’s accuracy on the cued recall and the independent probe memory tests. For valence ratings mean scores of positive, depression-relevant and neutral cues were submitted to a one way ANOVA. For memory accuracy mean scores of words recalled in the final tests were submitted to a one way ANOVA. The factor of interest was valence (positive vs. depression-relevant vs. neutral).The significance level was set at 0.05. Follow up analyses were conducted using paired samples t-tests. Alpha levels for pairwise comparisons were adjusted in accordance to the Bonferroni correction method (see Keppel & Wickens, 2004).

In order to investigate the relationship between the total number of positive, depression-relevant and neutral targets correctly recalled for each cue word in the cued recall and independent probe memory tests, individual chi-squares were carried out.

Participants were classified on two separate variables. The first variable was recall (i.e. whether they correctly or incorrectly recalled the target word) the second variable was valence (positive, depression-relevant and neutral). The data for each cue word was presented in the form of a matrix with the row corresponding to valence and the columns corresponding to recall. Total frequency scores of correct and incorrect responses for each valence condition (positive, depression-relevant and neutral) were then obtained for both the final cued recall and independent probe tests.

Results

Emotionality ratings

A one way ANOVA revealed a significant effect, $F(1, 19) = 153.0$ $p < 0.001$ with subsequent pairwise analyses revealing that participants rated positive words ($M = 3.70$, $SD = 0.4$) as significantly more positive than neutral ($M = 3.10$, $SD = 0.5$) and depression-relevant words ($M = 2.20$, $SD = 0.4$); all tests $p > 0.05$. Furthermore, depression-relevant words were significantly more negative than positive and neutral words; all test $p < 0.001$.

Cued recall test

A one way ANOVA revealed a significant effect, $F(1, 39) = 10.4$ $p < 0.001$ with subsequent pairwise analyses revealing that participants recalled significantly more neutral ($M = 56\%$, $SD = 0.3$) than positive ($M = 35\%$, $SD = 0.2$) or depression relevant words ($M = 36\%$, $SD = 0.2$); all tests $p < 0.001$. However, there was no significant difference in the recall of positive and depression relevant words; $p > 0.05$.

Individual chi-squares revealed that there were no significant differences in the recall of positive and depression-relevant targets for 37 cue words. However, chi-squares revealed that there were 5 cues which involved participants recalling significantly more of one valenced target word than the other.

Independent probe test

A one way ANOVA revealed that there were overall no significant differences between the recall of positive ($M = 46\%$, $SD = 0.2$), depression-relevant ($M = 47\%$, $SD = 0.2$) and neutral words ($M = 47\%$, $SD = 0.2$); $F(1, 39) = 0.03$ $p > 0.05$.

Individual chi-squares revealed that there were no significant differences in the recall of positive and depression-relevant targets for 40 cue words. However, chi-squares revealed that there were 2 cues which involved participants recalling significantly more of one valenced target word than the other.

Discussion

Findings demonstrated that there was a significant difference between the valence ratings for word pairs. Specifically, participants rated positive words as being more pleasant than both depression-relevant and neutral words, whilst depression-relevant words were rated as being more unpleasant than positive and neutral words. The final cued recall test revealed that overall neutral words were better remembered than both positive and depression-relevant words. However, there were no significant differences in the recall of positive and depression-relevant words. Individual chi-squares looking at the relationship between recall of positive and depression-relevant words revealed that positive and depression-relevant words were equally well remembered for 37 cue words. However, for 5 cue words participants recalled significantly more of one valenced target word than the other. The independent test revealed that there were overall no significant differences between the recall of positive, depression-relevant and neutral words. Furthermore, individual chi-squares revealed that positive and depression-relevant words were equally well remembered for 38 cue words.

The 2 cues which revealed significant differences between positive and depression-relevant words in the independent test were part of the 5 cues which revealed significant differences between positive and depression-relevant words in the final cued recall test and were therefore, not included as material for the study reported in Chapter 5. Furthermore, because only 36 word pairs were required and positive word pair ratings were still rather low in comparison to neutral ratings one word pair with the lowest positive rating was not included as material for the study reported in Chapter 5.

APPENDIX IX

Characteristics of *POSITIVE* words piloted out for the study reported in Chapter 5.

Cue	Target	Length	Emotionality	*Memory (cued recall test)	*Memory (independent probe test)
ANTIQUE	CHARMING	8	3.85	.43	.29
ARTIST	GOOD	4	4.15	.57	.29
BABY	LOVING	6	4.10	.29	.79
BOSS	ADMIRED	7	4.00	.71	.5
CHILD	ENERGETIC	9	3.80	.21	.5
CLOWN	JOLLY	5	3.10	.57	.71
COMEDIAN	WITTY	5	4.45	.43	.36
COMPANION	AMUSING	7	4.15	.14	.5
COUPLE	DYNAMIC	7	3.95	.07	.29
CROWD	EXHILARATED	11	3.85	.21	.14
DATE	CONFIDENT	9	3.30	.5	.5
DAY	ENCHANTING	10	4.05	.43	.5
DOG	CONTENTED	9	4.05	.42	.58
FEELING	EUPHORIC	8	3.70	.25	.5
FOOL	CHEERFUL	8	3.30	.43	.43
FRIEND	CONSIDERATE	11	3.25	.25	.42
GIRL	LOVABLE	7	3.55	.33	.67
GROUP	TRUSTWORTHY	11	3.65	.07	.29
LECTURER	CREATIVE	8	4.0	.57	.5
LOVER	FAITHFUL	8	3.20	.5	1
MAN	NICE	4	4.20	.07	.79
MEMORY	HAPPY	5	4.30	.5	.29
PERSON	EXCITED	7	3.60	0	.5
PIANIST	TALENTED	8	3.60	.33	.33
SINGER	JUBILANT	8	3.35	.33	.67
SOUL	DEPENDABLE	10	3.70	.14	.29
STAFF	POSITIVE	8	3.80	.36	.29
STUDENT	POLITE	6	3.15	.25	.17
TEAM	ELATED	6	3.25	.43	.5
TEENAGER	FRIENDLY	8	3.75	.42	.25
TOY	ENTERTAINING	12	3.85	.33	.42
WEEKEND	EXUBERANT	9	3.25	.29	.21
WIDOW	THOUGHTFUL	10	3.65	.29	.14
WIFE	UNSELFISH	9	3.50	.08	.08
WOMAN	CARING	6	4.10	.43	.86
WRITER	ENTHUSIASTIC	12	3.15	.42	.67
	Mean	**7.94**	**3.71**	**0.33**	**0.45**
	SD	**(2.1)**	**(0.4)**	**(0.2)**	**(0.2)**

*** = Mean memory scores**

APPENDIX X

Characteristics of *DEPRESSION-RELEVANT* words piloted out for the study reported in Chapter 5.

Cue	Target	Length	Emotionality	*Memory (cued recall test)	*Memory (independent probe test)
ANTIQUE	WORTHLESS	9	2.45	.58	.33
ARTIST	BAD	3	2.75	.36	.21
BABY	HELPLESS	8	2.15	.25	.67
BOSS	SHATTERED	9	1.60	.36	.57
CHILD	CONFUSED	8	2.30	.36	.71
CLOWN	DISMAL	6	1.90	.21	.71
COMEDIAN	DOWNCAST	8	2.50	.14	.29
COMPANION	SULKING	7	2.35	.08	.33
COUPLE	INSIGNIFICANT	13	2.30	.36	.29
CROWD	MISERABLE	9	1.95	0	.17
DATE	BORING	6	2.05	.83	.67
DAY	DREARY	6	2.20	.33	.58
DOG	ABANDONED	9	2.35	.36	.43
FEELING	ISOLATED	8	1.70	.14	.36
FOOL	INCOMPETENT	11	2.45	.67	.58
FRIEND	SULLEN	6	1.85	.21	.43
GIRL	DISLIKED	8	2.15	.21	.64
GROUP	SAD	3	1.95	.33	.25
LECTURER	UNPOPULAR	9	2.45	.5	.58
LOVER	REJECTED	8	2.30	.21	.71
MAN	GUILTY	6	3.30	.07	.57
MEMORY	LONELY	6	2.35	.25	.25
PERSON	ASHAMED	7	2.20	0	.5
PIANIST	RESIGNED	8	1.80	.21	.43
SINGER	USELESS	7	1.70	.5	.79
SOUL	BURDENED	8	2.15	.07	.14
STAFF	PESSIMISTIC	11	2.40	.29	.43
STUDENT	FAILING	7	3.05	.57	.29
TEAM	INFERIOR	8	2.25	.33	.67
TEENAGER	ANTISOCIAL	10	2.15	.71	.14
TOY	INADEQUATE	10	2.25	.57	.57
WEEKEND	TRAGIC	6	2.15	.07	.36
WIDOW	WRETCHED	8	1.90	.5	.07
WIFE	HOPELESS	8	1.85	.29	.21
WOMAN	UNHAPPY	7	1.85	.42	.75
WRITER	DEPRESSED	9	2.15	.71	.79
	Mean	**7.78**	**2.20**	**0.33**	**0.46**
	SD	**(2.0)**	**(0.4)**	**(0.2)**	**(0.2)**

*** = Mean memory scores**

APPENDIX XI

Characteristics of *NEUTRAL* words piloted out for the study reported in Chapter 5.

Cue	Target	Length	Emotionality	*Memory (cued recall test)	*Memory (independent probe test)
ANTIQUE	HOUSEHOLD	9	3.25	.43	.36
ARTIST	GRAPHIC	7	3.60	.25	.25
BABY	BIG	3	2.55	.79	.64
BOSS	AGEING	6	2.30	.75	.5
CHILD	TALL	4	2.80	.14	.42
CLOWN	CLASS	5	2.80	.5	.75
COMEDIAN	STANDUP	7	3.40	1	.42
COMPANION	TRAVEL	6	3.75	.57	.79
COUPLE	MARRIED	7	3.55	.42	.25
CROWD	SMALL	5	3.10	.29	.14
DATE	BLIND	5	3.00	.79	.5
DAY	LONG	4	2.50	.71	.64
DOG	BROWN	5	3.00	.79	.29
FEELING	DROWSY	6	2.20	.07	.57
FOOL	APRIL	5	2.65	.21	.5
FRIEND	BOY	3	2.80	.64	.71
GIRL	YOUNG	5	3.00	.57	.93
GROUP	LARGE	5	2.80	.21	.21
LECTURER	PHYSICS	7	2.90	.79	.71
LOVER	NAKED	5	3.15	.71	.86
MAN	GIANT	5	3.70	0	.5
MEMORY	LASTING	7	3.75	.14	.21
PERSON	THIRD	5	3.00	.14	.43
PIANIST	CONCERT	7	3.15	.43	.57
SINGER	KARAOKE	7	2.50	.71	.71
SOUL	SPIRITUAL	9	2.55	.5	.17
STAFF	TEMPORARY	9	3.60	.42	.33
STUDENT	LAW	3	3.30	.57	.29
TEAM	FOOTBALL	8	3.15	.86	.5
TEENAGER	HORMONAL	8	2.85	.57	.21
TOY	COLOURFUL	9	3.35	.86	.71
WEEKEND	WET	3	3.40	.58	.33
WIDOW	BLACK	5	2.65	.92	.17
WIFE	SECOND	6	2.75	.71	.14
WOMAN	MATURE	6	3.85	.29	.86
WRITER	TABLOID	7	3.00	.43	.43
	Mean	**5.92**	**3.05**	**0.52**	**0.47**
	SD	**(1.7)**	**(0.4)**	**(0.3)**	**(0.2)**

*** = Mean memory scores**

APPENDIX XII

Words presented in the TNT task in the studies reported in Chapters 5-7

Cue	Positive	Depression-relevant	Neutral (substitute)	Block
WIDOW	THOUGHTFUL	WRETCHED	BLACK	1
BOSS	ADMIRED	SHATTERED	AGEING	1
WOMAN	CARING	UNHAPPY	MATURE	1
CHILD	ENERGETIC	CONFUSED	TALL	1
SINGER	JUBILANT	USELESS	KARAOKE	1
DATE	CONFIDENT	BORING	BLIND	1
FRIEND	CONSIDERATE	SULLEN	BOY	2
GROUP	TRUSTWORTHY	SAD	LARGE	2
PIANIST	TALENTED	RESIGNED	CONCERT	2
STUDENT	POLITE	FAILING	LAW	2
TEAM	ELATED	INFERIOR	FOOTBALL	2
CLOWN	JOLLY	DISMAL	CLASS	2
WRITER	ENTHUSIASTIC	DEPRESSED	TABLOID	3
COMEDIAN	WITTY	DOWNCAST	STANDUP	3
CROWD	EXHILARATED	MISERABLE	SMALL	3
DOG	CONTENTED	ABANDONED	BROWN	3
MAN	NICE	GUILTY	GIANT	3
GIRL	LOVABLE	DISLIKED	YOUNG	3
MEMORY	HAPPY	LONELY	LASTING	4
DAY	ENCHANTING	DREARY	LONG	4
ARTIST	GOOD	BAD	GRAPHIC	4
WIFE	UNSELFISH	HOPELESS	SECOND	4
COUPLE	DYNAMIC	INSIGNIFICANT	MARRIED	4
STAFF	POSITIVE	PESSIMISTIC	TEMPORARY	4
LOVER	FAITHFUL	REJECTED	NAKED	5
SOUL	DEPENDABLE	BURDENED	SPIRITUAL	5
TEENAGER	FRIENDLY	ANTISOCIAL	HORMONAL	5
PERSON	EXCITED	ASHAMED	THIRD	5
ANTIQUE	CHARMING	WORTHLESS	HOUSEHOLD	5
COMPANION	AMUSING	SULKING	TRAVEL	5
WEEKEND	EXUBERANT	TRAGIC	WET	6
BABY	LOVING	HELPLESS	BIG	6
LECTURER	CREATIVE	UNPOPULAR	PHYSICS	6
FEELING	EUPHORIC	ISOLATED	DROWSY	6
FOOL	CHEERFUL	INCOMPETENT	APRIL	6
TOY	ENTERTAINING	INADEQUATE	COLOURFUL	6

APPENDIX XIII

Word fragments of *POSITIVE* target words used in the independent probe test during the think no-think task in the studies reported in Chapters 5-7.

Target	Word fragment
THOUGHTFUL	t _ o _ g _ _ _ u l
ADMIRED	a _ m _ _ e d
CARING	c _ r _ _ g
ENERGETIC	e _ _ r _ _ _ I c
JUBILANT	j _ b i _ a _ _
CONFIDENT	c _ n _ i _ e _ t
CONSIDERATE	c _ n _ i _ _ r _ t e
TRUSTWORTHY	t _ u _ t w _ _ _ _ y
TALENTED	t _ _ e n _ _ d
POLITE	p _ l _ _ e
ELATED	e _ a _ _ d
JOLLY	j _ l l _
ENTHUSIASTIC	e _ _ _ u _ _ _ s t _ c
WITTY	w _ t _ y
EXHILARATED	e _ h _ l _ r _ _ _ d
CONTENTED	c _ _ t _ _ t _ d
NICE	n _ c _
LOVABLE	l _ v _ _ _ e
HAPPY	h _ _ _ y
ENCHANTING	e _ _ h _ _ t _ n _
GOOD	g _ o _
UNSELFISH	u _ s _ l _ _ _ h
DYNAMIC	d _ n _ _ i c
POSITIVE	p _ _ i _ i v _
FAITHFUL	f _ _ t _ f _ l
DEPENDABLE	d _ p _ n _ _ _ l e
FRIENDLY	f _ _ e n _ _ y
EXCITED	e x _ _ t e _
CHARMING	c _ a r _ _ _ g
AMUSING	a _ _ s i _ g
EXUBERANT	e _ u _ _ r a _ t
LOVING	l _ v _ _ g
CREATIVE	c _ _ a _ _ v e
EUPHORIC	e u _ _ o _ _ c
CHEERFUL	c _ e _ _ f u _
ENTERTAINING	e _ t _ r _ _ i _ g

APPENDIX XIV

Word fragments of *DEPRESSION-RELEVANT* words used in the independent probe test in the studies reported in Chapters 5-7

Target	Word fragment
WRETCHED	**w _ e t _ _ _ d**
SHATTERED	**s _ _ t t _ r _ d**
UNHAPPY	**u _ h _ _ p _**
CONFUSED	**c _ n f _ _ _ d**
USELESS	**u _ _ l _ _ s**
BORING	**b _ r _ _ g**
SULLEN	**s _ l _ _ n**
SAD	**s _ _**
RESIGNED	**r _ _ i g _ _ d**
FAILING	**f _ _ l _ _ g**
INFERIOR	**i _ f _ _ _ _ r**
DISMAL	**d _ s _ _ l**
DEPRESSED	**d _ p _ _ s _ _ d**
DOWNCAST	**d _ w _ c _ _ t**
MISERABLE	**m _ s _ _ _ b _ e**
ABANDONED	**a _ _ n _ _ n _ d**
GUILTY	**g _ _ _ t y**
DISLIKED	**d _ _ l _ k _ d**
LONELY	**l _ _ e _ y**
DREARY	**d _ _ a _ y**
BAD	**b _ _**
HOPELESS	**h _ _ e l _ _ s**
INSIGNIFICANT	**i _ s _ _ _ _ f i _ a _ t**
PESSIMISTIC	**p _ s _ _ _ _ s t _ c**
REJECTED	**r _ j _ c _ _ d**
BURDENED	**b _ _ d _ n _ d**
ANTISOCIAL	**a _ t _ s _ _ I _ l**
ASHAMED	**a _ _ a m _ d**
WORTHLESS	**w _ r t _ _ e _ s**
SULKING	**s _ _ k _ _ g**
TRAGIC	**t r _ _ _ c**
HELPLESS	**h _ _ p l _ _ s**
UNPOPULAR	**u _ p _ _ _ l _ r**
ISOLATED	**i _ _ l _ t _ d**
INCOMPETENT	**i n _ o _ _ _ t _ n t**
INADEQUATE	**i _ a _ _ q u _ _ e**

APENDIX XV

Pilot study for materials used in the study reported in experimental Chapter 7

Introduction

The study reported in Chapter 7 involved participants completing the think no-think task prior to and after the mood induction. Therefore, a new set of 24 word pairs were required. The aim of this study was to pilot out positive, depression-relevant and neutral word pairs that would be used in the study reported in Chapter 7.

Method

Participants

40 participants (9 M; 31 F) (Mean age = 20.73, SD = 1.4) took part in the study. Participants were recruited via poster and electronic advertisements (full outline in Chapter 2, Section 2.4.1. page 39) and were selected to take part according to the inclusion and exclusion criteria cited in Chapter 2 (Sections 2.4.2. & 2.4.3. pages 40-42).

Materials

<u>Word pairs</u>

30 positive, 30 depression-relevant and 30 neutral words were obtained (positive and depression-relevant words were obtained from John, 1988). Each positive, depression-relevant and neutral word was matched together with a noun (see Appendix VIII for a more detailed outline). The 90 word pairs were divided into three sets of 30 word pairs with each booklet containing one of the three sets. Each set consisted of the 30

nouns with one third of nouns accompanied by positive words, one third accompanied by depression-relevant words and the final third accompanied by neutral words. Booklets were prepared instructing participants to rate their emotional reaction to each word on a 5 point scale with 1 = *'extremely negative'* and 5 = *'extremely positive'*.

<u>The Trail Making Task (Version B) (Lezak, 1995)</u>

See Appendix VIII for a detailed description of the task.

<u>Independent probe test</u>

See Appendix VIII for a detailed description of the independent probe test.

Procedure

The procedure for the study was exactly the same as the procedure for the previous pilot study (see Appendix VIII for more information).

Data analysis and scoring

The measure of interest was participants' valence ratings to determine how emotionally evocative word pairs were and participant's accuracy on the cued recall and the independent probe memory tests. For valence ratings mean scores of positive, depression-relevant and neutral cues were submitted to a one way ANOVA. For memory accuracy mean scores of words recalled in the final tests were submitted to a one way ANOVA. The factor of interest was valence (positive vs. depression-relevant vs. neutral). The significance level was set at 0.05. Follow up analyses were conducted using paired samples t-tests. In order to investigate the relationship between the total number of positive, depression-relevant and neutral targets correctly recalled for each cue word in the cued recall and independent probe memory tests individual chi-squares were carried out (refer to Appendix VIII for a full description of the data analysis and scoring).

Results

Emotionality ratings

A one way ANOVA revealed a significant effect, $F(1, 39) = 233.8$ $p < 0.01$ with subsequent pairwise analyses revealing that participants rated positive words ($M = 3.92$, $SD = 0.3$) as being significantly more positive than neutral words (($M = 3.13$, $SD = 0.4$); $t(39) = 7.6$ $p < 0.001$) and depression-relevant words ($M = 1.91$, $SD = 0.3$) being significantly more negative than neutral words; $t(39) = 11.3$ $p < 0.001$.

Cued recall test

A one way ANOVA revealed a significant effect, $F(1, 39) = 11.4$ $p < 0.01$ with subsequent pairwise analyses revealing that participants recalled significantly more neutral ($M = 51\%$, $SD = 0.2$) than positive ($M = 39\%$, $SD = 0.2$) or depression relevant words ($M = 32\%$, $SD = 0.1$); positive $t(39) = 3.0$ $p < 0.001$; depression-relevant $t(39) = 4.7$ $p < 0.001$. However, there was no significant difference in the recall of positive and depression relevant words; $p > 0.05$.

Individual chi-squares revealed that there were no significant differences in the recall of positive and depression-relevant targets for the 24 cue words. However, chi-squares revealed that for 6 cues participants recalled significantly more of one valenced target word than the other.

Independent probe test

A one way ANOVA revealed a significant effect, $F(1, 39) = 19.8$ $p < 0.001$ with subsequent pairwise analyses revealing that participants recalled significantly more neutral ($M = 53\%$, $SD = 0.2$) than positive ($M = 33\%$, $SD = 0.1$) or depression relevant words ($M = 32\%$, $SD = 0.1$); positive $t(39) = 6.0$ $p < 0.001$; depression-relevant $t(39) =7.1$ $p < 0.001$. However, there was no significant difference in the recall of positive and depression relevant words; $p > 0.05$.

Individual chi-squares revealed that there were no significant differences in the recall of positive and depression-relevant targets for all 30 cue words.

Discussion

As expected the results showed that there was a significant difference between the valence ratings for the word pairs. Specifically, participants rated the positive words as being more pleasant than both the depression-relevant and neutral words, whilst the depression-relevant words were rated as being more unpleasant than positive and neutral words.

The cued recall and independent probe tests revealed that overall neutral words were better remembered than both positive and depression-relevant words. However, there were no significant differences in the recall of positive and depression-relevant words. Individual chi-squares looking at the relationship between recall of positive and depression-relevant words on the cued recall test revealed that positive and depression-relevant words were equally well remembered for 24 cue words. Furthermore, individual chi-squares looking at the relationship between recall of positive and depression-relevant words on the independent probe test revealed that positive and depression-relevant words were equally well remembered for all 30 cue words.

Conclusion

The pilot study resulted in 24 word pairs suitable to use in the study reported in Chapter 7. These word pairs were included with the existing 36 word pairs to create 60 word pairs to use. 30 word pairs were used for the first think no-think task prior to the mood induction and 30 word pairs were used for the think no-think task after the mood induction.

APPENDIX XVI

Characteristics of *POSITIVE* words piloted out for the study reported in Chapter 7.

Cue	Target	Length	Emotionality	*Memory (cued recall test)	*Memory (independent probe test)
ATHLETE	SUPERB	6	4.20	.50	.25
BALLAD	DELIGHTFUL	10	4.15	.14	.33
BOOK	INSPIRED	8	3.85	.29	.42
BUNCH	LIVELY	6	3.95	.14	.59
COLOUR	VIBRANT	7	3.80	.42	.25
COTTAGE	COMFORTABLE	11	4.00	.67	.50
DOCTOR	PIOUS	5	3.75	.33	.16
FILM	ADVENTUROUS	11	3.70	.33	.50
GAME	PLEASANT	8	4.15	.57	.57
GIFT	GENEROUS	8	4.20	.29	.21
GOODBYE	HUMOROUS	8	3.65	.42	.21
HOLIDAY	EXOTIC	6	3.10	.33	.36
HOUSE	ROMANTIC	8	3.60	.21	.21
IDEA	INSPIRED	8	3.85	.36	.29
INDIVIDUAL	CAREFREE	8	4.00	.43	.36
LEADER	VICTORIOUS	10	4.30	.14	.36
LIFE	AMAZING	7	4.05	.29	.21
MOTHER	PLEASED	7	4.00	.21	.50
MUSIC	HARMONIOUS	10	3.65	.50	.57
OFFICER	COURAGEOUS	10	4.20	.33	.14
PARENT	GENTLE	6	3.35	.43	.43
PUPPY	ADORABLE	8	3.70	.43	.36
THOUGHT	BRIGHT	6	4.45	.43	.21
WORKER	RELAXED	7	3.30	.42	.29
	Mean	**7.88**	**3.87**	**0.36**	**0.35**
	SD	**(1.7)**	**(0.3)**	**(0.1)**	**(0.1)**

*** = Mean memory scores**

APPENDIX XVII

Characteristics of *DEPRESSION-RELEVANT words* piloted out for the study reported in Chapter 7.

Cue	Target	Length	Emotionality	*Memory (cued recall test)	*Memory (independent probe test)
ATHLETE	DESPONDENT	10	1.95	.42	.21
BALLAD	MELANCHOLIC	11	2.25	.07	.36
BOOK	DREADFUL	8	2.50	.25	.50
BUNCH	GRIEVING	8	2.00	.25	.57
COLOUR	UGLY	4	1.80	.43	.21
COTTAGE	GLOOMY	6	1.65	.57	.57
DOCTOR	GLUM	4	2.45	.29	.14
FILM	UPSETTING	9	1.60	.43	.50
GAME	PITIFUL	7	1.70	.50	.50
GIFT	UNWANTED	8	1.60	.33	.16
GOODBYE	TEARFUL	7	1.85	.43	.25
HOLIDAY	AWFUL	5	1.70	.21	.33
HOUSE	DESOLATE	8	2.35	.25	.16
IDEA	UNSUCCESSFUL	12	1.25	.43	.25
INDIVIDUAL	SUFFERING	9	2.40	.33	.33
LEADER	POWERLESS	9	1.60	.25	.33
LIFE	TORMENTED	9	2.20	.36	.29
MOTHER	DESPERATE	9	1.60	.29	.50
MUSIC	SOLEMN	6	1.95	.50	.50
OFFICER	HURT	4	1.90	.29	.21
PARENT	HUMILIATED	10	1.95	.36	.36
PUPPY	DEJECTED	8	1.60	.33	.29
THOUGHT	SUICIDAL	8	1.60	.42	.14
WORKER	DISCOURAGED	11	2.25	.36	.21
	Mean	**7.92**	**1.90**	**0.35**	**0.33**
	SD	**(2.2)**	**(0.3)**	**(0.1)**	**(0.1)**

*** = Mean memory scores**

APPENDIX XVIII

Characteristics of *NEUTRAL* words piloted out for the study reported in Chapter 7

Cue	Target	Length	Emotionality	*Memory (cued recall test)	*Memory (independent probe test)
ATHLETE	FEMALE	6	3.00	.79	.50
BALLAD	POWER	5	3.35	.59	.50
BOOK	STORY	5	2.75	.21	.57
BUNCH	WILD	4	3.35	.64	.50
COLOUR	PRIMARY	7	3.10	.50	.21
COTTAGE	SPACIOUS	8	3.00	.57	.71
DOCTOR	MEDICAL	7	3.85	.64	.36
FILM	FEATURE	7	3.60	.57	.71
GAME	BASEBALL	8	3.55	.59	.79
GIFT	UNEXPECTED	10	3.00	.57	.43
GOODBYE	PROMPT	6	2.80	.43	.43
HOLIDAY	FAMILY	6	3.25	.43	.64
HOUSE	DETACHED	8	3.30	.57	.21
IDEA	MAIN	4	3.15	.42	.50
INDIVIDUAL	OLDER	5	2.55	.71	.57
LEADER	PROJECT	7	2.90	.36	.64
LIFE	STILL	5	2.30	.42	.50
MOTHER	GRAND	5	3.15	.33	.67
MUSIC	COUNTRY	7	3.75	.57	.50
OFFICER	SECURITY	8	2.80	.29	.50
PARENT	WORKING	7	3.85	.33	.25
PUPPY	WHITE	5	3.60	.64	.33
THOUGHT	DEEP	4	3.00	.71	.75
WORKER	SKILLED	7	2.50	.57	.75
	Mean	**6.29**	**3.14**	**0.52**	**0.52**
	SD	**(1.5)**	**(0.4)**	**(0.1)**	**(0.2)**

*** = Mean memory scores**

APPENDIX XIX

Additional piloted words included in the study reported in Chapter 7.

Cue	Positive	Depression-relevant	Neutral (substitute)	Block
GAME	PLEASANT	PITIFUL	BASEBALL	1
OFFICER	COURAGEOUS	HURT	SECURITY	1
BOOK	INSPIRED	DREADFUL	STORY	1
MUSIC	HARMONIOUS	SOLEMN	COUNTRY	1
HOLIDAY	EXOTIC	AWFUL	FAMILY	1
WORKER	RELAXED	DISCOURAGED	SKILLED	1
GOODBYE	HUMOROUS	TEARFUL	PROMPT	2
THOUGHT	BRIGHT	SUICIDAL	DEEP	2
PUPPY	ADORABLE	DEJECTED	WHITE	2
BALLAD	DELIGHTFUL	MELANCHOLIC	POWER	2
LEADER	VICTORIOUS	POWERLESS	PROJECT	2
PARENT	GENTLE	HUMILIATED	WORKING	2
DOCTOR	PIOUS	GLUM	MEDICAL	3
ATHLETE	SUPERB	DESPONDENT	FEMALE	3
HOUSE	ROMANTIC	DESOLATE	DETACHED	3
IDEA	INSPIRED	UNSUCCESSFUL	MAIN	3
MOTHER	PLEASED	DESPERATE	GRAND	3
FILM	ADVENTUROUS	UPSETTING	FEATURE	3
BUNCH	LIVELY	GRIEVING	WILD	4
COLOUR	VIBRANT	UGLY	PRIMARY	4
LIFE	AMAZING	TORMENTED	STILL	4
INDIVIDUAL	CAREFREE	SUFFERING	OLDER	4
GIFT	GENEROUS	UNWANTED	UNEXPECTED	4
COTTAGE	COMFORTABLE	GLOOMY	SPACIOUS	4

APPENDIX XX

Additional word fragments of *POSITIVE* target words used in the independent probe test during the think no-think task in the study reported in Chapter 7

Target	Word fragment
PLEASANT	p _ e _ s _ _ t
COURAGEOUS	c _ _ r a _ e _ u _
INSPIRED	i _ s _ _ r e _
HARMONIOUS	h _ r m _ n i _ _ s
EXOTIC	e _ o t _ c
RELAXED	r _ l a _ e d
HUMOROUS	h _ m o _ _ u s
BRIGHT	b _ _ g _ t
ADORABLE	a _ _ r a _ l e
DELIGHTFUL	d _ l _ g _ t _ u _
VICTORIOUS	v _ _ t _ r _ o _ s
GENTLE	g _ n t _ _
PIOUS	p _ o u _
SUPERB	s _ p e _ b
ROMANTIC	r _ m a _ t _ _
INSPIRED	i n _ _ i _ e d
PLEASED	p _ e _ s _ d
ADVENTUROUS	a _ v _ _ t _ r _ u s
LIVELY	l _ v _ l _
VIBRANT	v _ b _ a n _
AMAZING	a _ a _ _ n g
CAREFREE	_ r _ _ r _ e
GENEROUS	g _ n _ r o _ _
COMFORTABLE	c _ m f _ _ t a _ _ e

APPENDIX XXI

Additional word fragments of *DEPRESSION-RELEVANT* target words used in the independent probe test during the think no-think task in the study reported in Chapter 7.

Target	Word fragment
PITIFUL	p _ t i _ u _
HURT	h _ r _
DREADFUL	d r _ _ d _ _ l
SOLEMN	s o _ _ m _
AWFUL	a _ f _ l
DISCOURAGED	d _ s c _ u _ a _ _ d
TEARFUL	t _ a _ f _ l
SUICIDAL	s _ i _ i _ a l
DEJECTED	d _ j _ c _ e _
MELANCHOLIC	m e _ a _ _ h o _ i _
POWERLESS	p _ w _ r _ _ s _
HUMILIATED	h _ m _ l _ a _ e d
GLUM	g _ _ m
DESPONDENT	d e _ p _ _ d _ n t
DESOLATE	d _ s _ _ a t _
UNSUCCESSFUL	u _ s u _ _ e _ s _ u _
DESPERATE	d _ s _ _ r _ t e
UPSETTING	u _ _ e _ t _ _ g
GRIEVING	g r _ _ _ i n _
UGLY	u _ l _
TORMENTED	t _ r m _ _ t _ d
SUFFERING	s _ f _ _ r _ _ g
UNWANTED	u _ w a _ _ e _
GLOOMY	g _ o _ _ y

APPENDIX XXII

Neutral filler word pairs

Neutral filler word pairs used to avoid primacy and recency effects in the learning phase of the think no-think task in the studies reported in Chapters 1- 7. The words were also used as practice stimuli for the think no-think phase of the tasks.

Cue	**Target**
TABLE	ROUND
DOOR	CLOSED
WINDOW	OFFICE
BANNER	CLOTH
CELLAR	UNDERGROUND
BEACH	SANDY
HOUND	RACING
MONK	HUMBLE
VESSEL	OCEAN
VEHICLE	PARKED

Additional filler words used in the study reported in Chapter 7.

Cue	**Target**
SHADE	LAMP
WATCH	POCKET
APPLE	GREEN
HEATER	ELECTRIC
PEN	INK
SCREEN	COMPUTER
SKY	CLEAR
PAGE	FRONT
STORE	DEPARTMENT
SWITCH	LIGHT