Cogn Ther Res (2013) 37:1189–1200
DOI 10.1007/s10608-013-9557-9

BRIEF REPORT

Enhancement of False Memory for Negative Material in Dysphoria: Mood Congruency or Response Bias?

Jonathan N. Stea · Sharon M. Lee · Christopher R. Sears

Published online: 25 June 2013

Abstract Although there is an extensive literature on the effects of depression and dysphoria on memory accuracy, few studies have examined the effects of depression or dysphoria on false memory. This study used the Deese-Roediger-McDermott paradigm (Roediger and McDermott in J Exp Psychol Learn Mem Cogn 21:803–814, 1995) to look for evidence of a mood congruent false memory effect in dysphoric individuals. Participants studied lists of semantically associated negative and neutral words for a recognition memory test. The memory test included critical lures (words not presented in the study lists, but strongly related to words on the lists) to assess false memory and non-presented negative and neutral unrelated words to assess participants' response bias. Although dysphoric participants falsely recognized significantly more critical lures related to the negative word lists, additional analyses revealed that this difference could be explained by a response bias that inflated their recognition responses to negatively valenced words. Directions for future research are discussed.

Keywords False memory · Dysphoria · Depression · DRM · Response bias

Introduction

People sometimes remember events that never occurred and will confidently report their recollections to others, a phenomenon memory researchers refer to as *false memory*. Most laboratory studies of false memory have used the Deese-Roediger-McDermott paradigm (DRM; Deese 1959; Roediger and McDermott 1995) because of its documented effectiveness in evoking false memories (see Gallo 2006, 2010, for reviews). The DRM paradigm involves the presentation of several word lists for study, each of which is strongly associated to a single, never-presented word, referred to as the critical lure. For example, for the list *loaf, sandwich, slice, butter, knife, toast*, *jam*, etc., the critical lure is *bread*. Participants are instructed to study the word lists and are then administered a memory test. The typical finding is that participants falsely remember (i.e., recall or recognize) the lures as being presented in the lists with a high degree of confidence, despite factors intended to mitigate the false memory effect, including instructions not to guess, warnings about the possibility of false memories, and incentives for accurate recall (Jou and Foreman 2007; Roediger and McDermott 1995, 2000; Roediger et al. 2001). One theory proposed to account for the false memory effect is the Activation-Monitoring Theory (Meade et al. 2007; Roediger et al. 2001). According to this view, the semantically related words on DRM study lists are organized and linked together in memory, and during the process of recollection never-presented information that is semantically related to studied information can be activated and mistakenly retrieved. An alternative account, the Fuzzy Trace theory (Brainerd and Reyna 2002), postulates that DRM study lists are encoded in both verbatim and gist representations. False memories occur because a critical lure is strongly related to the underlying meaning or theme of a study list encoded in the gist representation, and therefore likely to be mistakenly recalled or recognized.

Although there is an extensive literature on the effects of depression and dysphoria on memory accuracy (e.g.,

J. N. Stea · S. M. Lee · C. R. Sears (✉)
Department of Psychology, University of Calgary,
2500 University Drive N.W., Calgary, AB T2N 1N4, Canada
e-mail: sears@ucalgary.ca

Mathews and MacLeod 2005; Williams et al. 1997), few studies have examined the effects of depression or dysphoria on false memory. All of the studies with clinically depressed individuals used the DRM paradigm and each reported a mood congruent false memory effect—depressed individuals falsely recalled or falsely recognized significantly more negatively valenced words than non-depressed controls (Howe and Malone 2011; Joormann et al. 2009; Moritz et al. 2005, 2008; Yeh and Hua 2009). For example, in the Moritz et al. (2008) study, one of the study lists included the items *death*, *coffin*, *mourning*, *grave*, and *cemetery*; the critical lure was *funeral,* which was falsely recognized more frequently by depressed participants. These findings can be explained by network theories of emotion (e.g., Bower 1981) and cognitive theories of depression (e.g., Beck and Clark 1988). According to these views, depressed individuals are more susceptible to false memories of negative material because depression is associated with an increased accessibility and activation of negative information (Gotlib and Joormann 2010). Depression is also associated with attentional biases that likely play some role in false memory formation; depressed and dysphoric individuals have been found to attend to negative information more than non-depressed individuals (Williams et al. 1997; Yiend 2010), which would make them more prone to develop false memories for negative material in the DRM paradigm. Fuzzy Trace theory predicts that increased attention to the underlying meaning or theme of a study list will produce higher false recognition and recall for lures strongly related to that theme; thus, dysphoric individuals' heightened attention to a negative theme (*death*, *coffin*, *mourning*, *grave*, *cemetery*, etc.) would be predicted to produce higher false recognition and recall for related lures.

Given that symptoms of depression can be conceptualized on a continuum of severity (Flett et al. 1997), one might expect to observe mood congruent false memory in dysphoric individuals (i.e., individuals with elevated but sub-clinical levels of depressive symptomatology). This expectation is based on the idea that the psychological characteristics of depressed individuals will be present in attenuated form in many dysphoric individuals. It is also the case that research with dysphoric individuals provides information about cognitive processes in those who are vulnerable to developing major depressive disorder, given the finding that young adults with elevated depressive symptoms are at a greater risk of developing major depressive disorder in the future (e.g., Fergusson et al. 2005; Lewinsohn et al. 2000). Surprisingly, only one study has looked for evidence of mood congruent false memory in dysphoric individuals, and, contrary to expectations, there was no difference between dysphoric and non-dysphoric individuals in their false memory for negative material. Torrens et al. (2008) had participants listen to DRM word lists and then complete both free recall and recognition memory tests. They found that dysphoric and non-dysphoric participants did not differ in their false recall or false recognition of critical lures from negative word lists. Interestingly, dysphoric participants did falsely recognize fewer positive critical lures than non-dysphoric participants; this outcome demonstrated that their procedures were capable of detecting group differences.

Negative mood induction procedures have also been used to look for evidence of mood congruent false memory. Of course, there can be important differences between dysphoric individuals and those experiencing a transient negative mood (induced dysphoria), but these studies do provide information as to whether negative affect alone can influence false memory formation. Ruci et al. (2009) used the DRM paradigm and found that participants who experienced a negative mood induction recalled and recognized more negative critical lures than participants who experienced a neutral mood induction. Contrary to this finding, however, Storbeck and Clore (2005) found that participants who experienced a negative mood induction were less likely to recall negative, positive, and neutral critical lures than participants who experienced a positive mood induction; in a subsequent study, Storbeck and Clore (2011) found that a negative mood induction reduced false memory in a recognition task, but only when the negative mood was induced prior to the study of the DRM lists. Considered together, these results do little to clarify whether one should expect dysphoric individuals to exhibit mood congruent false memory.

The Present Research

Although several studies have examined false memory in clinically depressed individuals and all have reported a mood congruent false memory effect, few studies have examined false memory in dysphoric individuals and the results have been equivocal. In our study, we used the DRM paradigm and a recognition memory test to look for group differences in the false recognition of critical lures. Our study differed from previous studies in two important respects. First, in addition to presenting lists of neutral words and lists of negative words for study, each list strongly related to a non-presented critical lure, we also presented combined lists of neutral and negative words (*cancer*, *cards*, *funeral*, *poker*, *grief*, *grave*, *board*, *gamble*, etc.). Two critical lures were chosen for these lists: one strongly related to the negative words in the list (*dead*) and the other strongly related to the neutral words in the list (*game*). (See Hutchison and Balota 2005, for a similar type of DRM study list.) We expected that dysphoric participants would attend to the negative words in

these combined neutral-negative lists more than non-dysphoric participants because, as noted, researchers have found that depressed and dysphoric individuals attend to negative information more than non-dysphoric individuals (Williams et al. 1997; Yiend 2010). As noted, according to Fuzzy Trace theory (Brainerd and Reyna 2002), increased attention to the underlying theme of a study list will increase the saliency and cohesion of the gist representation and thereby increase false memories for lures strongly related to the theme. We therefore expected that if dysphoric participants selectively attend to the negative words in these combined study lists they would falsely recognize more of the critical lures related to the negative words than non-dysphoric participants. Given the potential for the dysphoric participants to attend to the list items differently, we speculated that the combined neutral-negative lists might provide a more sensitive test for group differences than the standard DRM lists of negative words.

The second way that our study differed from previous research is that our recognition test included negative and neutral words that were not presented in the DRM study lists and, unlike the critical lures, were not related to any of the study lists. Memory researchers have used this type of non-studied item to assess the baseline frequency of false positive recognitions to items unrelated to the DRM study lists (e.g., Roediger and McDermott 1995; Huff and Hutchinson 2011), although the valence of these items has not been an important distinction in previous research. In our study we used negative and neutral non-studied unrelated words as a measure of participants' response bias—the tendency to respond "recognize" to non-studied negative and neutral words (false positive recognitions). Zuroff et al. (1983) were among the first to argue that this type of response bias must be considered when assessing depressed and dysphoric individuals' memory for valenced material (other researchers have stressed the same point; e.g., Fiedler et al. 2001). Zuroff et al., using a signal detection analysis, found that although their dysphoric participants exhibited mood congruent memory (i.e., better memory for negatively valenced words), they also exhibited a response bias favouring the liberal report of negative material that inflated their correct recognition performance. Similar response biases have been observed in a variety of laboratory tasks, with depressed and dysphoric individuals exhibiting a greater tendency to choose or endorse more negative response options (e.g., Potts et al. 1997). Incorporating non-studied unrelated words into our recognition test allowed us to take into account any group difference in this type of bias when comparing dysphoric and non-dysphoric individuals' false memory for negative material. If dysphoric participants adopt a more liberal criterion for a recognition response for negatively-valenced words, then their false recognitions of negative critical lures would be inflated, but so too would their false recognitions of negative non-studied unrelated words. Establishing a baseline level of such false recognitions for each group, rather than assuming these would be equivalent, allowed us to take into account potential group differences and should therefore provide a better comparison of the false memory phenomenon in dysphoric and non-dysphoric individuals.

Method

Participants

The participants were undergraduate students at the University of Calgary. Participants completed the Beck Depression Inventory (BDI-II: Beck et al. 1996), the Positive and Negative Affect Schedule (PANAS; Watson et al. 1988), and a demographics questionnaire that included self-report questions about recent and current mood. The BDI-II assesses participants' depressive symptoms during the previous 2 weeks, whereas the PANAS can be used to assess participants' pleasant and unpleasant mood states over several time periods. The PANAS consists of 20 words that describe different emotions (e.g., *excited*, *proud*, *upset*, *guilty*, *distressed*); participants read each word and indicate "to what extent you have felt this way", using a scale from 1 (*very slightly or not at all*) to 5 (*extremely*). These same 20 words can be rated for three time frames: "during the past few days", "during the past few weeks", and "how you feel on average" (we collected ratings only for the "past few days" time frame). For the 10 positive affect items and for the 10 negative affect items the minimum score is 10 and the maximum score is 50. Like other investigators (Howe and Malone 2011; Moritz et al. 2008; Yeh and Hua 2009), we administered the BDI-II and the supplementary measures of mood after the DRM procedure. A total of 169 individuals completed these measures.

Participants were assigned to groups based on their BDI scores. Participants in the dysphoric group had BDI scores greater than or equal to 20, the cut-off score recommended by Dozois et al. (1998) for a ''dysphoric-depressed'' classification for undergraduate samples. (Torrens et al. 2008, used a cut-off score of 14 to create their dysphoric group.) There were 24 participants in the dysphoric group (19 females and 5 males, mean age = 23.2, mean BDI score = 23.6, SD = 6.3).[1] Participants in the non-

[1] Readers should keep in mind that this method of selecting dysphoric participants (BDI > = 20) does not necessarily mean that all the participants have sub-clinical levels of depression. Because there was no diagnostic assessment, it is possible that some members of the dysphoric group would qualify for a diagnosis of major depression. This is an issue that McDermut et al. (1997) and others have considered in detail.

dysphoric group had BDI scores less than or equal to 6, which excluded participants experiencing depressive symptoms at the time of testing and within the previous 2 weeks. There were 69 participants in the non-dysphoric group (54 females and 15 males, mean age = 21.4, mean BDI score = 3.5, SD = 2.0). The two groups differed significantly in terms of their BDI scores, $t(91) = 23.15$, $p < 0.001$. Dysphoric participants had significantly higher PANAS negative affect scores than non-dysphoric participants (25.6 vs. 15.2), $t(91) = 9.55$, $p < 0.001$, which indicated that they were experiencing higher levels of negative affect. Dysphoric participants also had significantly lower positive affect scores than non-dysphoric participants (23.4 vs. 33.7), $t(91) = 6.90$, $p < 0.001$, consistent with research showing that higher levels of depressive symptoms are associated with lower levels of positive affect (e.g., Watson et al. 1995). The self-report of mood "during the past few days", using a scale from 1 (*extremely negative*) to 7 (*extremely positive*), indicated that dysphoric participants rated their recent mood as significantly more negative than non-dysphoric participants (3.3 vs. 5.2), $t(91) = 6.48$, $p < 0.001$. Participants' ratings of "current mood" using the same scale indicated that dysphoric participants rated their current mood as significantly more negative than non-dysphoric participants (3.7 vs. 5.1), $t(91) = 6.36$, $p < 0.001$.

Materials

Fifteen word lists were created, each list consisting of 20 words. Participants studied these lists for the recognition memory test. Each list consisted of strong semantic associates of a word that was not itself presented in the list, but was subsequently presented in the memory test (the non-presented critical lure). For example, for the list *eat*, *jam*, *loaf*, *meal*, *wheat*, *sandwich*, *slice*, *butter*, *dough*, *grain*, *jelly*, *milk*, *roll*, *wine*, *food*, *pastry*, *crust*, *yeast*, *flour*, and *rye*, the critical lure was *bread*.

There were five neutral word lists, and for each list there was a critical lure strongly related to the words in the list. For example, for the neutral list *hill*, *valley*, *summit*, *glacier*, *slope*, *climber*, etc., the critical lure was *mountain*. The neutral lists were modified versions of a subset of the lists used by Roediger and McDermott (1995), with five words added to each list to match the length of the combined neutral-negative lists described below (e.g., for the list *butter*, *food*, *eat*, *sandwich*, *rye*, *jam*, *milk*, *flour*, *jelly*, *dough*, *crust*, *slice*, *wine*, *loaf*, and *toast*, the words *meal*, *wheat*, *grain*, *roll*, and *pastry* were added; these additional words were selected by collecting data from a group of 24 undergraduates, who were asked to provide as many words as they could think of that were strongly related to the 15 words on each list). Similarly, there were five negative word lists, and for each list there was a critical lure strongly related to the words in the list. For example, for the negative list *hurt*, *pain*, *discomfort*, *misery*, *ache*, *concern*, etc., the critical lure was *distress*. The words in the neutral and negative lists were presented in a random order in order to match the presentation procedure used for the combined neutral-negative lists described below. The negative lists were created by the authors by first generating lists of words highly related to candidate critical lures and then pruning these lists by collected semantic relatedness ratings from undergraduates; pilot testing of lists was subsequently undertaken to select the lists that elicited the highest levels of false recognition. (The typical procedure for creating DRM lists, using the backward association strength values collected by Nelson et al. 1999, 2004, was not an option, because most of the words in that corpus are non-emotional, and thus there are not enough words to create lists of emotional semantic associates.) The mean Kucera and Francis (1967) normative frequency (per million words) of the words on the neutral lists was 53.8 and for the negative lists it was 28.1. Valence ratings for the words used in each list were collected from a group of 22 undergraduate students after the lists were created (none of these individuals participated in the false memory task). The ratings were collected online using the Survey Monkey website (www.surveymonkey.com). Each student rated each word on scale from 1 (*extremely negative*) to 9 (*extremely positive*). For the neutral lists the mean valence rating was 5.76 and for the negative lists the mean was 2.54.

The remaining five lists consisted of 10 negative words and 10 neutral words (referred to as the combined neutral-negative lists, to distinguish them from the standard neutral and negative DRM lists). The 10 negative words in each list were strongly related to one critical lure and the 10 neutral words were strongly related to a different critical lure. These lists were also created by the authors using the procedures described above. For example, the words *cancer*, *funeral*, *grief*, and *grave*, were strongly related to the critical lure *dead*, and the words *cards*, *poker*, *board*, and *gamble* were strongly related to the critical lure *game*. To quantify the strength of the semantic relations, semantic relatedness ratings were collected from 28 undergraduate students (none of whom participated in the false memory task), who were asked to rate how strongly related each critical lure was to its associated list using a 7-point scale from 0 (*not related*) to 7 (*very strongly related*). The rating task was completed online using the Survey Monkey website (www.surveymonkey.com). For the lures related to the neutral words in each list (e.g., *game*) the mean relatedness rating was 5.79, and for the lures related to the negative words in each list (e.g., *dead*) the mean rating was 5.42. The mean Kucera and Francis (1967) normative frequency of the neutral words was 74.7 and for the

negative words it was 56.6. The mean valence ratings for the neutral and negative words were 5.32 and 2.78, respectively. The words in each list were presented in a random order (a unique random sequence was generated for each participant) so that the nature of the list would not be obvious and to provide an opportunity for participants to selectively attend to either the negative or neutral theme of the list. For the recognition test both the lure related to the negative words (*dead*) and the lure related to the neutral words (*game*) was presented. We reasoned that if dysphoric individuals are more likely to attend to the negative words in these combined lists (due to an attentional bias for negative information), then any group difference in false memory would be more pronounced for the critical lures related to the negative words.

Recognition Memory Test

The 80-item recognition memory test consisted of 40 studied words and 40 non-studied words. Of the 40 studied words, 10 had been presented in the neutral word lists, 10 had been presented in the negative word lists, and 20 had been presented in the combined lists of neutral and negative words. For the words that had been presented in the combined lists, 10 were negative words (e.g., *cancer*) and 10 were neutral words (e.g., *cards*). The mean Kucera and Francis (1967) normative frequency of the studied words was 75.8.

Of the 40 non-studied words in the recognition test, 20 were critical lures. There were five lures related to the words in the neutral lists (*mountain*, *bread*, *window*, *girl*, *doctor*), five lures related to the words in the negative lists (*distress*, *negative*, *burn*, *harsh*, *fear*), and ten lures related to the words in the combined lists. For the lures related to the words in the combined lists, half of the lures were related to the negative words in these lists (*dead*, *assault*, *depressed*, *angry, gun*) and the remainder were related to the neutral words in these lists (*electric*, *game*, *job*, *colour*, *sour*). The mean Kucera and Francis (1967) normative frequencies of the four different types of lures were similar and averaged 86.5 (range of 72.4–102.6). The mean valence ratings of the neutral and negative lures were 5.23 and 2.47, respectively.

The remaining 20 non-studied words consisted of words not strongly related to any of the 15 study lists (the non-studied unrelated words). Half of these words were of negative valence (e.g., *destroy*, *lie*, *cult*) and half were of neutral valence (e.g., *new*, *school*, *bird*). These words were used to assess participants' response bias: their tendency to "recognize" any non-studied word presented in the recognition memory test (as described below, a "sure old" response). The non-studied unrelated words had printed frequencies (Kucera and Francis 1967) similar to the studied words ($M = 72.8$). The mean valence ratings for the neutral and negative words were 5.83 and 2.33, respectively. Ratings of semantic relatedness were collected prior to the study to ensure that the non-studied unrelated words were unrelated to the study lists. The ratings were collected from the same 28 undergraduate students described above, who were asked to judge the extent to which each word was related to each study list, using a 7-point scale from 0 (*not related*) to 7 (*very strongly related*). As expected, relatedness ratings for both the negative and neutral unrelated words were quite low (1.7 and 1.9, respectively), which confirmed that they were essentially unrelated to the study lists and therefore unlikely to be falsely remembered as having been a member of a study list.

Procedure

The study lists were presented auditorily because previous research has shown that the highest false memory rates are obtained when an auditory study presentation is paired with a visual recognition memory test (e.g., Gallo et al. 2001). Each of the study words was digitally recorded at 22,050 Hz (stereo) by a female speaker. Digital editing software was used to remove noise from the recordings and to ensure a uniform volume level. The 15 study lists were created by grouping together the 20 audio files corresponding to the 20 words in a list and playing them in a random sequence (a different random sequence was generated for each participant). The silent interval between the words in a list was 1.5 s.

The word lists were presented using a desktop microcomputer programmed using the DMDX software package (Forster and Forster 2003). Participants sat in front of the computer and wore a set of stereo headphones. They were told that they would hear 15 lists of 20 words each, each list separated by 10 s of silence, and that they were to carefully study each list for a recognition memory test. The order in which the 15 lists were presented was randomized separately for each participant. Participants began the recognition memory test after a 15-min delay (during this interval they listened to randomly chosen selections of classical music from the CD "Piano Classics", which was not expected to alter mood or to interfere with the memory test). They were seated at a desk in a different room and given a sheet of paper listing the 40 studied words and the 40 non-studied words described previously (these words were listed in a random order). For each word they were asked to choose one of four response options ("sure old", "guess old", "sure new", or "guess new") listed beside each word (similar to the procedure used by Roediger and McDermott 1995). This procedure provided information on both the accuracy and the confidence of participants' responses, unlike "yes" and "no" response options

(Torrens et al. 2008, used "old" and "new" responses, which is relatively common in the false memory literature). Given that the option to guess was always available (a "guess old" response), we intended that participants would use the "sure old" response only when they were very confident in their recollection, and the instructions made this clear. The instructions were as follows: "If you are certain the word is one you studied, choose 'sure old'. If you are not certain but guess the word is one you studied, choose 'guess old'. If you are certain you did not study the word, choose 'sure new'. If you are not certain but guess that you did not study the word, choose 'guess new'. Remember that half of the words are words that you studied and half are new words that you did not study." The experimenter ensured that the participant understood the meanings of these response options before administering the memory test. There was no time constraint for completing the memory test.

Results

The percentage of "sure old", "guess old", "sure new", and "guess new" responses for the critical lures (false recognitions) is shown in Table 1. The correct recognition data is shown in Table 2.

False Recognition Data

The false recognition data were submitted to a 2 (Group: dysphoric, non-dysphoric) × 2 (Lure Relation: negative study words, neutral study words) × 2 (Study List Type: standard, combined) mixed-model analysis of variance (ANOVA). Lure Relation and Study List Type were within-subjects factors. The analysis focused on the "sure old" responses because these reflected confident recollections of the lures. As can been seen in Table 1, the false memory procedure was successful, with the overall mean percentage of "sure old" responses to lures being 45.7 % (47.6 % for the dysphoric group and 43.7 % for the non-dysphoric group, $F < 1$). The overall false recognition rate was similar to the overall correct recognition rate (see Table 2), a common finding in studies using a recognition memory test with the DRM paradigm (e.g., Roediger and McDermott 1995).

In the analysis there was a main effect of Lure Relation, $F(1, 91) = 5.50$, $p < 0.05$, $MSE = 389.5$, partial $\eta^2 = 0.06$, with more false recognitions for lures related to neutral study words (48.4 %) than for lures related to negative study words (42.9 %). There was also an interaction between Lure Relation and Study List Type, $F(1, 91) = 10.26$, $p < 0.01$, $MSE = 270.8$, partial $\eta^2 = 0.10$. False recognitions were most frequent for lures related to the standard neutral word lists (53.0 %); false recognitions for lures related to the other three study list types were less frequent (41.3 % for lures related to the standard negative word lists, and for the combined study lists 43.8 and 44.6 % for lures related to the neutral and negative words, respectively). This outcome was not entirely unexpected given that the standard neutral word lists produced high levels of false recognition in previous studies (Roediger and McDermott 1995) whereas the other lists were newly created.

The most important result was the two-way interaction between Group and Lure Relation, $F(1, 91) = 9.08$, $p < 0.01$, $MSE = 389.5$, partial $\eta^2 = 0.10$ (the three-way interaction between Group, Lure Relation, and Study List Type was not significant, $F < 1$). This interaction occurred

Table 1 Percentage of "sure old", "guess old", "sure new", and "guess new" responses for critical lures (false recognitions)

Response	Non-dysphoric group		Dysphoric group	
	Neutral lures	Negative lures	Neutral lures	Negative lures
Standard study lists				
Sure old	55.2	37.0	50.8	45.6
Guess old	14.2	31.9	10.8	23.9
Sure new	18.5	10.0	23.3	14.1
Guess new	11.9	20.9	15.0	16.2
Combined study lists				
Sure old	44.7	37.9	42.9	51.2
Guess old	17.6	30.5	19.5	26.2
Sure new	16.9	9.6	21.6	11.6
Guess new	20.6	21.8	15.8	10.8

"Neutral lures" refers to the critical lures strongly related to the neutral words in a study list. "Negative lures" refers to the critical lures strongly related to the negative words in a study list

Table 2 Percentage of "sure old", "guess old", "sure new", and "guess new" responses for studied words (correct recognitions)

Response	Non-dysphoric group		Dysphoric group	
	Neutral words	Negative words	Neutral words	Negative words
Standard study lists				
Sure old	55.3	41.1	56.9	50.4
Guess old	15.3	23.0	11.2	22.5
Sure new	15.9	17.1	17.9	12.0
Guess new	13.3	18.6	13.7	15.0
Combined study lists				
Sure old	47.1	48.0	57.5	54.0
Guess old	23.6	24.8	21.6	17.1
Sure new	13.7	8.4	10.0	10.8
Guess new	15.5	18.6	10.8	17.9

because the groups differed in their false recognitions for lures related to negative word lists, but not for lures related to neutral word lists; for the former, false recognitions were significantly more frequent for dysphoric participants than for non-dysphoric participants (48.4 vs. 37.5 %), $t(91) = 2.01$, $p < 0.05$, whereas for the latter, the two groups did not differ (46.8 vs. 50.0 %), $t(91) = 0.55$, $p > 0.10$. These results are evidence of a mood congruent false memory effect.[2] Although we predicted that the difference between the groups would be larger for the lures related to the negative words on the combined neutral-negative lists because of the potential for the dysphoric participants to selectively attend to the negative words, the group difference for the combined lists (51.2 vs. 37.9 %) and the standard negative lists (45.6 vs. 37.0 %) was similar (hence the absence of a three-way interaction). This outcome suggests that dysphoric individuals did not attend to the negative words in the combined lists any differently than the negative words in the standard lists. However, as will be discussed below, the interpretation of this outcome is complicated by the fact that the group differences in false recognition rates for both types of lists may not reflect genuine differences in false memory.

Separate analyses of the "guess old", "guess new", and "sure new" responses to lures were carried out and are reported here for completeness. An analysis of the "guess old" responses produced a main effect of Lure Relation, $F(1, 91) = 56.43$, $p < 0.001$, $MSE = 200.84$, partial $\eta^2 = 0.38$, with a higher percentage of "guess old" responses to lures related to negative study words (28.1 %) than to lures related to neutral study words (15.5 %). There was no main effect of Group ($F < 1$), nor were there any interactions with Group (all $ps > 0.10$). As a result, there was no evidence that the dysphoric and non-dysphoric groups differed in their use of the "guess old" response category. An analysis of the "guess new" responses produced a significant interaction between Group and Study List Type, $F(1, 91) = 4.45$, $p < 0.05$, $MSE = 203.98$, partial $\eta^2 = 0.05$. For the standard study lists the dysphoric and non-dysphoric groups did not differ in their "guess new" responses to lures (15.6 vs. 16.4 %, respectively), whereas for the combined study lists the non-dysphoric participants had a higher percentage of "guess new" responses (21.2 %) than the dysphoric participants (13.3 %). The only other effect in the analysis of the "guess new" data was the interaction between Group and Lure Relation, which was not quite statistically significant, $F(1, 91) = 3.65$, $p = 0.06$, $MSE = 236.42$, partial $\eta^2 = 0.04$. For lures related to neutral study words the two groups did not differ (15.4 % for the dysphoric participants and 16.3 % for the non-dysphoric participants), whereas for lures related to negative study words the dysphoric participants made fewer "guess new" responses (13.4 % for the dysphoric participants and 21.3 % for the non-dysphoric participants). This outcome likely reflects the dysphoric participants' higher confidence in their (false) recognition of lures related to negative words on the study lists. Finally, for the "sure new" responses, the only significant effect was the main effect of Lure Relation, $F(1, 91) = 19.75$, $p < 0.001$, $MSE = 275.45$, partial $\eta^2 = 0.18$. There was a higher percentage of "sure new" responses for lures related to neutral study words (20.1 %) than for lures related to negative study words (11.3 %).

False Positive Recognitions for the Non-Studied Unrelated Words

An analysis of the "sure old" responses for the non-studied unrelated words was carried out to determine if the dysphoric and non-dysphoric participants differed in their erroneous recognition of these words. Recall that half of these words were of negative valence (e.g., *destroy, lie, cult*) and the remainder were of neutral valence (e.g., *new, school, bird*) and that none of these words were related to the study lists. An analysis of these data revealed a significant interaction between Group and Word Valence, $F(1, 91) = 4.74$, $p < 0.05$, $MSE = 123.8$, partial $\eta^2 = 0.05$. For neutral non-studied unrelated words, the dysphoric and non-dysphoric participants did not differ (7.9 %, SD = 13.5 vs. 7.1 %, SD = 10.1), $t(91) = 0.27$, $p > 0.10$, whereas for negative non-studied unrelated words the dysphoric participants responded "sure old" significantly more frequently than the non-dysphoric participants (20.6 %, SD = 20.7 vs. 11.7 %, SD = 12.5), $t(91) = 2.51$, $p < 0.05$. This outcome likely reflects a response bias and makes it difficult to interpret the dysphoric participants' more frequent false recognitions of lures related to the negative word lists (i.e., whether their more frequent false recognitions were due to a genuine enhancement of false memory or to a tendency to respond "sure old" to any negatively valenced word on the recognition memory test).

Adjusted False Recognition Data

The fact that dysphoric participants were more inclined to respond "sure old" to non-studied negative unrelated words suggests that their "sure old" responses to the lures related to the negative word lists were inflated. This observation is especially important because, as noted, dysphoric participants had higher false recognition rates for these lures; it is therefore possible that some or all of the difference between the groups for these lures was due to

[2] Recall that Torrens et al. (2008) used a BDI cut-off score of 14 to create their dysphoric group. When we analyzed the data using this lower BDI cut-off score the results were essentially the same.

dysphoric participants' tendency to respond "sure old" to any non-studied word of negative valence. To assess this possibility, we performed an additional analysis of the lure data to take into account individual differences in the tendency to respond "sure old" to the non-studied unrelated words, using a standard procedure in the DRM literature to incorporate these false positive responses (e.g., Huff and Hutchinson 2011). For each participant, the percentage of "sure old" responses to lures related to the negative word lists was adjusted by subtracting the percentage of "sure old" responses to negative non-studied unrelated words. The same adjustment was made to the lure data for the lures related to the neutral word lists and the lures related to the combined neutral-negative word lists. These adjustments to the false recognition data compensated for differences among participants in their tendency to respond "sure old" to any negative or neutral non-studied word presented in the recognition memory test.

An analysis of the adjusted critical lure data revealed both similarities and differences from the original analysis of the lure data. Like the original analysis, there was a main effect of Lure Relation, $F(1, 91) = 22.16$, $p < 0.001$, $MSE = 640.60$, partial $\eta^2 = 0.19$, with a higher percentage of false recognitions for lures related to neutral word lists (40.8 %) than to negative word lists (26.7 %). There was also an interaction between Lure Relation and Study List Type, $F(1, 91) = 10.26$, $p < 0.01$, $MSE = 270.82$, partial $\eta^2 = 0.10$. The nature of this interaction was the same as it was in the original analysis, with the highest false recognitions for the lures related to the standard neutral word lists. The most important result was the absence of an interaction between Group and Lure Valence ($F < 1$). Recall that this interaction was statistically significant in the original analysis and could be interpreted as a mood congruent false memory effect: dysphoric participants had a higher false recognition rate for lures related to negative word lists (48.4 vs. 37.5 % for non-dysphoric participants) but not for lures related to neutral word lists (46.8 vs. 50.0 %). In the analysis of the adjusted critical lure data there was no hint of this interaction.[3] Dysphoric and non-dysphoric participants had very similar false recognition rates for lures related to negative word lists (27.8 vs. 25.7 %) and lures related to neutral words lists (38.9 vs. 42.8 %). This outcome implies that the mood congruent false memory effect observed in the original analysis was artifactual and due to the dysphoric participants' response bias inflating their false recognitions.[4]

Correct Recognition Data

For completeness we also analyzed the correct recognition data, which is shown in Table 2. Group differences in correct recognition performance were assessed by analyzing the "sure old" responses to studied words, using a 2 (Group: dysphoric, non-dysphoric) × 2 (Study Word Valence: negative study words, neutral study words) × 2 (Study List Type: standard, combined) mixed-model ANOVA. None of the interactions with Group were statistically significant (all $ps > 0.10$). Notably, there was no evidence of a mood congruent memory effect: although dysphoric participants had better memory for negative words than non-dysphoric participants (52.2 vs. 44.6 %), this was true for neutral words as well (57.2 vs. 51.2 %). When the correct recognition data were adjusted in the same manner as the false recognition data (by subtracting the percentage of "sure old" responses to non-studied unrelated words from the percentage of "sure old" responses to studied words), these differences were reduced further (49.3 vs. 44.0 % for neutral words and 31.6 vs. 32.8 % for negative words, for the dysphoric and non-dysphoric participants, respectively).

As can be seen in Table 2, overall, negative words were not correctly recognized ("sure old" responses) more often than neutral words. Although this outcome might appear unusual given that several laboratory studies have shown that recognition of negative words is superior to recognition of neutral words in standard recognition memory tasks (e.g., Ferré 2003; Kessinger and Corkin 2003; Ochsner 2000; Talmi and Moscovitch 2004), a recognition advantage for negative words is not commonly observed in the DRM paradigm (see Howe et al. 2010), and therefore our results are consistent with previous research. Also consistent with previous research is the finding that both true and false recognition rates in our study were lower for the negative DRM lists than the neutral DRM lists. A similar finding was reported by Palmer and Dodson (2009). Using

[3] A statistical power analysis of the test of this interaction was conducted using the effect size (partial $\eta^2 = 0.10$) of the Group × Lure Relation interaction from the analysis of the unadjusted false recognition data in the power calculation (an effect size of 0.33, and a total sample size of 93). Using these parameters, achieved power was calculated to be 89% (using the G*Power 3.1 software package; Faul et al. 2007).

[4] An alternative analysis using an analysis of covariance (ANCOVA) design led to the same conclusion. For this analysis, only the data for the lures related to the negative word lists were analyzed, and false positive responses to the negative non-studied unrelated words was used as a covariate, which equated the participants in the dysphoric and non-dysphoric groups on their tendency to respond "sure old" to non-studied words of negative valence. In the analysis the covariate was statistically significant, $F(1, 90) = 17.23$, $p < 0.001$, $MSE = 15505.48$, partial $\eta^2 = 0.16$. As expected, false positive responses to negative non-studied unrelated words were positively correlated with false recognitions of lures related to negative word lists. The test of the Group effect was not significant, $F(1, 90) = 1.13$, $p > 0.10$, as the two groups did not differ in their false recognitions.

a recall task, they concluded that their emotional DRM lists suppressed both true and false memory, relative to their neutral DRM lists (they used both positive and negative DRM lists). The fact that we have observed a similar pattern of results with a recognition task suggests that this outcome reflects a fundamental difference in the way that neutral and emotional material is processed in the DRM paradigm (see Palmer and Dodson 2009, for a discussion).

Discussion

The purpose of this study was to determine if dysphoria is associated with higher rates of false recognition for negative material. Although several studies have reported that false memory for negative material is more pronounced in depressed individuals (e.g., Howe and Malone 2011; Joormann et al. 2009; Moritz et al. 2005, 2008; Yeh and Hua 2009), the false memory phenomenon in dysphoric individuals has received little attention. Although there would seem to be good reasons to expect that individuals with sub-clinical levels of depression would also exhibit mood congruent false memory, the one study that examined this possibility reported equivalent false recognition of negative words in their dysphoric and non-dysphoric groups (Torrens et al. 2008).

In our study we found that dysphoric individuals were more likely to falsely recognize critical lures related to the negative words on DRM study lists, an outcome that could be interpreted as a mood congruent false memory effect. However, we also found that dysphoric individuals were significantly more likely to "recognize" negatively-valenced non-studied unrelated words, words that were not presented during study and were not related to any of the DRM study lists. This result indicated that dysphoric individuals were more liberal in responding "sure old" to negatively valenced words, a tendency that likely inflated their false recognitions of the lures related to the negative word lists (because these lures were also negatively valenced). We suspected that this response bias could have been responsible for the dysphoric individuals' higher rates of false recognition we observed, and the results of our analysis of the adjusted critical lure data were consistent with this interpretation: when we compensated for differences among participants in their tendency to respond "sure old" to negatively-valenced non-studied unrelated words, the difference between the dysphoric and non-dysphoric groups was eliminated. Thus, although dysphoric individuals exhibited higher rates of false recognition for negative material, our analyses indicated that this difference did not reflect a genuine difference in the false memory phenomenon.

Our results are consistent with those of Torrens et al. (2008), to our knowledge the only other investigators to examine false memory in dysphoric individuals. Although we used different stimuli and different procedures (and a higher BDI cut-off score for the dysphoric group), like Torrens et al., we conclude that dysphoric individuals are no more susceptible to false memories for negative material than non-dysphoric individuals. The key question for depression researchers is why there is a mood congruent false memory effect for depressed individuals (Howe and Malone 2011; Joormann et al. 2009; Moritz et al. 2005, 2008; Yeh and Hua 2009) but not for dysphoric individuals (assuming that our results and those of Torrens et al. accurately assess the false memory phenomenon in dysphoric individuals). One possibility is that mood congruent false memory, like mood congruent true memory, is pronounced only in more severely depressed individuals. For example, many studies have shown that depressed individuals recall more negative words than positive words (the opposite of non-depressed individuals), whereas dysphoric participants often exhibit an ''even-handedness'' in their recollection, remembering positive and negative words equally well (e.g., Matt et al. 1992; Williams et al. 1997). A similar principle may be applicable to false memory, with a mood congruency effect present only in more severe depression. Researchers have documented similar differences between dysphoric and depressed individuals' in their memory and cognition; for example, whereas executive control deficits are consistently observed in severely depressed individuals, individuals with mild to moderate depression often exhibit little or no impairment (Grant et al. 2001; McDermott and Ebmeier 2009). Similarly, McKendree-Smith and Scogin (2000) reported that a negative interpretive bias was present only in their group of moderately/severely depressed individuals and not in their groups of mildly depressed and non-depressed individuals (see also Bisson and Sears 2007). Recent studies that have examined attention to emotional information using eye gaze tracking have shown that depressed and dysphoric individuals exhibit different patterns of attention to positive and negative images, and that only clinically depressed individuals attend to negative images more than non-depressed individuals (e.g., Eizenman et al. 2003; Kellough et al. 2008; Leyman et al. 2011; Sears et al. 2010).

The discrepancy in the findings of the false memory studies examining individuals with subclinical versus clinical depressive symptoms does raise important questions about whether the mood congruent false memory effect is related to variables such as affective states, symptoms of depression beyond mood, correlates of depression such as negative cognitive style and rumination, attentional biases, and duration of mood states. A better understanding of mood congruent false memory in depression and dysphoria will be possible when researchers explore these possibilities in future studies. Direct

comparisons between depressed and dysphoric individuals in the same study, using identical materials, would be ideal.

Another consideration for future research is the possibility that depressed and dysphoric individuals differ from non-dysphoric individuals in their subjective experiences when recollecting negatively valenced lures during a recognition memory test, which influences the confidence of their recognition responses (e.g., "sure old" vs. "guess old").[5] For negatively valenced lures, depressed and dysphoric individuals may experience a heightened sense of familiarity due to their personal associations with negative material, resulting in greater confidence that a lure was studied and a greater inclination to respond "sure old". Non-dysphoric individuals may not experience the same sense of familiarity and would therefore be less inclined to respond "sure old" and more inclined to respond "guess old" to the same lures, even though their actual recollection may be no different. This type of bias to respond "sure old" would produce the general pattern of data we have observed in our study, with dysphoric participants responding "sure old" to lures related to negative word lists more often than non-dysphoric participants, and non-dysphoric participants responding "guess old" to the same lures more often that dysphoric participants (Table 1). A study by Sharot et al. (2004) is informative in this respect. Sharot et al. tested participants' true recognition memory for negative and neutral images using the remember/know paradigm (Tulving 1985; Yonelinas 2002); participants responded "remember" when they had a conscious recollection of an image and "know" when the image was familiar but was not consciously recollected. They found that negative images received more "remember" responses than "know" responses, whereas for neutral images this was not the case. (Interestingly, although there was an enhanced sense of remembering for the negative images, there was no difference in memory accuracy: negative images were not correctly recognized more often than neutral images.) These results suggest that the remember/know paradigm could provide additional insights into mood congruent false recognition memory in depressed and dysphoric individuals. Depressed, dysphoric, and non-dysphoric individuals may differ in their phenomenological experiences when recollecting negative material, and distinguishing between recognition-based ("remember") and familiarity-based ("know") responses when evaluating false memory would provide an alternative method to test for group differences in mood congruent false memory.

We should point out that one limitation of our study is that memory was tested soon after the words were studied and within the same experimental session. Researchers have shown that false memories can persist for weeks (e.g., Seamon et al. 2002; Thapar and McDermott 2001; Toglia et al. 1999). Although previous studies with depressed and dysphoric individuals have not looked for group differences in false memory after extended delays, it is conceivable that mood congruent false memory is more pronounced in these situations. Especially relevant to this possibility is a recent study by Howe et al. (2010). Using the DRM paradigm, Howe et al. had participants study lists of neutral and negative words and tested their false recognition of critical lures either immediately or after a 1-week delay. They reported that the false recognition rate for lures related to the neutral study lists was largely unchanged over the 1-week interval, whereas the false recognition rate for lures related to the negative study lists increased over the 1-week interval. Thus, false memories for both neutral and negative material persisted for at least 7 days, but only false memories for negative material increased between the immediate and delayed recognition tests. The implication for the present study is that it is possible that a genuine mood congruent false memory effect could be observed in dysphoric individuals when memory is tested days rather than minutes following study. Moreover, depression and dysphoria-related differences in long-term false memories for negative material would seem to have more relevance for cognitive theories of depression that emphasize the role that negative cognitions and memories play in the recurrence and maintenance of depression (Gotlib and Joormann 2010).

Conclusions

In the present study we found that although dysphoric individuals exhibited higher rates of false recognition for negative material, additional analyses revealed that this difference could be explained by a response bias that inflated their recognition responses to studied and non-studied negatively valenced words. Our results suggest that mood congruent effects on false memory in dysphoric individuals may be as elusive as mood congruent effects on true memory. However, several directions for future research appear promising, including comparing depressed and dysphoric individuals' mood congruent true and false memory in the same study using both immediate and delayed recognition tests that distinguish between recognition-based and familiarity-based responses.

Acknowledgments This research was supported by a Natural Sciences and Engineering Research Council (NSERC) grant to Christopher Sears. We thank Verna Chow, Crystal Campbell, and Lindsay Day for their assistance with data collection and coding, Mark Huff and John Roberts for their valuable recommendations, Kate Nielsen for her proofreading and editing assistance, and three anonymous reviewers for their excellent feedback and suggestions.

[5] We thank an anonymous reviewer for suggesting this possibility.

Correspondence concerning this article should be addressed to Christopher Sears, Department of Psychology, University of Calgary, 2500 University Drive NW, Calgary, Alberta, Canada, T2N 1N4. E-mail: sears@ucalgary.ca.

Conflict of interest We have no conflict of interests to declare.

References

Beck, A. T., & Clark, C. A. (1988). Anxiety and depression: An information processing perspective. *Anxiety Research, 1*, 23–36.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Manual for the beck depression inventory-II*. San Antonio, TX: Psychological Corporation.

Bisson, M. A. S., & Sears, C. R. (2007). The effect of depressed mood on the interpretation of ambiguity, with and without negative mood induction. *Cognition and Emotion, 21*, 614–645.

Bower, G. H. (1981). Mood and memory. *American Psychologist, 36*, 129–148.

Brainerd, C. J., & Reyna, V. F. (2002). Fuzzy-trace theory and false memory. *Current Directions in Psychological Science, 11*, 164–169.

Deese, J. (1959). On the prediction of occurrence of particular verbal intrusions in immediate recall. *Journal of Experimental Psychology, 58*, 17–22.

Dozois, D. J. A., Dobson, K. S., & Ahnberg, J. L. (1998). A psychometric evaluation of the beck depression inventory-II. *Psychological Assessment, 10*, 83–89.

Eizenman, M., Yu, L. H., Grupp, L., Eizenman, E., Ellenbogen, M., Gemar, M., et al. (2003). A naturalistic vision scanning approach to assess selective attention in major depressive disorder. *Psychiatry Research, 118*, 117–128.

Fergusson, D. M., Horwood, L. J., Ridder, E. M., & Beautrais, A. L. (2005). Subthreshold depression in adolescence and mental health outcomes in adulthood. *Archives of General Psychiatry, 62*, 66–72.

Ferré, P. (2003). Effect of level of processing on memory for affectively valenced words. *Cognition and Emotion, 17*, 859–880.

Fiedler, K., Nickel, S., Muehlfriedel, T., & Unkelbach, C. (2001). Is mood congruency an effect of genuine memory or response bias? *Journal of Experimental Social Psychology, 37*, 210–214.

Flett, G. L., Vredenburg, K., & Krames, L. (1997). The continuity of depression in clinical and nonclinical samples. *Psychological Bulletin, 121*, 395–416.

Forster, K. I., & Forster, J. C. (2003). DMDX: A Windows display program with millisecond accuracy. *Behavior Research Methods, Instruments, and Computers, 35*, 116–124.

Gallo, D. A. (2006). *Associative memory illusions*. New York: Psychology Press.

Gallo, D. A. (2010). False memories and fantastic beliefs: 15 years of the DRM illusion. *Memory & Cognition, 38*, 833–848.

Gallo, D. A., McDermott, K. B., Percer, J. M., & Roediger, H. L. (2001). Modality effects in false recall and recognition. *Journal of Experimental Psychology. Learning, Memory, and Cognition, 27*, 339–353.

Gotlib, I. H., & Joormann, J. (2010). Cognition and depression: Current status and future directions. *Annual Review of Clinical Psychology, 6*, 285–312.

Grant, M. M., Thase, M. E., & Sweeney, J. A. (2001). Cognitive disturbance in outpatient depressed younger adults: Evidence of modest impairment. *Biological Psychiatry, 50*, 35–43.

Howe, M. L., Candel, I., Otgaar, H., Malone, C., & Wimmer, M. C. (2010). The role of valence in the development of immediate and long-term false memory illusions. *Memory, 18*, 58–75.

Howe, M. L., & Malone, C. (2011). Mood-congruent true and false memory: Effects of depression. *Memory, 19*, 192–201.

Huff, M. J., & Hutchison, K. A. (2011). The effects of mediated word lists on false recall and recognition. *Memory and Cognition, 39*, 941–953.

Hutchison, K. A., & Balota, D. A. (2005). Decoupling semantic and associative information in false memories: Explorations with semantically ambiguous and unambiguous critical lures. *Journal of Memory and Language, 52*, 1–28.

Joormann, J., Teachman, B. A., & Gotlib, I. H. (2009). Sadder and less accurate? False memory for negative material in depression. *Journal of Abnormal Psychology, 118*, 412–417.

Jou, J., & Foreman, J. (2007). Transfer of learning in avoiding false memory: The roles of warning, immediate feedback, and incentive. *The Quarterly Journal of Experimental Psychology, 60*, 877–896.

Kellough, J. L., Beevers, C. G., Ellis, A. J., & Wells, T. T. (2008). Time course of selective attention in clinically depressed young adults: An eye tracking study. *Behaviour Research and Therapy, 46*, 1238–1243.

Kessinger, E. A., & Corkin, S. (2003). Memory enhancement for emotional words: Are emotional words more vividly remembered than neutral words? *Memory and Cognition, 31*, 1169–1180.

Kucera, H., & Francis, W. N. (1967). *Computational analysis of present-day American English*. Providence, RI: Brown University Press.

Lewinsohn, P. M., Solomon, A., Seeley, J. R., & Zeiss, A. (2000). Clinical implications of "subthreshold" depressive symptoms. *Journal of Abnormal Psychology, 109*, 345–351.

Leyman, L., De Raedt, R., Vaeyens, R., & Philippaerts, R. M. (2011). Attention for emotional facial expressions in dysphoria: An eye movement registration study. *Cognition and Emotion, 25*, 111–120.

Mathews, A., & MacLeod, C. (2005). Cognitive vulnerability to emotional disorders. *Annual Review of Clinical Psychology, 1*, 167–195.

Matt, G. E., Vazquez, C., & Campbell, W. K. (1992). Mood-congruent recall of affectively toned stimuli: A meta-analytic review. *Clinical Psychology Review, 12*, 227–255.

McDermott, L. M., & Ebmeier, K. P. (2009). A meta-analysis of depression severity and cognitive function. *Journal of Affective Disorders, 119*, 1–8.

McDermut, J. F., Haaga, D. A., & Bilek, L. A. (1997). Cognitive bias and irrational beliefs in major depression and dysphoria. *Cognitive Therapy and Research, 21*, 459–476.

McKendree-Smith, N., & Scogin, F. (2000). Depressive realism: Effects of depression severity and interpretation time. *Journal of Clinical Psychology, 56*, 1601–1608.

Meade, M. L., Watson, J. M., Balota, D. A., & Roediger, H. L. (2007). The roles of spreading activation and retrieval mode in producing false recognition in the DRM paradigm. *Journal of Memory and Language, 56*, 305–320.

Moritz, S., Glaescher, J., & Brassen, S. (2005). Investigation of mood congruent false and true memory recognition in depression. *Depression and Anxiety, 21*, 9–17.

Moritz, S., Voigt, K., Arzola, G. M., & Otte, C. (2008). When the half-full glass is appraised as half empty and memorised as completely empty: Mood-congruent true and false recognition in depression is modulated by salience. *Memory, 16*, 810–820.

Nelson, D. L., McEvoy, C. L., & Schreiber, T. A. (1999). The University of South Florida free association, rhyme and word fragment norms. (Available at: http://luna.cas.usf.edu/nelson/).

Nelson, D. L., McEvoy, C. L., & Schreiber, T. A. (2004). The University of South Florida free association, rhyme, and word fragment norms. *Behavior Research Methods, Instruments and Computers, 36*, 402–407.

Ochsner, K. N. (2000). Are affective events richly recollected or simply familiar? The experience and process of recognizing feelings past. *Journal of Experimental Psychology: General, 129*, 242–261.

Palmer, J. E., & Dodson, C. S. (2009). Investigating the mechanisms fuelling false recall of emotional material. *Cognition and Emotion, 23*, 238–259.

Potts, A. J., Bennett, P. J., Kennedy, S. H., & Vaccarino, F. J. (1997). Depressive symptoms and alterations in sucrose taste perception: Cognitive bias or a true change in sensitivity? *Canadian Journal of Experimental Psychology, 51*, 57–61.

Roediger, H. L., Balota, D. A., & Watson, J. M. (2001a). Spreading activation and arousal of false memories. In H. L. Roediger, J. S. Naime, I. Neath, & M. Surprenant (Eds.), *The nature of remembering: Essays in honor of Robert G. Crowder* (pp. 95–115). Washington, DC: American Psychological Association.

Roediger, H. L., & McDermott, K. B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology. Learning, Memory, and Cognition, 21*, 803–814.

Roediger, H. L., & McDermott, K. B. (2000). Tricks of memory. *Current Directions in Psychological Science, 9*, 123–127.

Roediger, H. L., Watson, J. M., McDermott, K. B., & Gallo, D. (2001b). Factors that determine false recall: A multiple regression analysis. *Psychonomic Bulletin and Review, 8*, 385–407.

Ruci, L., Tomes, J. L., & Zelenski, J. M. (2009). Mood-congruent false memories in the DRM paradigm. *Cognition and Emotion, 23*, 1153–1165.

Seamon, J. G., Luo, C. R., Kopecky, J. J., Price, C. A., Rothschild, L., Fung, N. S., et al. (2002). Are false memories more difficult to forget than accurate memories? The effect of retention interval on recall and recognition. *Memory and Cognition, 30*, 1054–1064.

Sears, C. R., Thomas, C. L., LeHuquet, J. M., & Johnson, J. C. S. (2010). Attentional biases in dysphoria: An eye tracking study of the allocation and disengagement of attention. *Cognition and Emotion, 24*, 1349–1368.

Sharot, T., Delgado, M. R., & Phelps, E. A. (2004). How emotion enhances the feeling of remembering. *Nature Neuroscience, 7*, 1376–1380.

Storbeck, J., & Clore, G. L. (2005). With sadness comes accuracy, with happiness, false memory: Mood and the false memory effect. *Psychological Science, 16*, 785–791.

Storbeck, J., & Clore, G. L. (2011). Affect influences false memories at encoding: Evidence from recognition data. *Emotion, 11*, 981–989.

Talmi, D., & Moscovitch, M. (2004). Can semantic relatedness explain the enhancement of memory for emotional words? *Memory and Cognition, 32*, 742–751.

Thapar, A., & McDermott, K. B. (2001). False recall and recognition induced by presentation of associated words: Effects of retention interval and level of processing. *Memory and Cognition, 29*, 424–432.

Toglia, M. P., Neuschatz, J. S., & Goodwin, K. A. (1999). Recall accuracy and illusory memories: When more is less. *Memory, 7*, 233–256.

Torrens, D., Marche, T. A., & Thompson, V. (2008). *Depressive symptoms and negative-biased false memories: Does dysphoria lead to schema-consistent false memories?*. Saarbrucken, Germany: VDM.

Tulving, E. (1985). Memory and consciousness. *Canadian Psychology, 26*, 1–12.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063–1070.

Watson, D., Clark, L. A., Weber, K., Assenheimer, J. S., Strauss, M. E., & McCormick, R. A. (1995). Testing a tripartite model. II. Exploring the symptom structure of anxiety and depression in student, adult, and patient samples. *Journal of Abnormal Psychology, 104*, 15–25.

Williams, J. M. G., Watts, F. N., MacLeod, C., & Mathews, A. (1997). *Cognitive psychology and emotional disorders* (2nd ed.). Chichester, UK: Wiley.

Yeh, Z. T., & Hua, M. S. (2009). Effects of depressive disorder on false memory for emotional information. *Depression and Anxiety, 26*, 456–463.

Yiend, J. (2010). The effects of emotion on attention: A review of attentional processing of emotional information. *Cognition and Emotion, 24*, 3–47.

Yonelinas, A. P. (2002). The nature of recollection and familiarity: A review of 30 years of research. *Journal of Memory and Language, 46*, 441–517.

Zuroff, D. C., Colussy, S. A., & Wielgus, M. S. (1983). Selective memory and depression: A cautionary note concerning response bias. *Cognitive Therapy and Research, 7*, 223–232.