Research Article

INVESTIGATION OF MOOD-CONGRUENT FALSE AND TRUE MEMORY RECOGNITION IN DEPRESSION

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The present study investigated the extent of mood-congruent false and true memory recognition in depression. A group of 25 patients with depression and 28 healthy controls completed a variant of the Deese-Roediger McDermott task. Four lists were read to participants in sequence, followed by a recognition task. The words in each list were associated with a central but unmentioned theme word that was either depression-relevant (i.e., loneliness), delusion-relevant (betrayal), positive (holidays), or neutral (window). Whereas it was expected to replicate the conventional mood-congruent effect in depression (better recognition of depression-relevant items), the available literature did not allow strong predictions to be made on the extent of mood-congruent false recognition in depression. Results showed that depressed patients learned emotionally charged material equally well as healthy participants but forgot significantly more neutral material. A conventional mood-congruent memory bias was not found, but relative to healthy controls, patients with depression committed more false recognition errors for emotionally charged words, particularly for depression-relevant items. The results confirm that depressed patients are biased toward emotional material. Reasons for the absence of the expected mood-congruent memory bias are discussed. It is suggested that researchers as well as clinicians should pay more attention to mood-congruent false recollection, because it may undermine the validity of autobiographic reports in depressive patients and may represent a maintenance factor for the disorder. Depression and Anxiety 21:9–17, 2005. © 2005 Wiley-Liss, Inc.

Key words: *depression; memory; mood-congruent memory*

INTRODUCTION

Over the last decades, a consistent body of evidence has indicated that patients with depression suffer from substantial memory impairment [Burt et al., 1995; Moritz et al., 2001], which in some studies was correlated with the severity of the depressive illness [e.g., Bornstein et al., 1991]. Furthermore, early cognitive research, especially in the 1980s and early 1990s, has demonstrated consistently that participants with manifest or subclinical depression share a pronounced bias to recall or recognize negative-valenced or depression-related material more efficiently than controls [Bower, 1981; Denny and Hunt, 1992]. Such a mood-congruent processing bias has also been demonstrated with attention paradigms like the emotional Stroop task, where depression-related words elicit significantly greater interference than do neutral or happy words in patients with depression [Segal et al., 1995], although typically the effect is stronger for anxiety disorders than for depression [Williams et al., 1996]. Despite some recent empirical setbacks [e.g., Banos et al., 2001], the existence of a mood-congruency effect is widely accepted in the literature. Part of the attractiveness of the theory is that it provides an elegant framework for explaining the emergence and maintenance of mood disturbances.

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A related question, which is one focus of the present study, is whether patients with depression also show an enhanced number of mood-congruent false recognition/intrusions (i.e., recognition of unstudied items), an aspect that has received little attention in prior research on mood-congruent memory. Most studies either did not report memory intrusions or were unable to compute group differences on errors due to overall low error rates [e.g., Bradley et al., 1995]. We know of only two studies that have investigated mood-congruent false memory. Murray et al. [1999] did not find any differences between dysphoric and nondepressed participants regarding mood-congruent false memory. In contrast, an early study [Watkins et al., 1992] showed that depressed patients exhibited the expected mood-congruent effect for studied items, whereas healthy participants showed a stronger bias to produce negative-valenced false recognition.

Opposing predictions can be formulated regarding the extent of mood-congruent false memory in depression when presuming better veridical memory of such material in this disorder. If depressed patients are guided by a familiarity-based strategy, whereby the extent of correctly memorized items enhances the false recognition of nonstudied items (i.e., "I think I have heard something like this before, so I guess it was presented"), a higher rate of mood-congruent hits should lead to a higher rate of mood-congruent intrusions. The use of this strategy has been inferred for other patient samples [dementia, Balota et al., 1999; schizophrenia, Moritz et al., 2004] to explain their performance pattern on the false memory paradigm (see below). Contrarily, if depressive patients are more accurate in retrieving mood-congruent material and have a conservative threshold to judge items as presented previously, one should rather expect a negative relationship between true and false memory as evidenced by healthy participants in some studies [Roediger et al., 2001].

The question of whether memory for studied items in depression is positively (such as in schizophrenic or demented patients) or negatively (such as in healthy participants) linked with increased false recognition bears importance for our understanding of the pathogenesis of depression and is also relevant to psychotherapeutic intervention. If false mood-congruent material intrudes into the memory storage to a larger extent than other material, this—along with the preferred retrieval of veridical negative-valenced information (mood-congruency effect)—may constitute an important pathogenetic factor for depressive episodes. Consciousness would be clouded with negative-valenced information via three major sources: (1) more negative life-events in the past [Olsen et al., 2004]; (2) greater accessibility of such memories, i.e., mood-congruent effect [Watkins et al., 1992]; and (3) more frequent negative-valenced pseudomemories. To put it differently, the half-empty glass may seem even less than half empty to the patient.

The present study employed a recognition test with emotionally charged material that was derived from the Deese-Roediger McDermott (DRM) paradigm [Roediger and McDermott, 1995]. The DRM paradigm elicits a high number of false recognition responses and is therefore well suited for the rationale of the present study. In the basic procedure, lists of words (e.g., *hill*, *climb*, *valley*, *summit*, *top*, *molehill*, *peak*, *plain*, *glacier*, *goat*, *bike*, *climber*, *range*, and *steep*) are presented consecutively to the participant, each converging on one so-called critical lure (e.g., *mountain*). It has been shown [Deese, 1959; Roediger and McDermott, 1995] that healthy controls frequently falsely memorize the critical lure in a later recall or recognition trial. Unlike false memory errors in other paradigms, such false memories are typically reported with high confidence and are remembered vividly by the participants. In the present study, we employed four lists tapping into different psychological states (depression-relevant, delusion-relevant, positive, and neutral).

Consistent with prior research, it was hypothesized that depressed patients would recognize more mood-congruent words (i.e., depression-relevant words) than controls would, although newer studies call for some caution regarding the replicability of this bias [Banos et al., 2001; Bazin et al., 1996; Calev, 1996]. As outlined above, no clear predictions can be made concerning the extent of false recognition. Adoption of a familiarity-based retrieval strategy, as in schizophrenic or demented patients, would predict greater false recognition of depression-related words than that in controls, whereas greater reliance on item-specific information would allow for a more effective rejection of intrusive material, thereby predicting an attenuated rate of false recognition for mood-congruent items.

SUBJECTS AND METHODS

SUBJECTS

Twenty-five inpatients who fulfilled Diagnostic and Statistical Manual-Fourth Edition (DSM-IV) diagnostic criteria for major depression or dysthymia were recruited from the University hospital for Psychiatry and Psychotherapy of Hamburg (11 males, 14 females; age: $M = 44.56$ years, standard deviation [sd] $= 12.14$ years; years of education: $M = 11.28$, $sd = 2.03$). Psychiatric diagnoses relied on the MINI psychopathological interview [Sheehan et al., 1998], which was carried out by a trained rater. The Hamilton Depression Rating Scale [HDRS; Hamilton, 1960] was administered in its 17-item version directly before the experiment ($M = 18.80$, $sd = 8.49$). Patients did not have any psychotic illness, brain damage, or substance abuse.

The healthy control group was drawn from the general population via advertisement and word-of-mouth and consisted of 28 participants (6 males, 22 females; age: $M = 35.04$ years, $sd = 12.28$ years; years of

education: $M = 11.86$, $sd = 1.74$). Healthy participants were also screened for psychopathological disturbances or substance abuse using the MINI interview. HDRS assessment was carried out before the experiment ($M = 0.91$, $sd = 1.15$).

Subjects did not significantly differ on sociodemographic background characteristics (all comparisons $P > .05$), except for age ($P = .003$). The depressed patients showed significantly higher depression scores for both the core depression subscore [items 1, 7 and 8; see Pancheri et al., 2002] and total score of the HDRS ($P < .001$). Age was carefully controlled for subsequent analyses. All participants gave written informed consent to participate after they had been fully informed about the study. Experiments were carried out in the neurocognitive facility of the psychiatric hospital.

MATERIAL

The learning lists were compiled subsequent to a norming study, in which we had asked 75 healthy participants (32 females, 32 males; 11 participants did not reveal their gender; age: $M = 31.73$ years, $sd = 9.09$ years) to produce up to five spontaneous associations for an entire set of 30 thematic words. The thematic words were depression-relevant, delusion-relevant, positive, and neutral words. These thematic words had been selected partly based on prior studies [e.g., Denny and Hunt, 1992]. Thematic words were deemed appropriate for the study if they were characteristic of the psychological state they were intended to capture. According to consensus between five raters, the following words were chosen: *loneliness* (depression-relevant), *betrayal* (delusion-relevant), *holidays* (positive), and *window* (neutral). These four thematic words also served as critical lure items in the test.

Subsequently, for each of the four theme words, lists of 12 items each were compiled. These items were sorted in descending order according to the word frequencies in the normation study (Table 1), i.e., the first word in a learning list was the word produced most often in the association study. In case association words had the same frequency the first author determined the order. Items from the four lists did not differ in word length ($P > .4$) and associative strength ($P > .05$). In particular, post hoc comparisons revealed that the neutral list did not differ from the other lists on these two variables.

To compile the items for the recognition phase, the word lists were divided into triplets of four words each (weakly related, moderately related, and strongly related to the critical lure word). From each triplet, one word was taken out for the recognition list to serve as lure item so that nine words remained for each encoding list. Of the remaining three words in each triplet, two words were chosen to be re-presented as "old" items in the recognition list. Eventually, eight recognition items were created that were unrelated to any of the list words but fit the main themes of the lists: depression-relevant (*powerless*, *tiredness*), delusion-relevant (*oppression*, *devil*), positive (*gift*, *refection*), and neutral (*girl*, *chair*).

The recognition list thus consisted of 24 old words (two for every word list of the following types: strongly, moderately, and weakly related words) and 24 new words (one for every word list of the following types: critical lure, strongly related, moderately related, and weakly related lure words, as well as eight unrelated words).

PROCEDURE

Subjects were tested individually as part of a larger neurocognitive investigation. Participants were instructed that words from four lists would be read to them. The emotional content of some of the lists was not mentioned. The four lists were then read consecutively to the subject. The lists were balanced between participants to avoid recency or primacy effects. Each list was announced as List 1, List 2, etc. Subjects were told that later they would have to recognize studied words among distracter items.

Subsequent to the presentation of the learning lists, the recognition list was administered. Subjects were required to state after each item of the recognition list whether it was old or new and whether they were confident or not in their response. Responses were recorded by the experimenter. Words from each item type were pseudorandomized within the recognition list.

RESULTS

RECOGNITION ACCURACY

We conducted a $2 \times 4 \times 3 \times 2$-way mixed analysis of variance (ANOVA) with Group (healthy and depressed participants) as between-subject and Word Type (depression-relevant, delusion-relevant, positive, and neutral), Relatedness (i.e., strong, moderate, or weak relatedness to the theme word), and Item Type (true or false) as within-subject variables. The following results are restricted to the major main effects and interactions as well as all interactions that involved Group as a factor. The percentage of recognition (i.e., "old" responses, both true and false recognition for items) served as the dependent variable. For the Relatedness factor, the lure and the strongly related items were combined into a category entitled Strong and the unrelated and weakly related items into another entitled Weak. This was done to investigate false and true recognition within a single ANOVA as there were no unrelated or critical lure items for the studied items.

We found a significant main effect of Word Type ($F[3,51] = 24.81$; $P < .001$). As can be seen from Figure 1, this is attributable to an overall lower number

TABLE 1. Word lists

Whole list	Lure words	Studied
LONELINESS (*EINSAMKEIT*)	LONELINESS	
Sad (*traurig*) (17)		Sad
Alone (*allein*) (14)	Alone	
Silence (*Stille*) (9)		Silence
Sorrow (*Trauer*) (5)		
Isolation (*Isolation*) (4)		
Emptiness (*Leere*) (4)	Emptiness	
Longing (*Sehnsucht*) (4)		Longing
Boring (*langweilig*) (4)		Boring
Depression (Depression) (3)		Depression
Dull (*dunkel*) (3)	Dull	
Cold (*Kälte*) (2)		Cold
Hermit (*Einsiedler*) (2)		
WINDOW (*FENSTER*)	WINDOW	
Light (*Licht*) (20)		Light
View (*Ausblick*) (14)		View
Air (*Luft*) (13)	Air	
Glass pane (*Glasscheibe*) (13)		
Clean (*putzen*) (10)		Clean
Open (*offen*) (7)		Open
Curtain (*Gardine*) (5)	Curtain	
Cover (*Schutz*) (4)		
Door (*Tür*) (2)	Door	
Flowers (*Blumen*) (2)		Flowers
Bird (*Vogel*) (2)		Bird
Transparent (*durchsichtig*) (2)		
HOLIDAYS (*URLAUB*)	HOLIDAYS	
Sun (*Sonne*) (47)	Sun	
Beach (*Strand*) (25)		Beach
Sea (*Meer*) (17)		Sea
Relaxation (*Entspannung*) (16)		
Recovery (*Erholung*) (10)		Recovery
Leisure (*Freizeit*) (9)	Leisure	
Fly (*Fliegen*) (6)		Fly
Vacation (*Ferien*) (5)		
Palms (*Palmen*) (4)		Palms
Travel (*reisen*) (3)	Travel	
Read (*lesen*) (3)		Read
Adventure (*Abenteuer*) (3)		
BETRAYAL (*VERRAT*)	BETRAYAL	
Disappointment (*Enttäuschung*) (11)		Disappointment
Deceit (*Betrug*) (6)	Deceit	
Back-Stabbing (*hinterhältig*) (6)		Back-stabbing
Trust (*Vertrauen*) (6)		
Mistrust (*Misstrauen*) (5)	Mistrust	
Loyality (*Treue*) (5)		Loyality
Intrigue (*Intrige*) (3)		Intrigue
Enemy (*Feind*) (3)		
Secret (*Geheimnis*) (2)	Secret	
State (*Staat*) (2)		State
Dishonest (*unehrlich*) (2)		Dishonest
Spy (*Spion*) (2)		

The original German items are set in brackets followed by the number of naming frequency in the normation study. Critical lure words (i.e., thematic words for the association study) are set in uppercase.

of old responses (i.e., false and true recognition) for the neutral words compared to that for the emotionally charged words. The main effect for Relatedness was also significant ($F[2,51] = 79.88$; $P < .001$): the higher the relatedness of the lure words to the central list theme, the more old responses were given (see Fig. 2).

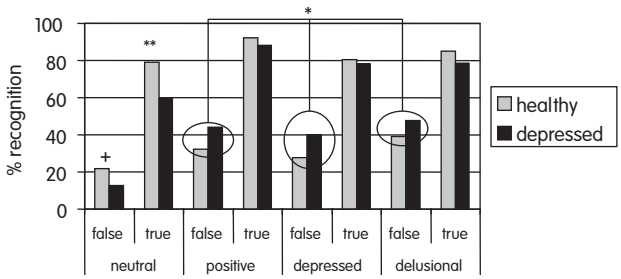

Figure 1. Percentage of true and false recognition separated for Word Type (i.e., percentage of items classified as "old"). The interaction of Group × Word Type achieved significance ($P<.001$). For emotional words, depressed patients committed more false recognition than controls did ($P<.05$), whereas the opposite pattern emerged for neutral words ($P=.07$). The true recognition rate was comparable between the groups, except for neutral words, where patients performed worse than controls did ($P=.003$). $+P<.1$; $*P<.05$; $**P<.01$.

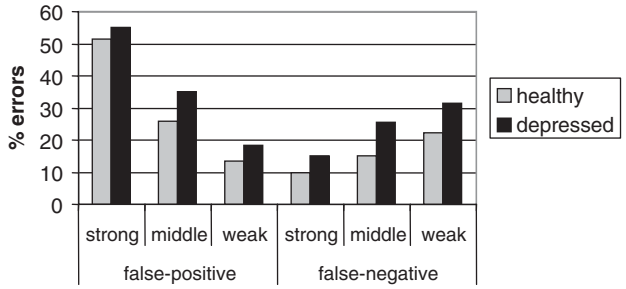

Figure 2. True and false recognition per condition. Overall, depressive patients learned less items and made more false recognitions ($P=.006$). The rate of errors was moderated by the relatedness of the distractors to the critical lure: whereas false recognition decreased with greater semantic distance from the lure, the opposite effect showed up for true recognition ($P<.001$).

A significant main effect emerged for Item Type ($F[1,51]=370.65$; $P<.001$), showing that the rate for true recognition was far greater than was the rate for false recognition (80 versus 33%). In other words, nonstudied items were more often rejected correctly as new. The main effect of Group did not achieve significance ($F[1,51]=.15$; $P>.7$); depressive patients gave as many old responses as healthy controls.

As can be seen in Figure 2, the interaction of Group × Item Type achieved significance ($F[1,51]=8.39$; $P=.006$). Although patients displayed worse true recognition than controls did (76 versus 84%; $t[51]=2.10$; $P=.04$), patients committed numerically more false recognition (36 versus 30%; *ns*).

The interaction of Group × Word Type yielded a significant result ($F[3,51]=5.54$; $P<.001$). As can be derived from Figure 1, patients showed excessively enhanced (true and false) recognition for emotional list words relative to that for neutral words in comparison

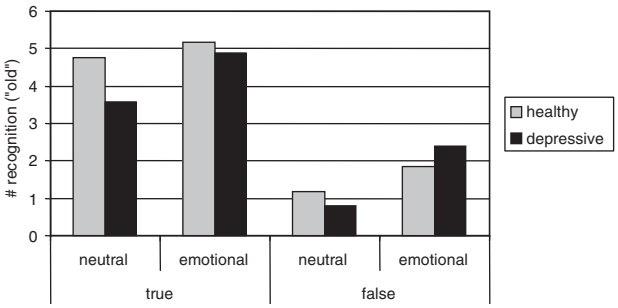

Figure 3. Subjects made more "old" responses (recognition) for emotional than for neutral words, particularly depressive patients as evidenced by a significant Group × Valence interaction.

to the recognition shown by healthy subjects. This interaction was inspected further using simple comparisons. When looking solely at true recognition, healthy and depressed subjects had comparable rates for all studied emotional items (at least $P>.2$), but depressed patients displayed decreased recognition rates for neutral words ($t[51]=3.16$; $P=.003$). Depressive patients learned all emotional words (mean recognition rate) better than neutral words (all comparisons, $t[24]>.2.9$; $P<.01$). For healthy controls, emotional words were also learned better than neutral words were ($t[27]=2.26$; $P=.03$) but this was attributable mainly to better true recognition for positive-valenced items relative to that for neutral items ($t[27]=3.32$; $P=.003$). Analyses for false recognition revealed a higher error rate in depressed patients on the emotional lists compared to that in healthy controls (all emotional lists collapsed to a mean score, $t[51]=2.00$; $P=.05$), whereas on the neutral list the opposite pattern emerged ($t[51]=1.88$; $P=.07$; see Fig. 3). A secondary analysis revealed that depressed patients falsely recognized more depression-relevant unrelated words ($t[51]=3.16$; $P=.004$). The difference turned out to be significant ($P<.05$) for both single depression-relevant items (i.e., *powerless*, *tiredness*).

Finally, we computed an additional index for core depression-relevant, positive, and neutral words. Blind to results, all words that were related to the lure words but not congruent to the corresponding emotion/psychological state were removed from the lists. For example, the word *read*, which was part of the positive (*holidays*) list (see Table 1), was not entered in this analysis as it was not judged by the authors to be unequivocally positive. This analysis showed that the true recognition for the core neutral words was significantly higher in healthy participants than in patients ($t[51]=2.70$; $P<.01$). Depressed patients again falsely recognized more depression-relevant words at trend level ($t[51]=1.84$; $P=.07$).

Correlations between the Hamilton Depression total score and true and false recognition (collapsed and

separated for the different word types) showed that lower true recognition was highly associated with severity of the depression ($r = .54$; $P = .01$). This was pronounced particularly for neutral words ($r = .62$; $P = .004$). No significant correlation emerged between depression severity and the number of false-positive recognitions.

CONFIDENCE RATINGS

A four-way mixed ANOVA was repeated, with highly confident recognition serving as the dependent variable to explore whether depressed patients would be more confident in mood-congruent items. The results were comparable to the results obtained previously with accuracy scores. The main effects for Word Type ($F[3,153] = 14.81$; $P < .001$), Relatedness ($F[2,102]; = 35.22$; $P < .001$), and Item Type ($F[1,51] = 278.06$; $P < .001$) were again significant. Importantly, the interaction of Group × Word Type ($F[3,153] = 3.47$; $P = .02$) and the interaction of Group × Item Type ($F[1,51] = 4.15$; $P = .05$) also achieved significance.

EFFECT OF AGE

Because both groups differed in age, we correlated age with false and true recognition (collapsed and separated for the different word types) but found no significant correlations. When the entire sample was split according to age (more or less than 40 years of age) no significant difference emerged ($P > .7$). Finally, age was entered as a covariate in the above four-way ANOVA. Again, age did not have any independent effect ($F[1,50] = 0.35$; $P > .5$) and results in the interactions remained essentially unchanged. In particular, none of the interactions involving age achieved significance.

RELATIONSHIP BETWEEN TRUE AND FALSE RECOGNITION

We correlated the number of correctly recognized items with the number of falsely recognized items (only related lure words; unrelated items were dropped). Whereas a rather low correspondence between true recognition and false recognition emerged for healthy participants ($r = .13$; $P > .5$), a stronger relationship between both indexes emerged for depressive patients ($r = .38$; $P = .06$).

DISCUSSION

We tested the hypothesis that depressed patients display a mood-congruent memory bias for true and pseudo-memories. We found better veridical recognition of emotional words in depressed patients relative to that for neutral words. In line with more recent research, we did not find strong evidence for mood-congruent true recognition, i.e., no statistically significant better memory for depression-relevant words. However, depressed patients tended to falsely recognize more depression-relevant new words, particularly for unrelated items.

Congruent with prior neurocognitive studies [for a metaanalysis see Burt et al., 1995], it was shown that overall patients with major depression forgot more studied items of the learning lists. In agreement with several studies that have reported a relationship between the severity of depressive symptomatology and memory deficits in depressive samples [Bornstein et al., 1991] as well as in other psychiatric diseases such as obsessive-compulsive disorder [Moritz et al., 2003], we found that the HDRS total score was related to the extent of forgetting (i.e., decreased true recognition rates), especially for neutral material.

According to cortical network models of depression [Mayberg et al., 1999], ventromedial and lateral prefrontal cortex, rostral anterior cingulate cortex, and the hippocampus–amygdala formation, regions that play a major role for neurocognitive processes, are affected in the disorder. Gray matter atrophy in depression particularly has been found in the hippocampus [for a metaanalysis see Campbell et al., 2004; Davidson et al., 2002], which is ascribed a key role for episodic memory function [Squire and Zola, 1996]. Moreover, functional magnetic resonance imaging (fMRI) studies have associated verbal memory for nonemotional material with differentiated areas of the hippocampus and its adjacent cortices [Strange et al., 2002]. A recent study has substantiated further the linkage between malfunctioning of the hippocampus and memory problems in depression [Bremner et al., 2004]. Against the background of these studies, the memory deficits of our depressive patients for nonemotional items likely reflect dysfunction in the hippocampal formation.

As noted, we did not find the conventional mood-congruent effect, predicting that depressed patients display superior memory performance for depression-related material relative to neutral and other emotionally toned material. A strong bias emerged in depressive patients to memorize emotionally charged material better than neutral material, irrespective of content. Healthy participants also displayed an "emotional memory" effect in line with prior research, especially for positive-valenced material [for a similar finding see Ferré, 2003]; however, the emotional memory effect was significantly less pronounced than it was in depressive patients.

As the mood-congruency effect is widely accepted in the literature, concerns against the reliability of the results seem legitimate at first sight. However, several recent studies have produced contradictory findings with some research showing either no mood-congruent effect [Banos et al., 2001; for a metaanalysis see Matt et al., 1992] or even a bias in favor of positive information in dysphoric participants [Calev, 1996]. Bazin et al. [1996], for example, reported that depressive patients

with subclinical symptomatology reproduced more positive than negative words, whereas manifest depressive patients showed no word type preferences compared to that shown by healthy controls. Moreover, the conventional mood-congruent effect is elicited more robustly with free recall procedures [e.g., Neshat-Doost et al., 1998]; the present study employed a recognition task.[1]

In our view, recent neuroimaging studies provide a parsimonious explanation of the present behavioral data. Subsequent memory for emotional material is thereby associated with enhanced amygdala activation during encoding [Cahill and McGaugh, 1998; Canli et al., 2000]. The relatively preserved memory for emotional material as seen in our data may thus derive from a pathologically overactive amygdala, a malfunction that is reported consistently in depression [for a review see Drevets, 2003]. Although the integrity of the amygdala is associated commonly with memory enhancement for negative-valenced, particularly anxiety-relevant information, there is also evidence that the amygdala is involved in the encoding of pleasant information [Hamann et al., 1999]. The relative sparing of emotional memory in depression may therefore stem from an overactive amygdala, which "compensates" for hippocampal deficits. Congruent with this assumption is the finding that neutral material is less well learned in depression, as the amygdala is not involved in the encoding of such material [Alkire et al., 1998].

Despite these arguments, it might seem counter-intuitive that patients with depression recognize positive and depression-related words comparatively better than neutral words. However, depressive thinking and ruminations often involve *positive* cognitions, albeit in a depressive context (e.g., fear never to regain *health*, *freedom*, *enjoyment of life*; envying others for their *talents* and *beauty*). With a rather context-free (single-word) learning procedure such as the one adopted in the present study, as well as in most other investigations, one thus may not fully grasp mood-congruent effects. Procedures providing context (with items such as "Anna is in bad health") may be more useful in this regard. In agreement with these arguments, it has been found in some studies on depression that an emotional Stroop effect can be elicited for both negative- and positive-valenced words (e.g., *fearless*, *happy*) on the condition that these are concern-related [for a review, see Williams et al., 1996]. In additional, positive cognitions may reflect an active attempt adopted by the patient to raise his/her currently decreased mood [i.e., mood repair; Calev, 1996].

Some arguments can be raised against the hypothesis that patients learn the emotional words better only when these are related to their concerns. In particular, the *holiday* list contained several words that are unrelated to depressive psychopathology (perhaps with the exception of *recovery*; see Table 1), yet this list was learned better than was a neutral list. Finally, the delusion-relevant list is only related obliquely to core depressive concerns. This indicates that depressed patients are more alert to emotional information even if this does not match their current mood.

Superior ability to recognize emotional words relative to neutral words was accompanied by an elevated number of emotional intrusions in depressed patients. At a trend level, healthy participants committed more false-positive errors than depressed patients for neutral words, whereas the opposite pattern was apparent for the emotional word lists ($P < .05$). Another important finding of the study was that patients with depression displayed more mood-congruent false memories at a trend level (i.e., more false-positive recognitions for depression-relevant words; $P = .07$). This effect achieved significance when looking at unrelated new words.

We suspect that the excess of emotional intrusions in depression is caused by a familiarity-based recognition strategy, whereby the familiarity of an item is regarded as sufficient evidence to judge an item as old/studied. Support for this hypothesis comes from the correlation between true and false recognition in depression. The relatively superior true recognition of emotional material thus enhances the probability of false recognition. Because controls do not rely so much on familiarity, as evidenced by a weaker correlational relationship between true and false recognition, healthy participants exhibit less emotional false memories, despite similar performance on true recognition for emotional words. Replication of this divergent pattern of results in healthy and depressed participants is required to draw more firm conclusions.

Clearly, further investigation into false recognition is needed, as a confirmation of our results would suggest that the validity of patients' reports is distorted in various ways. First, emotionally valenced information is recognized to a greater extent than is neutral information, which—when considering current negative contextual factors (*stress*, *rejection*, *loss*) and previous negative life events in many patients with major depression—possibly creates an overweight of negative-valenced information in consciousness of depressed patients. Secondly, due to greater reliance on familiarity in depression, the generation of mood-congruent material is accompanied by an elevated production of pseudo-memories. This may distort what the patient memorizes and may exert a major impact on the way that a patient views her/his current situation, resources, and future.

A limitation of the present paradigm is that we collected lure words around single constructs (e.g., *loneliness*), thus narrowing the range of depressive preoccupations. Moreover, although the lists did not differ regarding associative strength and word length,

[1]The depressed group may have limited attentional resources and direct their comprised resources only to emotionally meaningful words.

it cannot be ruled out that the lists differed in other aspects. This concern could be eliminated with the administration of multiple lists per condition, although any prolongation of the encoding phase may easily frustrate and exhaust depressed patients. Finally, not all words in a particular list necessarily captured the same mood. In a secondary analysis, we therefore computed a new condition in which all depression-relevant words were entered. The same analysis was carried out for words with a positive and a neutral connotation. The results remained compatible and also pointed in the direction of more mood-congruent false recognitions.

To conclude, in view of the apparent reliance of depressed patients on familiarity ("gist"-based recognition) clinicians should be very cautious to trust the memories of depressed patients, because not only is neutral information lost to a greater degree but the memory system is also susceptible to emotional false memories, at least when elicited via recognition techniques.

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