Published in : Journal of Psychopathology and Behavioral Assessment (2009), vol. 31, n°1, pp. 27-35
DOI: 10.1007/s10862-008-9093-1
Status : Postprint (Author's version)

Recollective Experience During Recognition of Emotional Words in Clinical Depression

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KEYWORDS: Clinical depression;Recognition;Remember;Know;Emotional words

ABSTRACT

Earlier work has shown that free recall tasks produce a robust mood-congruent memory effect in depression, whereas recognition tasks produce heterogeneous results. This study aimed to further investigate recognition memory for positive, negative and neutral words in depressed patients and matched comparison participants with the Remember/Know/Guess procedure for assessing recollection and familiarity. No mood-congruent memory bias effect was detected in discrimination abilities. However, depressed patients recollected (more Remember responses) more negative than positive or neutral words, whereas comparison participants recollected more positive than neutral words. No mood-congruent pattern was evidenced for Know responses. However, the depressed patients responded to fewer words overall with Know responses than the comparison participants. These results suggest that the mood-congruent memory pattern in depressed patients is related to conscious recollection rather than to familiarity. Attentional biases toward negative words and elaboration processes and/or encoding in reference to the self may contribute to these findings.

Mood-congruent memory corresponds to the tendency to retrieve information consistent with one's mood (for a review: Blaney 1986; Watkins et al. 2000). In other words, people recall or recognize stimuli that are in accordance with their mood (e.g., negative words in the case of depressed people) better than stimuli that are not in accordance with their mood (e.g., positive words in the case of depressed people). Results of studies that have investigated memory for emotional words in depression with implicit memory tasks are contradictory (e.g., Bradley et al. 1996; Ruiz-Caballero and González 1997; Watkins et al. 1992, 1996; Danion et al. 1995; Denny and Hunt 1992) while results obtained with explicit recall tasks are much clearer and have often detected a mood-congrent memory bias in depressed people (e.g., Danion et al. 1995; Denny and Hunt

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1992; Neshat-Doost et al. 1998; Ruiz-Caballero and González 1997).

Findings obtained with recognition tasks are inconsistent (Danion et al. 1995; Deijen et al. 1993; Dunbar and Lishman 1984; Moritz et al. 2005; Neshat-Doost et al. 1998). These studies explored recognition memory for neutral, positive and negative words in a clinically depressed patient group and a comparison participant group and analyzed their results on the basis of signal detection theory, which enables one to assess participants' discrimination capacities and response bias (tendency to answer yes or no whenever they have to recognize a word). Regarding discrimination capacities, only one study showed a mood-congruent memory bias in depressed patients (Dunbar and Lishman 1984). The other studies showed a range of different results, for example, that both groups (depressed and comparison participants) discriminated positive and negative words better than neutral words (Deijen et al. 1993) or worse than neutral words (Neshat-Doost et al. 1998). The results were also contradictory for the response bias score. Danion et al. (1995) found that neither the participants' status (depressed vs. comparison participants) nor the valence of the words had an influence on the response bias score. Dunbar and Lishman (1984) and Deijen et al. (1993), however, found that depressed patients and comparison participants differed regarding the response bias for positive words. Indeed, Dunbar and Lishman (1984) found that depressed patients showed a conservative bias for these words (i.e., they tended to answer "no" consistently) whereas Deijen et al. (1993) obtained exactly the opposite result (liberal bias, that is the patients tended to answer "yes"). In addition, Dunbar and Lishman (1984) showed that depressed patients have a more conservative response bias for neutral words than comparison participants.

Recently, Moritz et al. (2005) investigated recognition memory for neutral, depression-relevant, positive, and delusion-relevant words in depressed patients and comparison participants. No mood-congruent memory bias was evidenced for the percentage of hits but the authors showed that depressed people produced more false alarms for negative words than the comparison participants. It should be noted that these authors did not analyze their data according to signal detection theory.

The inconsistent results of all these recognition tasks could be related to differences in the material used (e.g., the type and number of words), the procedures (e.g., the encoding conditions) and/or the type of participants included (e.g., hospitalized or ambulatory depressed patients).

In light of these heterogeneous results, the mood-congruent recognition bias needed to be re-examined. In addition to overall recognition performance, it was important to measure the subjective state of awareness associated with each recognition judgment, which was done by using the "Remember/Know/Guess" (R/K/G) procedure (Gardiner 1988; Tulving 1985). The R/K/G procedure has been shown to result in a more fine-grained analysis of recognition memory than standard recognition tasks (e.g., Perfect et al. 1995). According to Gardiner and Richardson-Klavehn (2000), a recognition judgment can be made either because one recollects the encoded information, which means that some contextual details associated with the stimulus are recovered (Remember response), or because one has a feeling of familiarity without having any other information (Know response). The possibility of responding "I guess" (Guess response) when one does not remember or know was added to the original procedure in order to separate the Guess responses from the Know responses (see Gardiner et al. 1998). The R/K procedure has been found to be an efficient research tool to investigate cognitive functioning in psychopathological states (e.g., schizophrenia, Danion et al. 2003;

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Huron et al. 1995; dysphoria, Ramponi et al. 2004).

Only one study has used the R/K procedure to investigate memory performance in dysphoria (Ramponi et al. 2004), and it used only neutral words. Participants had to encode words in two different conditions: phonemic (count the number of syllables) and semantic (think about the meaning of the word and rate it on a scale from concrete to abstract). The results showed that dysphoric participants recollected (Remember responses) fewer words than comparison participants and that both groups' recollection was poorer after the phonemic than after the semantic encoding condition. However, familiarity (Know responses) was unaffected by dysphoric mood or by encoding condition. No previous study investigated recognition memory for neutral, negative and positive words in clinical depression with the R/K/G procedure.

Past studies using the R/K/G procedure showed that experimental manipulations that divided the attention focus during encoding (e.g., encoding words while tracking an auditory tone) decreased the number of Remember responses (e.g., Mangels et al. 2001; Parkin et al. 1995) but has little impact on the number of Know responses (Mangels et al. 2001) or has no impact at all (Parkin et al. 1995). One possible hypothesis regarding depressed patients is that rumination, which has been shown to disrupt controlled processing (Hertel 1998), decreases the amount of attention that can be allocated to the encoding of words. Consequently, it can be postulated that depressed patients will produce fewer Remember responses overall than comparison participants.

Furthermore, the level of processing was also shown to be a variable that influences recollection (Remember responses) but leaves the number of Know responses unaffected (e.g., Gardiner et al. 1999; Khoe et al. 2000). In depression, it can be assumed that an activated negative self-schema could favor a deep level of processing for negative words (semantic processing) at encoding, as well as an enhanced level of elaboration (encoded stimuli are related or linked to other information available in memory) of these words. Consequently, it can be postulated that depressed patients should show enhanced recollection (Remember responses) for negative words whereas familiarity (Know responses) should not be affected by the interaction of depressed mood state and the emotional valence of the words.

Method

PARTICIPANTS

Twenty French-speaking depressed patients constituted the clinical group. Five participants (four women and one man) were hospitalized at the time of participation, while 15 (13 women and 2 men) were ambulatory outpatients. Patients were recruited from an adult psychiatric hospital and from the outpatient department of the same hospital (hôpital de jour). The study was approved by the clinical institution in which it took place. All patients were diagnosed during routine clinical treatment for major depressive episode by an experienced psychiatrist according to the DSM-IV criteria (American Psychiatric Association 1994). The exclusion criteria were a bipolar disorder, ongoing substance abuse and/or a neurological problem that would impair cognitive functioning. The patients were referred to the experimenter (third author) by two psychiatrists. Comorbid

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disorders were not documented and anxiety disorders cannot be excluded. The inpatients were hospitalized for at least one week and the experimental procedures were administered then. For the outpatients, the experimental procedures were administered as they participated in a day hospital program. None of the patients was in remission. The mean age of the clinical group was 42.20 ± 7.25 years and their mean number of years of education was 13.25±3.84. The Beck Depression Inventory (BDI-II, Beck et al. 1996; French version: Éditions du Centre de Psychologie Appliquée 1998) was used to assess the current severity of their depressive symptomatology. The depressed participants included in this study all scored higher than 17 on the BDI-II (mean score: 35.75±11.00). The participants' BDI-II scores correspond to mild to severe depressive symptomatology (2 patients were in a mild depressive state, 2 in a moderate depressive state and 16 in a severe depressive state). The mean number of past depressive episodes was 3.45± 1.50 (min. 1, max. 7). All patients except one were taking antidepressant medication at the time of testing [11 patients were taking an SSRI (selective serotonin reuptake inhibitor), 5 an SNRI (serotonin–norepinephrine reuptake inhibitor), 2 patients a TCA (tricyclic antidepressant) and 1 a NaSSA (norad-renergic and specific serotonergic)]. Moreover, 13 patients were taking a benzodiazepine at the time of testing and 2 patients a neuroleptic medication (prescribed to reduce anxiety symptoms) while one patient was on both kinds of medication.

Twenty gender-, age-and education-matched comparison participants were recruited from the same cultural community as the depressed patients (mean age: 42.25± 6.73 years; mean number of years of education: 14.20± 3.12). Participants in the comparison group had not previously suffered from clinical depression and had no prior neurological impairment or history of substance abuse. Their BDI-II scores were all below 7 (the mean score for the comparison group was 2.10±2.29).

The stimulus pool used in this study is composed of 66 French verbs ending with *-er*. These words were selected from a list of 300 French verbs created by the first author. A group of 20 students rated each word in the list according to its affective valence and mental imageability. Valence was evaluated on a Likert scale from 1 (very positive) to 7 (very negative). Mental imagery was evaluated on a Likert scale from 1 (difficult to represent mentally) to 7 (easy to represent mentally). Sixty-six verbs were selected: 22 that represent positive affective valence (e.g., 'to triumph,' 'to admire'), 22 that represent negative affective valence (e.g., 'to depress,' 'to beg') and 22 that represent neutral affective valence (e.g., 'to measure,' 'to pivot'). These verbs had equivalent (a) frequency of occurrence in the French language (LEXIQUE database, New et al. 2001) (neutral: 4.59±3.44; negative: 4.11±3.90; positive: 4.54±4.12); (b) number of letters (each valence group had six nine-letter words, six eight-letter words and ten seven-letter words); and (c) degree of mental imageability (neutral: 3.42±1.05; negative: 3.79±0.88; positive: 3.82±1.09). Each group differed according to its valence value (neutral: 3.65± 0.23; negative: 5.96±0.57; positive: 2.33±0.43).

Each group of 22 valenced words was subdivided into two sets of 11 verbs (set A and set B). This was done in order to use either set A or set B as targets. Among each group of valenced words, the two sets were equivalent according to (a) the frequency of occurrence of the words in the French language; (b) the number of letters; (c) the degree of mental imagery; and (d) the valence value.

The order of word presentation during encoding and during recognition was counterbalanced across participants (two encoding orders, E1 and E2, and two recognition orders, R1 and R2). For 12 participants in

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each group, set A was used as targets and set B as distractors, and for the remaining eight participants, set B was used as targets and set A as distractors. For half of the participants of each group (six who saw set A as targets and four who saw set B as targets), words were encoded in the E1 order, and for the other half, words were encoded in the E2 order. For half of the participants who encoded words in the E1 order, the recognition order was R1 and for the other half the recognition order was R2. The same was true for the participants who encoded words in the E2 order.

PROCEDURE

The session began with the signing of an informed consent form. Then some personal information (age, number of years of education and number of past depressive episodes) was collected and the BDI-II was completed. After this, the recognition task was presented. The task ran on E-Prime 1.0. Participants were seated in front of a 15″ screen. The recognition task began with a learning phase (encoding 33 target words). Words always appeared one at a time in lower case in the center of the screen in white on a black background (character size: Arial 60). Participants had to read aloud and memorize the words, which appeared on the screen for 4 s. The instruction that appeared on the screen was the following: "Memory task: You will see a series of words on the screen. These words are going to appear on the screen one by one for 4 seconds each. Your task will be to read these words aloud and to look at them carefully so you can recognize them later on." There was no attempt to promote a specific level of processing (e.g., surface or deep encoding). The interstimulus time was 1 second. After the encoding phase, participants had to count backwards in ones for 1 min, starting at 136. Then the recognition phase began. Words from the encoding phase (33 target words) were inter- mixed with new words (33 distractor words). Participants had to decide whether they had seen the presented word before. Each time participants recognized a word, they had to describe their recognition awareness in more detail. They could answer either "I remember" (R), "I know" (K) or "I guess" (G). Participants received detailed instructions about the distinction between R, K and G responses before the recognition phase. These instructions were adapted from those used by Gardiner and colleagues (Gardiner et al. 1998). Briefly, participants were told that an R response should be given to any word which, at the time it was recognized, brought to mind something they had consciously experienced (e.g., an association, a thought, a feeling). In contrast, they were asked to make a K response if the word felt familiar but they were unable to recollect details of its prior exposure. Finally, they were asked to make a G response if they were unsure whether or not the word had been presented in the study phase. As soon as the participant gave an answer, the experimenter pressed a key so that the next word appeared. Participants had unlimited time to make their judgments and no data were collected regarding the decision time.

DATA ANALYSIS

The overall recognition performance for each type of word (neutral, negative and positive) was examined from the perspective of signal detection theory (Snodgrass and Corwin 1988). Two measures, namely a discrimination index (capacity to recognize a studied word among distractor words) and a response bias index (tendency to answer "yes" or "no" when having to recognize a word), were computed following

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Snodgrass and Corwin's (1988) method. These indices were computed separately for each valence. Proportions of hits and false alarms (FAs) for each valence were transformed into *Z* scores. The *Z* score for a given probability corresponds to the quantile function of the normal distribution. Proportions needed to be corrected before they were transformed into *Z* scores in order to avoid infinite *Z* scores when a proportion was equal to 1 or 0. The hits and FAs, respectively, were corrected with the following formulae: $P_{corrected}$(hit) = (number of hits + 0:5) / number of studied words +1) and $P_{corrected}$(FA) = (number of FAs + 0:5° /number of distractor words + 1). Corrected hit and FA probabilities were then transformed into *Z* scores: respectively, [$Z(P_{corrected}$hit)] and [$Z(P_{corrected}$FA)]. A discrimination index (*d*′) was obtained for each valence by the following formula: [$Z(P_{corrected}$hit)] – [$Z(P_{corrected}$FA)]. A *d*′ value of 0 or less indicates that subjects were unable to discriminate studied words from distractor words. A high *d*′ value indicates good discrimination abilities. A response bias index (*C*) for each valence was obtained by the following formula: - 0:5 [$Z(P_{corrected}$hit)] + [$Z(P_{corrected}$FA)]. A C index with a positive sign indicates a conservative bias (participants have tendency to answer "no" when they have to recognize a word) and a *C* index with a negative sign indicates a liberal bias (participants have tendency to answer "yes" when they have to recognize a word).

Moreover, according to the recommendations of Wilkinson and the Task Force on Statistical Inference (1999), effect sizes for main and interaction effects of the ANOVAs are reported (partial eta squares—η_p^2).

Non-parametric Mann–Whitney *U* tests were computed to compare inpatients (*n* -5) and outpatients (*n* -15) on all measures (total hits, proportion of R, K and G for hits, false alarms (FAs), proportion of R, K and G for FAs) and showed no significant effects. Consequently, the analyses amalgamate in- and outpatients.

RESULTS

For each group and for each valence (neutral, negative and positive), means (and standard deviations) for total hits and for the number of R, K and G responses for hits are presented in Table 1, as are means (and standard deviations) for total FAs and for the number of R, K and G responses for FAs.

ANALYSES OF PROPORTIONS OF HITS

Separate 2 (group) × 3 (valence) ANOVAs were conducted on the overall proportion of hits and on the amount of R, K and G responses for hits.

Regarding the total proportion of hits, there was no significant effect [valence: $F(2,76)= 2.677$; $p = 0.08$; $\eta_p^2 =$ 0:07; group: $F(1,38)= 2.76$; $p= 0.11$; $\eta_p^2 =$ 0:07; interaction ($F(2,76)=2.414$; $p=0.10$; $\eta_p^2 =$ 0:06].

The results for R responses showed no group effect [$F(1,38)= 0.00$; $p = 0.98$; $\eta_p^2 =$ 0:00] but a significant valence effect [$F(2,76)= 8.058$; $p < 0.01$; $\eta_p^2 =$ 0:18], and a significant interaction [$F(2,76)= 5.434$; $p < 0.01$; $\eta_p^2 =$ 0:13].

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Table 1 Means (standard deviations) for proportions of total Hits and FAs, for the amount of R, K words and G responses, for discrimination scores (*d*') and for response bias scores (C) for neutral, negative and positive

		Depressive patients			Comparison participants		
		Neutral	Negative	Positive	Neutral	Negative	Positive
Hits	Total	0.67 (0.24)	0.81 (0.17)	0.73 (0.19)	0.81 (0.19)	0.81 (0.17)	0.83 (0.15)
	R *	0.30 (0.22) a	0.53 (0.21) b	0.44 (0.25) c	0.39 (0.26) d	0.40 (0.27) d,e	0.48 (0.30) e
	K	0.21 (0.17)	0.15 (0.13)	0.16 (0.14)	0.30 (0.20)	0.26 (0.21)	0.27 (0.22)
	G	0.16 (0.14)	0.13 (0.13)	0.13 (0.10)	0.12 (0.14)	0.15 (0.15)	0.08 (0.10)
FAs	Total	0.15 (0.11)	0.26 (0.26)	0.20 (0.16)	0.22 (0.18)	0.20 (0.17)	0.21 (0.16)
	R *	0.04 (0.06) a,b	0.09 (0.17) a	0.03 (0.06) b	0.02 (0.05) d	0.03 (0.08) d,e	0.04 (0.09) e
	K	0.05 (0.07)	0.07 (0.12)	0.07 (0.11)	0.09 (0.09)	0.07 (0.08)	0.07 (0.09)
	G	0.06 (0.07)	0.10 (0.12)	0.10 (0.12)	0.11 (0.12)	0.10 (0.12)	0.10 (0.09)
d'		1.47 (0.71)	1.65 (0.71)	1.58 (0.64)	1.75 (0.97)	1.73 (0.79)	1.74 (0.68)
C		0.25 (0.47)	−0.09 (0.61)	0.12 (0.52)	−0.05 (0.38)	−0.04 (0.38)	−0.09 (0.36)

**Within each group, means that do not share a letter are statistically different based on planed comparisons.*

Planned comparisons showed no differences between depressive patients and comparison participants regarding the number of R responses for neutral, negative and positive words [neutral: $F(1,38)=1.276$; $p= 0.27$; negative: $F(1,38)=2.602$; $p=.12$; positive: $F(1,38)= 0.225$; $p = 0.64$). However, the depressed patient group gave more R responses for negative words than for neutral words (F (1,38)= 19.71; $p < 0.001$); they also gave more R responses for positive words than for neutral words [$F(1,38)= 8.593$; $p < 0.01$]. The difference between the number of R responses for negative compared to positive words approached significance [$F(1,38)=3.738$; $p=0.06$]; more R responses were given for negative than positive words. Comparison participants made marginally more R responses for positive than for neutral words [$F(1,38)= 3.819$; $p= 0.06$]. No other difference between valences was significant (neutral vs. negative: $F(1,38)=0.074$; $p= 0.79$; negative vs. positive: $F(1,38)= 2.992$; $p = 0.09$).

The results for K responses showed no valence effect or interaction effect [respectively, $F(2,76)= 1.149$; $p = 0.32$; $\eta_p 2 = 0:03$, and $F(2,76)= 0.067$; $p= 0.94$; $\eta_p 2 = 0:00$], but a significant group effect [$F(1,38)= 5.260$; $p < 0.05$; $\eta_p 2 = 0:12$]. Depressed subjects gave fewer K responses than comparison participants.

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The results for G responses showed no significant effects [valence: $F(2,76)=1.564$; $p=0.22$; $\eta_p{}^2 =$ 0:04; group: $F(1,38)=0.542$; $p=0.47$; $\eta_p{}^2 =$ 0:01; interaction: $F(2,76)= 1.314$; $p= 0.28$; $\eta_p{}^2 =$ 0:03].

ANALYSES OF PROPORTIONS OF FAS

Separate 2 (group) × 3 (valence) ANOVAs were conducted on the total proportion of FAs and on the amount of R, K and G responses for FAs.

The results for the total proportion of FAs showed no significant effects [valence: ($F(2,76)= 1.628$; $p = 0.20$; $\eta_p{}^2 =$ 0:04; group: $F(1,38)= 0.025$; $p = 0.87$; $\eta_p{}^2 =$ 0:00; interaction: $F(2,76)= 2.701$; $p= 0.07$; $\eta_p{}^2 =$ 0:07].

The results for the amount of R responses for FAs also showed no valence or group effects [respectively, $F(2,76)=1.863$; $p = 0.16$; $\eta_p{}^2 =$0:05, and $F(1,38)= 0.769$; $p =0.39$; $\eta_p{}^2 =$0:02], but there was a significant interaction [$F(2,76)=3.456$; $p <0.05$; $\eta_p{}^2 =$0:08]. Planned comparisons showed no difference between depressed and comparison participants for any valence group [neutral: $F(1,36)=1.678$; $p = 0.20$; negative: $F(1,36)= 2.028$; $p = 0.16$; positive: $F(1,36)=0.559$; $p =0.46$). However, the depressed patients gave more R responses for FAs for negative words than positive words [$F(1,38)= 7.691$; $p< 0.01$]. The depressed patients' results showed no difference between neutral and negative words [$F(1,38)= 3.231$; $p = 0.08$] or between neutral and positive words [$F(1,38)= 0.912$; $p= 0.35$]. For the comparison participants, the difference between neutral and positive word approached significance [$F(1,38)=3.648$; $p = 0.06$]. No other difference between valences was significant [neutral vs. negative: $F(1,38)=0.129$; $p= 0.72$; negative vs. positive $F(1,38)= 0.728$; $p= 0.40$].

The results for K responses for FAs showed no significant effects [valence: $F(2,76) = 0.03$; $p =0.97$; $\eta_p{}^2 =$ 0:00, group: $F(1,38)= 0.42$; $p =0.52$; $\eta_p{}^2 =$ 0:01, interaction: $F(2,76)= 0.58$; $p = 0.56$; $\eta_p{}^2 =$0:02].

The results for G responses for FAs showed no significant effects either [valence: $F(2,76)= 0.396$; $p= 0.67$; $\eta_p{}^2 =$ 0:01, group: $F(1,38)= 0.315$; $p = 0.58$; $\eta_p{}^2 =$0:01, interaction: $F(2,76)= 1.424$; $p= 0.25$; $\eta_p{}^2 =$ 0:04].

DISCRIMINATION AND RESPONSE BIAS INDICES

The discrimination and response bias indices (d' and C) for each group and valence are presented in Table 1. Separate 2 (group) × 3 (valence) ANOVAs were conducted on the d' and C indices.

The results for the d' index showed no significant effects [valence: $F(2,76)=0.220$; $p= 0.80$; $\eta_p{}^2 =$0:01; group: *F(1,38)=0.768; p=0.39;* $\eta_p{}^2 =$ 0:02; interaction: $F(2,76)= 0.325$, $p= 0.72$, $\eta_p{}^2 =$ 0:01.

The results for the C index also showed no significant effects [valence: $F(2,76)=2.214$; $p=0.12$; $\eta_p{}^2 =$ 0:06; group: $F(1,38)=1.713$; $p =0.20$; $\eta_p{}^2 =$0:04; interaction: $F(2,76)= 2.969$; $p= 0.06$; $\eta_p{}^2 =$ 0:07].

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PEARSON CORRELATIONS

In order to investigate whether the memory bias observed in the depressed patient group is related to the amount of reported depressive symptoms and/or to the number of past depressive episodes, Pearson correlations were computed. To do these analyses, two memory bias indices were computed for the hits and the FAs with R responses: (a) Neu-Neg, which corresponds to a bias toward negative words over neutral words (the percentage of R responses for negative words is subtracted from the percentage of R responses for neutral words); (b) Pos-Neg, which corresponds to a bias toward negative words over positive words (the percentage of R responses for negative words is subtracted from the percentage of R responses for positive words). The results showed no significant correlation between the BDI-II score and the memory bias indices nor was there a significant correlation between the number of past episodes and the memory bias indices (see Table 2).

Finally, correlations between the BDI-II score, the number of past depressive episodes and the total number of K responses for hits were considered. The results showed that there was no significant correlation between the number of K responses for hits and the BDI-II score [$r(20) = -0.32$; $p = 0.17$] or between the number of K responses for hits and the number of past depressive episodes [$r(20) = -0.18$; $p = 0.45$].

Discussion

The aim of this study was to explore recognition memory for neutral, negative and positive words in depressed participants by using the R/K/G procedure. No mood-congruent memory pattern was evidenced for the proportion of hits and the discrimination index. However, some evidence of a mood-congruent memory pattern was seen in depressed patients when they consciously recollected words (R responses). Furthermore, the results showed that depressed patients gave fewer K responses overall than comparison participants.

Several factors may potentially have contributed to the mood-congruent pattern found in the present study when words were consciously recollected (R responses). First, several studies showed that depressed patients present an attentional bias toward negative material (Gotlib et al. 2004; Mogg et al. 1995; Joormann 2004; Murphy et al. 1999). It could be that an attentional bias during the encoding phase may favor the creation of links between the negative words and other contents available in memory. A second potential explanation could be related to the cognitive schemata that characterize depressed patients (Beck et al. 1979). It can be hypothesized that a strongly interconnected negative cognitive structure as identified by Dozois and Dobson (2001) in depressed people facilitates the encoding of new negative words and the creation of associations. This may also account for the finding that depressed patients provide more R responses for FAs regarding negative words compared to positive words. It could be that irrelevant associations may be more easily activated and may erroneously provide false contextual information (false

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recognition with R responses).

Table 2 *Pearson correlations between the BDI-II score, the number of past depressive episodes and the memory bias indices for the depressed patient group*

			BDI-II		Number of past depressive episodes	
			r	*p*	*r*	*p*
Hits	R	Neu-Neg	0.24	0.31	0.07	0.78
		Pos-Neg	0.19	0.43	−0.11	0.64
FAs	R	Neu-Neg	−0.27	0.26	0.16	0.50
		Pos-Neg	−0.25	0.28	0.10	0.68

This would not be the case for positive words, as the positive selfsystem is less interconnected in depression (Dozois and Dobson 2001). For that matter, Moritz et al. (2005) showed that depressed patients falsely recognized more depression- related words than comparison participants. Future studies could investigate whether both enhanced false recognitions of negative words and enhanced correct recognitions of negative words reinforce the negative cognitive structure of depressed patients.

A third possible hypothesis regarding the enhanced R responses for negative words in depressed people refers to encoding in reference to the self. Watkins et al. (2000) proposed that this factor might contribute to mood-congruent memory biases in depressed patients. In the present study, at least two factors could have contributed to self-referential encoding. On the one hand, the negative attributional style (tendency to attribute the causality of negative events to internal factors) that characterizes depressed patients could have favored the encoding of negative words in reference to the self (Abramson et al. 1989). On the other hand, the use of verbs (e.g., 'to cry') rather than nouns (e.g., 'tears') may have facilitated encoding in reference to the self. Nouns label something in the world whereas verbs depend more on the semantic context in which they are used (Kersten and Earles 2004). One possible assumption regarding depressed patients is that they see themselves as the context of encoding for negative verbs. Consequently, recollection of negative verbs may be enhanced since the self serves to cue the encoding context at the time of recognition.

As mentioned above, a mood-congruent memory bias has been evidenced when words are consciously recollected (R responses) but there was no overall reduction of R responses contrary to the findings of Ramponi et al. (2004) who used the R/K/G procedure to investigate memory for neutral words in dysphoric participants. Ramponi et al. (2004) found that the dysphoric participants made fewer R responses than comparison participants and there was no group difference for K responses. That study and this one, however, are very different in terms of the sample (dysphoric vs. depressed) and the stimuli (neutral words vs. neutral and emotional words). Using a mixed list of words (neutral and emotional words) may have enhanced the attention that depressed patients paid to the words overall (including, by extension, the neutral words) during the encoding phase, thereby preventing any decrease in their overall number of R responses. Moreover,

Published in : Journal of Psychopathology and Behavioral Assessment (2009), vol. 31, n°1, pp. 27-35
DOI: 10.1007/s10862-008-9093-1
Status : Postprint (Author's version)

the negative verbs used were not all specifically related to depression what could have weakened the enhanced recognition effect for these words in depressed patients. This may have contributed to the lack of difference between groups specifically for negative words. Finally, the absence of a group difference could also be related to the fact that the samples are rather small, which could have had an influence on the statistical power to detect differences.

In addition to the findings for R responses, the results also showed a group difference for the amount of K responses. Several hypotheses can be formulated to interpret this finding. Firstly, it can be postulated that part of the depressed patients' attention was captured by aspects independent of the task (e.g., ruminations) and this may have decreased the amount of K responses. Indeed, divided attention during the encoding process can resulted in fewer K responses (Mangels et al. 2001) andin fewer R responses (but see Parkin et al. 1995 for contradictory results) but no evidence for this latter result was found in the present study.

A second interpretation is related to the nature of K responses. To engage in familiarity-based recognition, people have to use clues such as fluency of processing due to repetition (Jacoby and Dallas 1981) and/or the positive affect that can also result from repeated presentation of words (mere exposure effect, Zajonc 1968). From this perspective, at least two assumptions can be made. On the one hand, depressed patients may have fewer clues on which they can base their familiarity-based recognition decisions (e.g., processing fluency, positive affect). Quoniam et al. (2003), for example, showed that depressive patients are unable to develop positive affect for previously presented material. On the other hand, depressed people may develop clues but be less able to rely on them (e.g., difficulties attributing the clues to the correct source).

Finally, it is worth noting that the results suggest that neither the intensity of the depression nor the fact that a person has repeatedly experienced depressive episodes determines the mood-congruent memory effect. It can be hypothesized that certain phenomena that accompany being depressed (e.g., activation of negative schemata, attentional bias) matter more than the intensity of the symptoms or the fact of having experienced past episodes.

Certain limitations on the present study must be acknowledged. For one thing, there was no objective measure of rumination, which could have enabled a direct test of the proposed hypothesis. Moreover, it should be recognized that a bigger sample could have enhanced the statistical power. Furthermore, it should also be noted that almost all the patients were taking different medication at the time of testing and that the effects of medication on memory performance for valenced material still remain to be clarified. Finally, it should be noted that the negative words were more arousing than the positive words, which were more arousing than the neutral words[1]. In this regard, it could be that a different arousal level across word

[1] *In response to a reviewer comment, 20 independent raters evaluated the 66 words for their arousal level with the 9-point Self-Assessment Manikin (SAM) scale (Bradley and Lang 1994). SAM depicts the arousal dimension with a graphic character arrayed along a continuous 9-point range from 1 (sleepy with eyes closed) to 9 (excited with eyes open). Analyses showed that negative words were the most arousing (6.19; SD 1.04), followed by the positive words (4.10; SD 0.76), and lastly the neutral words (3.29; SD 0.69) - (all ts > 3.698; all ps < .01).*

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DOI: [10.1007/s10862-008-9093-1]()
Status : Postprint (Author's version)

categories enhanced both recollection (R responses) and familiarity (K responses; Kensinger and Corkin 2003). However, differences in arousal level seem not to be a central feature as there were within-group differences in performance.

In conclusion, in this study, no mood-congruent memory pattern was found for the discrimination indices but it was shown that in depressed patients, a particular state of consciousness, namely recollection, is associated with the increased recognition of negative words over neutral and positive words. The exploration of memory in depression with the R/K/G procedure offers the opportunity to analyze recognition performance more accurately than traditional approaches would allow.

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