



## DIRECTED FORGETTING IN MAJOR DEPRESSION

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**Abstract:** Basing ourselves upon the cognitive processing and recall of information, we studied directed forgetting in a sample of individuals diagnosed with major depressive disorder. The sample consisted of 30 such subjects and also included 15 subjects diagnosed with panic disorder and 30 subjects without a psychopathological disorder. The depressed subjects were evaluated on two occasions three months apart. We used a series of clinical scales and a Directed Forgetting Task. The results indicated that the instruction to forget was effective for the three groups. Depressed subjects showed a bias towards negative information in the processing and recall of information in depressed subjects. In addition, a self-characterisation task showed a devalued sense of self in the depressed subjects. Overall, our findings suggest that, in depressed subjects, positive characterisations do not resonate in a sufficiently strong self to have an impact on information recall.

**Keywords:** Depression; directed forgetting; information processing; panic disorder.

*Olvido dirigido en la depresión mayor*

**Resumen:** Basándonos en el procesamiento cognitivo de la información y el recuerdo, estudiamos el olvido dirigido en una muestra con diagnóstico de depresión mayor. La muestra estaba constituida por treinta participantes con diagnóstico de depresión mayor, incluyendo también quince participantes con diagnóstico de trastorno de pánico y treinta participantes sin alteración psicopatológica. Los participantes deprimidos fueron objeto de dos evaluaciones con un intervalo de tres meses. Utilizamos una batería de instrumentos clínicos y una tarea de olvido dirigido. Los resultados indican que la instrucción para olvidar fue efectiva en los tres grupos. Constatamos un sesgo relacionado con la información de valencia negativa en el procesamiento y evocación de la información en los participantes deprimidos. Encontramos también que, en los participantes deprimidos, se daba una desvalorización del self en una tarea de auto-caracterización. En general, los resultados sugieren que en los individuos deprimidos las caracterizaciones positivas no poseen resonancia en un self suficientemente fuerte para influir en el recuerdo de la información.

**Palabras clave:** Depresión; olvido dirigido; procesamiento de la información; trastorno de pánico.

### INTRODUCTION

Directed forgetting is the “forgetting of certain information after an instruction is given in that sense” (Cláudio, 1998, p. 256). Two tasks in particular can be used to assess it: (1) the item method, in which participants are asked to forget or remember specific items after being presented with them, a process involving a subject’s encoding capacity; or (2) the list

method, where a list of items is presented to the subject, and halfway through the presentation of the list the subject is asked to forget the previous items and remember the subsequent ones. Compared to the item method, the list method requires more of a subject’s information retrieval capacity (Araya, 2003; Foster & Sahakyan, 2011; Icht, Chajut, & Algom, 2013; Kliegl, Pastötter, & Bäuml, 2013; Sahakyan & Foster, 2009; Sahakyan & Kelley, 2002; Spillers & Unsworth, 2011; Williams, Hong, Kang, Carlisle, & Woodman, 2013).

According to Cláudio (2004, p. 111), the effects of directed forgetting in depression “would show a noticeable memory bias, which would be related to mood congruence”. This

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memory bias would be triggered because depressed patients, in contrast to subjects without psychopathology, tend to recall negative adjectives more easily than positive ones (lower forgetting rate of negative adjectives than positive adjectives) (Power, Dalgleish, Claudio, Tata, & Kentish, 2000). The research work of Berman et al. (2011) also pointed in this direction.

The process of directed forgetting can be influenced, according to Bjork (1972), by two coding mechanisms: selective rehearsal and set differentiation. In selective rehearsal, the subject focuses on information emerging after being instructed to forget certain information related to the instruction of oblivion. In set differentiation, the subject forms two groups of information – one to forget and another to remember.

In the research work of Cláudio (1998) and Power et al. (2000), subjects who were clinically depressed completed tasks of directed forgetting. In these tasks, before presentation of the information to be recalled (Bjork 1970), an instruction was given to forget a certain piece of information. The results from both studies were consistent with the existence of a mnemonic bias in depressed subjects, revealing a higher forgetting rate of positive adjectives relative to subjects without depressed mood and who were not clinically depressed. These depressed subjects processed, retained and preferentially evoked negative information, i.e., mood-congruent stimuli. Liang et al. (2011) later reinforced the existence of this congruence effect in subjects with social anxiety. Saunders (2012) identified a forgetting effect for neutral but not for negative stimuli with respect to low-anxious subjects.

Kobayashi and Tanno showed that the forgetting effect occurs for neutral but not for negative words (Kobayashi & Tanno, 2013), a finding consistent with results from Otani et al. (2012), which documented a significant directed forgetting effect for positive and neutral, but not for negative stimuli. In addition, Hanczakowski, Pasek and Zawadzka (2012) examined directed forgetting using discrimination and recognition list tasks. The authors observed the directed forgetting effect in conjunction with the discrimination list task but not the recognition list.

Mathews and MacLeod (2005) discussed the importance of information bias in the

development and maintenance of certain disorders. This bias may be due to several factors (e.g., mood-congruent ruminant thoughts, attention focus, or cognitive avoidance) that may contribute to the subjects' greater vulnerability when faced with external information. This idea is consistent with findings from several other investigative works (Joormann & Tran, 2009; Liang, Hsu, Hung, Wang, & Lin, 2011; Wingenfeld, Terfeh, Meyer, Löwe, & Spitzer, 2012) that identified ruminant thinking as one of several factors that generate and maintain certain emotional disorders. However, Groome and Sterkaj (2010) failed to find an effect for directed forgetting in depressed subjects, i.e., the authors were unable to confirm whether the results were due to memory bias.

On the other hand, Wessel and Merckelbach (2006) explored the relationship between resistance to forgetting and negative material due to information bias: negative material presented in their directed forgetting task was not more resistant to forgetting than the other stimuli. This led the authors to conclude that directed forgetting may be an effective strategy to help an individual overcome certain problems, such as the constant repetitive, negative and invasive thoughts that come to mind. Wong and Moulds (2008) observed the same absence of bias upon examining the impact of depressive rumination on subjects' encoding styles; they concluded that standard forgetting effects, such as depressive rumination, did not impact the encoding of positive or negative information for students who displayed the highest levels of dysphoria presented in both groups (rumination and distraction).

Several studies have attempted to confirm whether it could be possible for depressed individuals to undergo training to intentionally forget information through the use of specific instructions to forget or suppress recurrent negative materials. Cumulatively, these studies concluded that directed forgetting can reduce the frequency of ruminant thoughts, and thus, is a possible and effective strategy in the treatment of depressed subjects (Joormann, Hertel, Brozovich & Gotlib, 2005; Joormann, Hertel, LeMoult & Gotlib, 2009, LeMoult, Hertel & Joormann, 2010).

The aim of this investigation was to engage participants in a directed forgetting task and

then compare the observed performance among three groups, including depressed subjects, subjects with panic disorder and subjects with no psychopathological disorders. We also compared results from the two evaluations for depressed subjects.

The following two research questions were asked: (a) Is the adaptive process, created by inhibiting one's ability to access information, possible in depressed subjects? (b) Is the easier access to negative information observed in depressed subjects related to a preference for congruent information or to a decrease in the ability to process positive information? Based on the theoretical models, we hypothesised a relationship between depression and information processing. However, it may be easier to process negative information that references the self. Such aspects should become more evident with the increasing severity of the depression.

Thus, the following hypotheses were elaborated: (a) depressed subjects will recall more negative words from the first word list than the other two groups; (b) depressed subjects will recall fewer words from the second list of words; (c) depressed subjects will recall more negative words than positive words from the second list; and (d) depressed subjects will recall more negative words from the second list than the other groups.

Furthermore, we considered the same hypotheses when comparing results from depressed subjects at both times of assessment in both evaluation moments, taking into consideration the different severity levels of depression.

## METHOD

### *Participants*

The sample consisted of 30 participants with a major depressive diagnosis (mean age = 45.20 years,  $SD = 9.99$ ), 15 subjects diagnosed with panic disorder with or without agoraphobia (mean age = 33.70 years,  $SD = 6.43$ ), and 30 participants without psychopathological disorder (mean age = 37.6 years,  $SD = 11.07$ ). Clinical subjects were diagnosed according to DSM-IV diagnostic criteria (American Psychological Association, 1994) and the

inclusion criteria were (a) were currently without any psychopharmacological medication or had been on stable medication for at least three months, (b) could read and write, and (c) had no obvious impairment in visual acuity. Most clinical patients (73.3% and 86.7% of patients with depression and panic disorder, respectively) had been treated with anti-depressive/anxiolytic medication for at least three months. In each of the two clinical samples, subjects had been symptomatic for more than six months with no comorbidity. The provenance of the subjects was diversified: psychiatry and psychology appointments at different hospitals, the psychiatry department of the Aviation Medicine Service of the Portuguese Air Force, and private psychotherapy appointments. The origin of the nonclinical participants was also diverse and included students from the Institute of Applied Psychology and workers from different companies and institutions. Age differences were found between the three groups ( $F = 8.18, p < .05$ ); according to Tukey test, the mean age of the depressive group was higher than the mean of the remaining groups ( $p < .05$ ). Clinical and demographic variables are summarised in Table 1.

### *Measures*

*Directed forgetting task.* We selected 40 adjectives (20 positive and 20 negative) for this task, based on responses given by a sample of 350 students. The task was administered in two stages. First, we asked that each student write 20 positive adjectives. Second, after collecting this first sheet of responses, we asked them to write 20 adjectives having a negative valence. Through the analysis of the answers, we obtained the 20 most frequent positive and negative adjectives. The 40 adjectives selected were the following: (a) Positive: Sincere, Sweet, Beautiful, Funny, Generous, Understanding, Solidary, Kind, Satisfied, Nice, Loving, Affectionate, Dedicated, Confident, Intelligent, Optimistic, Honest, Brave, Calm, and Happy. (b) Negative: Treacherous, Cynical, Jealous, Ignorant, Liar, Hypocrite, Selfish, Dishonest, Unpleasant, Stupid, Repressive, Sad, Arrogant, Pessimistic, Hostile, Intolerant, Fearful, Stingy,

Table 1. Socio-demographic characteristics of the sample

		Depressed <i>n</i> = 30	Panic <i>n</i> = 15	Normal <i>n</i> = 30
Gender	Female	76.7%	80%	71.4%
	Male	23.3%	20%	28.6%
Medication	Yes	73.3%	86.7%	0%
	No	26.7%	13.3%	100%
Marital Status	Single	16.7%	20%	23.8%
	Married	63.3%	66.7%	52.4%
	Divorced	13.3%	13.3%	23.8%
	Widowers	6.7%	0%	0%
Qualifications	First to Fourth grade	30%	13.3%	14.3%
	Fifth to Sixth grade	10%	0%	0%
	Seventh to Ninth grade	6.7%	33.3%	19%
	High School	23.3%	26.7%	28.6%
	Bachelor	6.7%	10%	9.5%
	College Frequency	6.7%	13.3%	9.5%
	Graduate level or Higher	30%	13.3%	19%
Profession	Owners or senior positions	13.3%	20%	19%
	Liberal profession	3.3%	0%	4.8%
	Specialized work on an employed basis	26.7%	20%	19%
	Workmen, unskilled workers and rural workers	33.3%	40%	28.6%
	Student, housewife and no worker	23.3%	20%	28.6%

Note. Depressed = depressed patients, Panic = panic disordered patients, and Normal = participants without psychopathological disorder.

Vindictive, and Despicable. After the assessment of the adjectives, we established two lists. A total of 10 positive and 10 negative adjectives were selected for the first and second lists. The order of adjectives was pseudo-randomised so that no more than two adjectives with the same valence were presented consecutively.

*The Hamilton Rating Scale for Depression* (HRSD; Hamilton, 1960). We used the Portuguese translated version used by the Laboratory of Medical Psychology of Santa Maria Hospital (Lisbon). Internal consistency (alpha coefficient) in the present study was .77.

*The Beck Depression Inventory* (BDI; Beck, Ward, Mendelson, Mock & Erbaugh, 1961). In an unpublished study conducted in 1990 by the first author, we translated the BDI into Portuguese, testing and correcting the instrument in a sample of 1,500 student (Clinical and Health Psychology Department, ISPA, Lisbon). Internal consistency (alpha coefficient) in the present study was .81.

*The Hamilton Rating Scale for Anxiety* (HRSA; Hamilton, 1959). We used the translated version into Portuguese used by the

Laboratory of Medical Psychology of Santa Maria Hospital (Lisbon). Internal consistency (alpha coefficient) in the present study was .73.

*The State and Trait Anxiety Inventory* (STAI, Y Form; Spielberger, 1983). We used the Portuguese version translated by Américo Baptista (unpublished). Internal consistency (alpha coefficient) in the present study was .72 (STAI-Trait) and .68 (STAI-State).

*The Adult Sub-Verbal Test of the Wechsler Scale* (WAIS; 2008). This scale was translated and adapted into Portuguese by Leandro Almeida (unpublished). Internal consistency (alpha coefficient) in the present study was .67.

## PROCEDURE

We gave each subject a grid with four columns and twenty rows. The columns were labelled “Characterises Me Very Much”, “Moderately Characterises Me”, “Slightly Characterises Me”, and “Does not Characterise Me”. Each line corresponded to a single adjective. Next, the following instruction was given: “Read attentively

each word that appears on the screen. The words may characterise you very much, moderately, slightly or not at all. For each word, mark with a cross the option that best characterises you. There are no right or wrong answers. You must learn the words and then repeat them". After the instruction, the first list of adjectives was presented.

After presenting this first list, we provided the subjects with the following statement: "So far you have been practicing; you should forget all the words that you have read so far. Words will continue to appear on the screen. Read each one carefully. The words may characterise you very much, moderately, slightly or not at all. For each word, mark with a cross the option that best characterises you. There are no right or wrong answers. You must learn the words and then repeat them". Next, the second list of adjectives was shown.

When the presentation ended, subjects were told to count backwards from 250 to zero. The purpose of this request was to introduce a distraction task lasting three minutes. After three minutes, regardless of whether the subject had finished counting, we provided a blank sheet of paper and gave the following instruction: "From the words you saw, write down those you remember". If the subject asked the researchers if the words were from the first or second list, they were told the words were from the second list. The subjects were given five minutes to write all the words they remembered; afterwards, responses were collected.

We performed two separate evaluations of the depressed subjects with a three-month interval, with the aim of assessing differences in directed forgetting between the two time

points. We chose the three-month interval for two reasons: (a) to allow enough time for a subject to experience changes in the level of depression and (b) to minimise any memorisation effects on the assessment tasks.

Before conducting the experimental procedure, the participants completed the clinical measures and the vocabulary test of the WAIS.

### Data analysis

Analysis of variance (ANOVA) was conducted to compare results across the three groups. We used the Tukey post-hoc test to evaluate specific differences between two groups. To compare responses between the first and second evaluations of depressed subjects, we used the Student's t-test for paired samples. Moreover, we used multivariate analysis of variance (MANOVA) to analyse the *vectors* of means for the three groups. We calculated Pearson coefficients to estimate correlations. When multiple statistical tests were required, we applied the Bonferroni correction to reduce the possibility of Type I error.

## RESULTS

Descriptive statistics for clinical measures and vocabulary are shown in Table 2. We also indicate in the table the statistical differences between the groups on such variables.

Table 2. Means, *SDs* and differences between groups on clinical and vocabulary variables

	Depressed <i>n</i> = 30		Panic <i>n</i> = 15		Normal <i>n</i> = 30		<i>F</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
HRSD	13.1	5.65	11.7	5.47			
BDI	19.5 <sup>a</sup>	8.56	19.1 <sup>a</sup>	12.09	7.7 <sup>b</sup>	7.46	11.61*
HRSA	18.7 <sup>a</sup>	6.92	27.7 <sup>b</sup>	9.26			
STAI state	58.3 <sup>a</sup>	11.42	54.1 <sup>a</sup>	10.40	38.0 <sup>b</sup>	10.73	21.89*
STAI trait	48.3 <sup>a</sup>	12.50	46.0 <sup>a</sup>	7.83	36.5 <sup>b</sup>	10.72	7.54*
Vocabulary	22.8	12.47	17.3	7.75	26.8	11.83	3.01

*Note.* Means sharing superscripts are not significantly different at the .05 level according to Tukey post-hoc test. Depressed = depressed patients, Panic = panic disordered patients, and Normal = participants without psychopathological disorder.

HRSD = Hamilton Rating Scale for Depression, HRSA = Hamilton Rating Scale for Anxiety.

\*  $p < .05$ .

*Analysis of the directed forgetting task*

## Analysis of total words

At both time points, we observed (see Table 3) that the mean value of total words recalled

from the second list (first evaluation:  $M = 4.8$ ,  $SD = 2.67$ ; second evaluation:  $M = 5.6$ ,  $SD = 2.21$ ) was significantly higher ( $p < 0.05$ ) than for the first list (first evaluation:  $M = 3.2$ ,  $SD = 1.64$ ; second evaluation:  $M = 2.8$ ,  $SD = 2.25$ ).

Table 3. Means, SDs and differences on words in the factors of the Directed Forgetting Task in the group of depressed participants (first and second evaluations) ( $n = 30$ )

	First evaluation		Second evaluation		<i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Total Words 1st List	3.2 (1)	1.64	2.8 (3)	2.25	1.10
Positive Words 1st List	1.6 (2)	1.22	1.1 (4)	2.25	2.14
Negative Words 1st List	1.6	1.04	1.7	1.35	-0.34
Total Words 2nd List	4.8 (1)	2.67	5.6 (3)	2.21	-2.26
Positive Words 2nd List	2.8 (2)	1.87	3.1 (4)	1.48	-1.21
Negative Words 2nd List	2.1 1.87	1.87	2.5	1.50	-1.53

Note. Means sharing numbers in parenthesis are significantly different at .05 level according to Student's *t* test between words in the same temporal condition (see text).

In addition, the group of subjects with panic disorder (first list:  $M = 3.3$ ,  $SD = 1.54$ ; second list:  $M = 6.7$ ,  $SD = 2.43$ ) and the group with no psychopathological disorder (first list:  $M = 3.5$ ,  $SD = 2.04$ ; second list:  $M = 6.3$ ,  $SD = 2.28$ ),

each presented significantly higher scores on total words ( $p < 0.05$ ) than did the group of depressed subjects (see Table 4). However, when controlling for age no significant differences were found ( $p > 0.05$ ).

Table 4. Means, SDs and differences on words in the factors of the Directed Forgetting Task for the three groups, controlling for age

	Depressed <i>n</i> = 30		Panic <i>n</i> = 15		Normal <i>n</i> = 30		<i>F</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Total Words 1st List	3.2	1.64	3.3 (1)	1.54	3.5 (4)	2.04	0.19
Positive Words 1st List	1.6	1.22	1.7 (2)	1.22	1.6 (5)	1.24	0.09
Negative Words 1st List	1.6	1.04	1.6 (3)	0.91	1.9 (6)	1.28	0.40
Total Words 2nd List	4.8 <sup>a</sup>	2.67	6.7 <sup>b</sup> (1)	2.43	6.3 <sup>a,b</sup> (4)	2.28	3.66*
Positive Words 2nd List	2.8	1.87	3.6 (2)	1.82	2.9 (5)	1.46	1.15
Negative Words 2nd List	2.1	1.44	3.1 (3)	1.06	3.3 (6)	1.59	5.80

Note. Means sharing superscripts are not significantly different at the .05 level according to Tukey post-hoc test. Means sharing numbers in parenthesis are significantly different at .05 level according to Student's *t* test between words in the same group (see text). Depressed = depressed patients, Panic = panic disordered patients, and Normal = participants without psychopathological disorder.

\*  $p < .05$ .

## Analysis of positive words

For depressed subjects at both time points (see Table 3), the mean number of positive words recalled from the second list (first evaluation:  $M$

$= 2.8$ ,  $SD = 1.87$ ; second evaluation:  $M = 3.1$ ,  $SD = 1.48$ ) was significantly higher ( $p < 0.05$ ) than the mean number of positive words recalled from the first list (first evaluation:  $M = 1.6$ ,  $SD = 1.22$ ; second evaluation:  $M = 1.1$ ,  $SD = 1.27$ ).

In subjects with panic disorder, the mean number of positive words recalled from the second list ( $M = 3.6, SD = 1.82$ ) was significantly higher ( $p < 0.05$ ) than the number recalled from the first list ( $M = 1.7, SD = 1.22$ ) (see table 4).

In subjects with no history of psychopathological disorders, the mean number of positive words recalled from the second list ( $M = 2.9, SD = 1.46$ ) was significantly higher ( $p < 0.05$ ) than that from the first list ( $M = 1.6, SD = 1.24$ ). However, differences between the three groups were not significant ( $p > 0.05$ ).

#### Analysis of negative words

At the first time point, there was no significant difference ( $p > 0.05$ ) in the number of negative words recalled from the first list ( $M = 1.6, SD = 1.04$ ) compared to those from the second list ( $M = 2.1, SD = 1.44$ ). At the second time point, the mean number of negative words recalled from the second list ( $M = 2.5, SD = 1.50$ ) was significantly higher ( $p < 0.05$ ) than from the first list ( $M = 1.7, SD = 1.35$ ). By comparing data from the two points, we can observe that the number of negative words recalled at the second time point was significantly higher ( $p < 0.05$ ) for the second list (Table 3).

In subjects with panic disorder (first list:  $M = 1.6, SD = 0.91$ ; second list:  $M = 3.1, SD = 1.06$ ) and subjects with no history of any psychopathological disorder (first list:  $M = 1.9,$

$SD = 1.28$ ; second list:  $M = 3.3, SD = 1.59$ ), the mean number of negative words recalled was significantly higher ( $p < 0.05$ ) in the second list (see Table 4).

#### Analysis of the words considering primacy and recency effects

We conducted the analysis described above while removing the first and last words from each list to limit possible primacy and recency effects. In the first list, we removed the words “Repressive” and “Dedicated”, and in the second list we removed the words “Arrogant” and “Funny”.

For depressed subjects at the first evaluation, the mean number of total and positive words recalled was significantly lower than non-depressed subjects in both lists ( $p < 0.05$ ) while controlling for primacy and recency effects. Regarding negative words, there were no significant differences ( $p > 0.05$ ) in the first list. This was in contrast with findings for the second list, which showed mean numbers that were significantly lower ( $p < 0.05$ ), also considering the above-referenced effects.

In the second evaluation of depressed subjects, analyses showed no significant differences in the first list ( $p > 0.05$ ) at any level. However, in the second list, subjects recalled a significantly lower mean number ( $p < 0.05$ ) at all levels of analyses, again while controlling for primacy and recency effects (see Table 5).

Table 5. Means, *SDs* and differences on words in the factors of the Directed Forgetting Task for the depressive group ( $n = 30$ ), considering primacy and recency effect (first and second evaluations)

	First valuation		Second evaluation		<i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Total Words 1st List	2.6	1.61	2.7	2.26	-0.35
Positive Words 1st List	1.1	1.14	1.1	1.27	-0.15
Negative Words 1st List	1.5	1.01	1.6	1.35	-0.52
Total Words 2nd List	4.2	2.29	5.0	2.04	-2.90
Positive Words 2nd List	2.3	1.62	2.7	1.46	-1.58
Negative Words 2nd List	1.9	1.31	2.3	1.37	-1.66

Depressed = depressed subjects, Panic = panic disorder subjects, and Normal = subjects without psychopathological disorder.

In subjects with panic disorder, the mean values from both lists of total and positive

words recalled were significantly lower ( $p < 0.05$ ) compared to the average for all words,

accounting for primacy and recency effects. The mean number of negative words recalled was significantly lower ( $p < 0.05$ ) for the second list,

when considering the primacy and recency effects (see Table 6).

Table 6. Means, SDs and differences on words in the factors of the Directed Forgetting Task for the three groups, considering primacy and recency effect

	Depressed $n = 30$		Panic $n = 15$		Normal $n = 30$		F
	M	SD	M	SD	M	SD	
Total Words 1st List	2.6	1.61	2.8	1.61	3.0	1.84	0.35
Positive Words 1st List	1.1	1.14	1.2	1.42	1.2	1.12	0.09
Negative Words 1st List	1.5	1.01	1.6	0.91	1.8	1.33	0.40
Total Words 2nd List	4.2 <sup>a</sup>	2.29	5.9 <sup>b</sup>	2.39	5.3 <sup>ab</sup>	2.03	3.33*
Positive Words 2nd List	2.3	1.62	3.1	1.87	2.4	1.34	1.21
Negative Words 2nd List	1.9 <sup>a</sup>	1.31	2.8 <sup>ab</sup>	1.08	2.9 <sup>b</sup>	1.44	4.76*

Note. Means sharing superscripts are not significantly different at the .05 level according to Tukey post-hoc test. Means sharing numbers in parenthesis are significantly different at .05 level according to Student's  $t$  test between words in the same group (see text). Depressed = depressed patients, Panic = panic disordered patients, and Normal = participants without psychopathological disorder.

\* $p < .05$ .

In subjects with no history of a psychopathological disorder, the average number of recalled words was significantly lower ( $p < 0.05$ ) when controlling for primacy and recency effects in the following cases: (a) total recalled words from both lists; (b) positive words recalled in both lists; and (c) negative words recalled from the second list. We conducted a second analysis using repeated measures multivariate analysis of variance between groups, and the results confirmed those obtained from the previous ANOVAs. Thus, we can affirm that the results are reinforced by the existence of this dual analysis.

#### *Analysis of recalled words and self-characterisation*

We reduced the level of self-characterisation from four to two categories. Specifically, "Does Not Characterise Me" and "Slightly Characterises Me" were condensed to "Does Not Characterise Me" while "Characterises Me Very Much" and "Characterises Me Moderately" were combined into "Characterises Me". This modification enabled a finer statistical analysis of the results, allowing us to then incorporate a Chi-Square test.

Analysis of subjects' self-characterisations showed that for depressed subjects at both first evaluation, significantly higher frequencies ( $p < 0.05$ ) were observed in the category "Characterises Me" for the following words: *Affectionate*, *Generous*, *Sweet*, *Solidary*, *Loving*, *Understanding* and *Dedicated*. In the second evaluation of these subjects, we observed that words significantly used in the same category ( $p < 0.05$ ) were the same: *Affectionate*, *Generous*, *Sweet*, *Solidary*, *Loving*, *Understanding* and *Dedicated*.

Subjects with panic disorder significantly used the category "Characterises Me" ( $p < 0.05$ ) for *Affectionate*, *Generous*, *Sweet*, *Solidary*, *Loving* and *Understanding*. In subjects with no history of psychopathological disorders, the first list was significant ( $p < 0.05$ ) in the category "Characterises Me" for *Affectionate*, *Generous*, *Sweet*, *Solidary*, *Loving*, *Understanding*, *Dedicated*, *Optimistic*, *Calm* and *Confident*.

In the category "Characterises Me", at the first evaluation (second list) the words to which depressed subjects significantly referred ( $p < 0.05$ ) were *Kind*, *Sincere*, *Honest*, *Nice* and *Sad*. In the second evaluation, the significant words ( $p < 0.05$ ) included *Kind*, *Sincere*, *Honest*, *Nice*, *Sad*, *Funny* and *Pessimistic*.

Subjects with panic disorder presented significantly higher ( $p < 0.05$ ) word frequencies

in the category “Characterises Me” for *Kind, Sincere, Honest, Nice and Intelligent*. Subjects with no history of a psychopathological disorder presented significantly higher ( $p < 0.05$ ) word frequencies in this category for *Kind, Sincere, Honest, Nice, Brave, Happy, Satisfied* and *Funny*.

## DISCUSSION

Our study yielded some important findings regarding the Directed Forgetting Task. For instance, at the first evaluation (first list), the number of words recalled by depressed subjects was very similar to that from the other two groups. Thus, we must reject our first hypothesis, i.e., we did not confirm that depressed subjects would recall more negative words from the first list compared to the other groups. Indeed, comparing results from the first and second lists, we observed that the instruction to forget had an effect on all groups, given that the number of recalled words from the second list was significantly higher than from the first list. Overall, the results indicated that depressed subjects, regardless of the severity of their depression, applied the instruction to forget to both the positive and the total words, but not to the negative words. However, in the other two groups the effect of the instruction was observed for negative words as well.

In the first evaluation of depressed subjects, the mean number of total words recalled from the second list was significantly lower than the results found for subjects with panic disorder. Furthermore, the mean value of negative words recorded by depressed subjects was significantly lower than that of subjects with no psychopathological disorders. While these results confirmed our second hypothesis that depressed subjects would recall fewer words from the second list, they invalidated the fourth hypothesis, which anticipated that depressed subjects would recall more negative words from the second list than the other groups would. Moreover, depressed subjects recalled more positive words than negative words, on average, invalidating our third hypothesis, which stated that depressed subjects would exhibit greater recall of negative words from the second list.

Evidence for this deficit was reinforced by the results from the second evaluation. When comparing both evaluations, we found that in the second evaluation, at which time the severity of the depression was lower, more words were recalled, in total as well as in both positive and negative valences, approaching the performance of the other two groups. This result suggests that less severe depression allows for better performance in a recall task, and thus, supports the existence of a memory deficit in individuals with depression.

Primacy and recency effects did not occur in the first list of negative words in any group. However, such effects were observed for the positive words in all three groups, with the exception of the second evaluation of the depressed subjects. In the second word list, this effect was observed for both positive and negative words in each group. These results might be because the first word from the first list had a negative valence and was later excluded from this analysis. This word, which was the first word shown to subjects at the beginning of the task, could have been an object of diminished information processing.

Regarding the total number of recalled words from the second list, it was interesting to observe that the subjects with no history of any psychopathological disorder were those on whom primacy and recency effects were most clear, followed by subjects with panic disorder and finally by depressed subjects.

For the characterisation profile, the group of words that were most often identified as “*Characterises Me*” was consistent across groups for the first list. Positive adjectives selected by depressed subjects in their self-characterisation were related to characteristics that others tend to value in a relationship, i.e., attributes that enhance interpersonal relationships, such as *Generous* and *Affectionate*. In subjects with no psychopathological disorder, those two adjectives coexisted with other positive assessments of themselves, such as *Optimistic, Calm* and *Confident*.

Cumulatively, these results reinforce the idea that depressed subjects have a devalued perception of self and only consider themselves as possessing positive attributes when these are

referred by others. This indicates the existence of an ambivalent self in the context of a strong sociotropic structure. This might result from the fact that, in depressed subjects, positive characterisations tend not to resonate in a sufficiently strong self to become evident at the level of recall. Additionally, negative bias observed in depressed subjects can be considered a characteristic of depression because it was not present in any of the other studied groups. This bias could be associated with a greater focus of attention on negative information along with a decrease in positive bias. As indicated by our results, depressed subjects showed an inability to block access to negative information. Unfortunately, such an ability, which was observed in non-depressed subjects, is one of the pillars of the adaptation process.

To alleviate their symptoms, it is essential to help depressed subjects develop the ability to process and recall positive information. One way to accomplish this is by modifying the encoding process to repair the processing and recalling of negative information, fostering a more effective cognitive psychotherapeutic intervention overall.

Further studies should compare subjects with major depression to those from other psychopathological groups to achieve a better understanding of the relationship between depression and memory processes. It will also be important to study a larger number of subjects with major depression and without medication and to conduct a longitudinal analysis by conducting follow-ups after completion of a cognitive psychotherapy treatment.

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