

# Uncovering Negative Interpretation Bias in Remitted/Recovered Depression with Laboratory Task

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## Abstract

**Objective:** Research has demonstrated that individuals with a history of depression engage in complicated strategies (e.g., thought suppression) that may mask the possible existence of major depression. Increasing the mental strain, such as retrieving a six-digit number, may reveal depressive thinking in previously depressed individuals. This study examined the hypothesis that thought suppression could mask a cognitive vulnerability to depression and illustrated how cognitive tasks disrupt mind control.

**Method:** This case-control study recruited 255 participants with a convenience sampling method conducted at the Razi Educational and Therapeutic Psychiatric Center (Tehran, Iran) in 2021. Participants were divided into five groups, then they were evaluated by a scrambled sentence test (SST) after random assignment to either mental load or no mental load conditions. The number of negative unscrambled statements was used as an index of negative interpretation bias. After gathering data, analysis of variance (ANOVA) for different group factors and conditions was carried out to test the main hypotheses.

**Results:** The effect of the intervention provided to each group on the score of the Hamilton Depression Rating Scale (HRDS) was significant ( $F(4, 208) = 511.77, P < 0.001$ ). A significant correlation ( $r = 0.36, P < 0.01$ ) was found between depression (HDRS) and negative interpretive bias (SST). Analysis of ANOVA has revealed a significant effect on the group ( $F(4, 412) = 14.94, P < 0.001$ ). The effect of the mental load was not significant ( $F(4, 412) = 0.09, P = 0.75$ ), but the group  $\times$  load interaction was significant ( $F(4, 412) = 5.03, P < 0.001$ ). Post hoc test was used to draw multiple comparisons between the five groups.

**Conclusion:** The results revealed that people who are vulnerable to depressive disorders are predominantly engaged in thought suppression, which can conceal their depressogenic thinking until cognitive requests consume their mind control efforts.

**Key words:** *Bias; Depressive Disorder; Interpretation; Remission; Vulnerability*

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**D**epression is one of the most prevalent psychiatric disorders and has numerous personal and social consequences. Depression has a global point prevalence and annual incidence of approximately 4.7% and 3%, respectively (1, 2). About 350 million people worldwide suffer from depression. Also, recent research has found that the prognosis for depression in primary care situations is worse than previously thought.

In recent decades, research into the cognitive factors underlying depression has exploded (3, 4). Cognitive based psychotherapy interventions rely heavily on cognitive biases that play a causal role in clinical symptoms. Thus, identifying the contributing factors to the onset and continuation of depression is critical for the conceptualization and treatment of this disorder (5). A specific line of research has identified abnormalities in how people perceive vague emotional cues associated with depression (1). Typically, previous researches have shown that negative interpretive biases are regarded as overarching cognitive factors that are not mood-dependent (6, 7).

Many studies have been conducted to answer questions about the role of interpretive bias in different groups of depression (acute, remission phase, recovery phase) (4, 8, 9). While assumptions are direct in this regard, empirical findings are not entirely consistent. Some meta-analysis studies have found negative interpretive bias in depressed patients and have provided significant research support for cognitive model predictions (4, 9). In contrast, other studies have highlighted the inconsistency of research findings (3, 8).

The theories of depression predict that the rate of negative interpretation biases is different in different groups of depression (acute, remission and recovery) (6). On the other hand, depression theories predict that the rate of interpretive bias varies across different groups of depression (6, 7). In determining these hypotheses, studies have examined a variety of samples, including patients diagnosed with major depressive disorder (MDD), undiagnosed individuals who report higher levels of depressive symptoms on self-report scales, and depressed patients in recovery (3, 4, 8-10). Theoretical models have suggested that negative interpretation bias is a vulnerability that persists beyond periods of depression (7). Hence, it is also expected that people who recover from depression will continue to show negative interpretive bias.

It is unclear whether there are differences in the rate of interpretive bias between depressed groups who have different clinical statuses (11). Meta-analysis shows negative interpretive biases in improved depression and concludes that interpretive bias is found even in the absence of relatively severe symptoms of depression. Such a finding could represent vulnerabilities to incidence, recurrence, and relapse (1). One of the clinical implications of this finding is that cognitive bias, at one level of processing, can hold dysfunctional

attitudes at other levels of information processing. It is noteworthy that information processing biases work together in various cognitive functions (attention, memory, and interpretation) to cause symptoms to persist, but this interpretive bias has been shown to cause the persistence of other cognitive biases (12, 13).

Previous research has used only self-assessment tools to determine the role of cognitive biases after complete recovery from depression (14). Studies using these scales have reported that people who recover from depression do not differ in the level of cognitive components compared to people who have never been depressed (15). Researchers have suggested that using self-report tools might fail in detecting negative interpretation biases in people with improved depression (16). The absence of evidence of negative interpretation biases in previously depressed people may be due to the attempted control to reduce reports of unwanted negative thinking (17). Researchers designed the scrambled sentences test SST (a task to evaluate interpretive bias) to overcome this problem. In this test, they interfere with the efforts of vulnerable individuals who are trying to mentally control their negative thinking by giving them an additional mental load (e.g., memorizing a 6-digit number) when arranging scrambled words to create a meaningful sentence that interferes with cognitive control (18). This innovative model seems to reveal the interpretation biases of depressed people better than self-report scales.

The present study seeks to correct the weaknesses and gaps in previous studies. In addition, it is unclear (or at least the findings are inconsistent) whether there are differences in the rate of interpretive bias among depressed groups with different clinical statuses (1, 11). In addition, the importance of such research in the field of implicit cognition in depression may result from classifying high-risk groups of depression (for example, based on the interpretive bias) (1, 19). Previous researches have mostly used self-report tools to investigate interpretation bias in depression (1, 19). Addressing these research gaps and inconsistency of findings can be considered another fundamental goal of the present study.

Therefore, the present study aimed to identify the role of interpretive bias in major depressive disorder in acute, remission, and recovery phases and in individuals who have not yet experienced a period of major depression. In other words, the aim of the present study is to investigate whether interpretation bias persists in vulnerable individuals after remission and recovery.

## Materials and Methods

The study design is causal-comparative. The statistical population of the study included depressed patients in different stages of recovery (acute, remission, and recovery phase, as well as insufficient symptoms of depressive disorder) and people who have not experienced major depression in their life. The sampling

method was convenience sampling. Because causal-comparative studies require more than 50 samples (20), the sample size includes 255 participants who were assigned to five comparison groups. The participants were assigned to the comparison groups based on a psychiatric interview according to the DSM-5 diagnostic criteria. The individuals were assigned to the groups based on their psychiatric history and a clinical interview that was performed by a licensed psychiatrist. After that, the Hamilton Depression Rating Scale (HDRS) was used to ensure whether the patient was in the recovery or the remission phase (21). Individuals who were never depressed were selected by publishing an advertisement about participating in the study and by the convenience sampling method.

The criteria for entering participants into each group included: 1) participants in acute depressed group were selected based on the psychiatric interview; those participants who possessed the criteria for MDD diagnosis and who had a score higher than 17 in HDRS were selected. 2) Remitted depressed participants were defined as those who had few symptoms of depression. The operational definition of remission was the score HRSD < 6 for three weeks (22). 3) Recovery depressed participants were defined by the period of stable remission that indicates the elimination of the indicators of the disorder period. operational definition of recovery was the score HRSD < 6 for six months and more (22). 4) Depressed participants with insufficient symptoms were defined as those who had symptoms of the major depressive disorder but did not meet the full criteria for MDD, and whose symptoms lasted for at least two weeks (23). 5) The never depressed participants were selected after obtaining a precise history and clinical interview. If the participants had not experienced any depressive episode in their lifetime, they were entered in this subgroup (24).

Inclusion criteria included depressed patients in different stages of recovery (acute, remission, recovery phase), depressed patients with insufficient symptoms, and people who had not experienced major depression in all their lifetime; being in the age range of 18 to 65 years; not receiving psychotherapy; not having a primary physical illness (such as heart disease, stroke); not taking a drug that affects the patient's cognition; not having seasonal depression; not having depression with psychotic characteristics; and not having major psychiatric disorders (such as schizophrenia, delusional disorder). Exclusion criteria included unwillingness to participate in the study, lack of cooperation and inability to complete the questionnaire owing to poor mental status and lack of interest in continuing with the study.

#### Measures

**Personal/clinical information form (demographic):** age, gender, education, marital status, number of depressive episodes, age of onset of depressive disorder, duration of depressive disorder, duration of current depressive episode, a combination of antidepressant

medications, and duration of antidepressant medication use.

**Hamilton Depression Rating Scale (HDRS):** this clinical interview has 17 items and evaluates the severity of depressive symptoms. The Persian version of this questionnaire has good psychometric properties (25) with reliability Cronbach's alpha of 0.89. Inter-rater reliability of HDRS was 0.90 to 0.094. In previous studies congruent validity was 0.60 to 0.84. The test-retest analysis has shown that  $r = 0.89$ .

**Scrambled sentences task (SST):** In the present study, a paradigm of 40 scrambled sentences was used that had been developed by Wenzlaff & Bates in 1998 to assess depression-related interpretation biases (IBs). Each set of words allows the participant to make a positive or negative sentence (e.g., the future looks bright/bleak). It is assumed that SST acts as a measure of interpretive bias. The sentences were presented randomly in pencil-paper format, and participants were asked to make a sentence from the available words. The SST score is determined by the number of positive and negative sentences compiled according to instructions (grammatically correct sentences using five words). SST was scored by dividing the score of negative sentences by the total score of sentences. The advantage of using ratios as an indicator of interpretation bias is that it controls the total number of possible sentences. Consistent with previous research (26, 27) using SST, this task is performed in two stages; that is, under mental load and without mental load. Participants were asked to memorize a six-digit number while unscrambling 20 sentences in the mental load condition. Participants were asked to recall the six-digit number following the mental load condition. In conditions without mental load, participants were asked to unscramble 20 scrambled sentences without additional instructions. Participants were given five minutes to complete each set of 20 sentences (with and without mental load) and were asked to do so quickly. Würtz and colleagues (19) reported in a review research that SST has good convergent validity (BDI-II:  $r = 0.51^{**}$ ) and reliability (Test-Retest in 50 days:  $r = 0.76$ ; Split Half = 0.72; Cronbach's  $\alpha = 0.92$ ). In Novović's (28) research, the correlation between SST and depression symptoms was significantly higher than the correlation between SST and anxiety symptoms ( $P < 0.01$ ). In the present research, a significant positive correlation ( $r = 0.36$ ,  $P < 0.01$ ) was found between depression and SST score as convergent validity. Also, in our research, the reliability of SST was good (Cronbach's  $\alpha = 0.83$ ).

#### Procedure

There are five groups and two test conditions (SST completion conditions with mental load and SST completion conditions without mental load). After obtaining written informed consent, the participants were tested individually. Before the experimental procedure, a psychiatric interview was conducted (with most depressed participants) either during the same

meeting or on a different day. Participants in each diagnostic group were allocated randomly to SST completion conditions with and without mental load. Before delivering the scrambled sentences, half of the participants were asked to memorize a six-digit number (in mental load conditions). The other participants were not given any instructions or extra work (no-load conditions). Participants attempted to recall the six-digit number following the mental load conditions. Participants were given only five minutes to complete each set of twenty SSTs and were instructed to complete them promptly. After the session, participants completed additional questionnaires.

The study was conducted after receiving the Code of Ethics from the University of Social Welfare and Rehabilitation Sciences (IR.USWR.REC.1400.102).

**Data analysis**

All statistical tests were conducted at an alpha level of 0.05. Analysis of variance (ANOVA) was conducted for different group factors and conditions with and without mental load as independent intergroup variables to test the main hypotheses. Scheffe's post hoc test was used for

drawing comparisons between groups. Central indices, mean dispersion, and standard deviation for demographic and age variables and other questionnaires were calculated by descriptive statistics. A chi-square test was conducted to examine adherence to load conditions and whether the recall of 6-digit numbers differed between the groups. There was no significant difference in the recall of 6-digit numbers in the five groups ( $\chi^2 = 2.31, P = 0/314$ ).

**Results**

The scores of participants in separate groups of the dependent variable (depression, age at the start of the first episode, comorbidity, and number of depression episodes) were analyzed based on mental-load conditions. The effect of group was significant for the HRDS score ( $F(4, 208) = 535.77, P < 0.001$ ). In contrast, pairwise comparison revealed that the remitted/recovered depressive participants and the non-depressed group did not obtain a significantly different HRDS score ( $P = 1.00$ ) (see Table 1 for mean and SD).

**Table 1. Demographic and Clinical Characteristics of the Sample**

Groups variables	Acute depressed (n = 53)		depressive episode with insufficient symptoms (n = 50)		Remitted depressed (n = 50)		Recovered depressed (n = 52)		Never depressed (n = 50)	
	M	SD	M	SD	M	SD	M	SD	M	SD
Age	35.5	11.58	30.62	10.45	41.14	10.67	31.94	9.73	31.94	9.19
HDRS	25.41	4.66	14.21	1.55	4.8	1.43	4.6	1.18	2.26	1.65
Gender	Female	72%	62%		81%		70%		82%	
	male	28%	38%		19%		30%		18%	
	single	27%	50%		10%		11%		55%	
Marital status	Married	68%	48%		90%		80%		42%	
	divorced	5%	2%		0%		9%		3%	

We used a 5×2 analysis of variance (ANOVA) to analyze the scores of the scrambled sentences task. In this analysis, the groups (including depression in the acute phase, depression in the remission phase, depression in the recovery phase, depressive episode with insufficient symptoms, and the never depressed) and the mental load (load, no load) were considered the between-subject factors. Levine's test was used to check the homogeneity of variances. The results of Levin's test showed that the significance level (sig) is higher than 0.05 ( $P = 0.59$ ). Also, considering that the significance level in the Kolmogorov-Smirnov test was  $P = 0.06$ , the assumption of normality of data distribution has been met.

The percentage of negative sentences completed by participants in SST was analyzed using ANOVA 5×2. The effects of groups on the percentage of negative unscrambled sentences in load and no-load conditions were analyzed separately to determine whether each group interacts with load conditions. Nevertheless, in the mental load condition, the percentage of negative statements increased in participants with remitted and recovered depression.

In the present study, the percentage of negative sentences was the major dependent variable as an index of depressogenic thinking. Analysis of ANOVA 5×2 with the group and mental load as between-subject factors on the percentage of unscrambled sentences revealed a significant effect for the Group ( $F(4, 412) =$

14.94,  $P < 0.001$ ). The effect of the mental load, however, was not significant ( $F(4, 412) = 0.09, P = 0.75$ ). But the group  $\times$  load interaction was significant ( $F(4, 412) = 5.03, P < 0.001$ ) (depicted in figure1). Also, the primary effect of the Group revealed a lower total number of sentences were generated by the acutely depressed participants in comparison to the participants with remitted and recovered depression and non-

depressed participants. Although the number of generated sentences was lower in the acutely depressed group than in the other groups, the differences were insignificant. The score of negative unscrambled sentences, the percentage of negative unscrambled sentences, and total generated sentences are provided in Table 2.

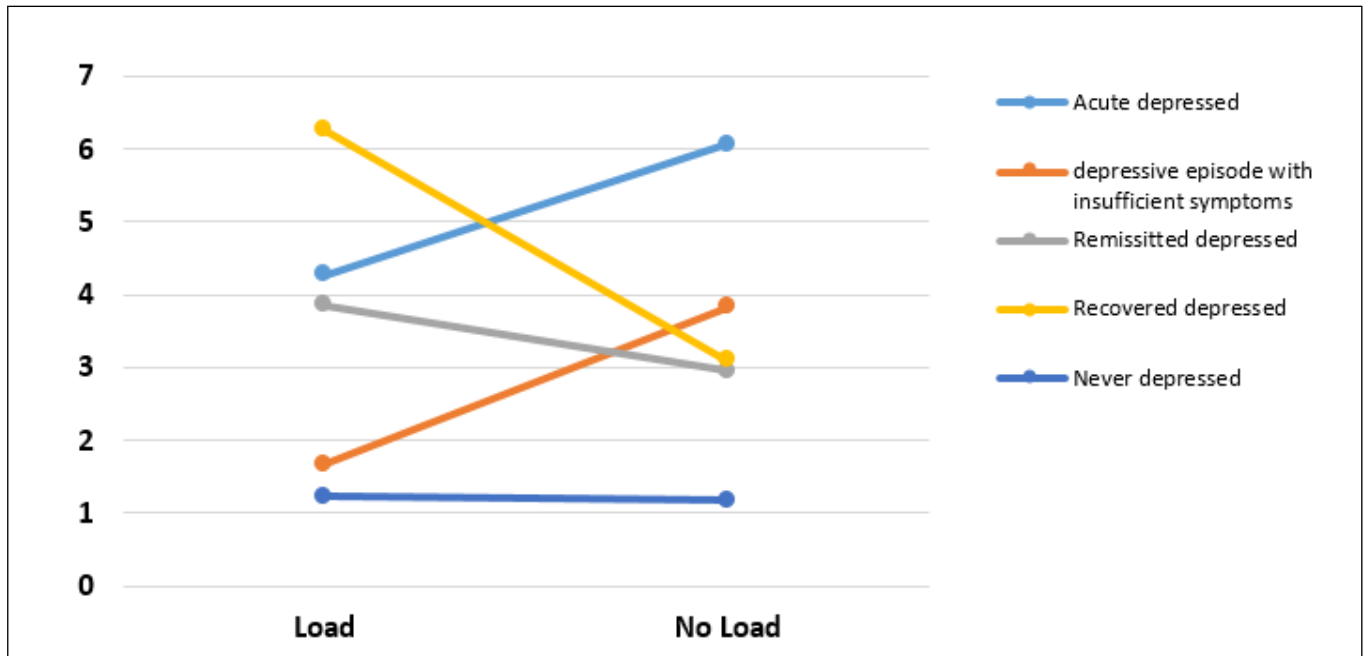


Figure 1. Analysis of ANOVA with the Group and Mental Load as between-Subject Factors

Table 2. The Score of Negative Unscrambled Statements, the Percentage of Negative Unscrambled Statements, and Total Sentences

variables	Acute depressed		depressive episod with insufficient symptoms		Remitted depressed		Recovered depressed		Never depressed	
	Load (n = 25)	No Load (n = 28)	Load (n = 24)	No Load (n = 23)	Load (n = 21)	No Load (n = 20)	Load (n = 20)	No Load (n = 23)	Load (n = 30)	No Load (n = 27)
score of negative unscrambled statements	4.72 (4.48)	6.07 (3.86)	1.67 (1.43)	3.83 (2.08)	3.86 (3.29)	2.95 (3.12)	6.26 (4.46)	3.09 (3.82)	1.23 (1.33)	1.18 (1.18)
percentage of negative unscrambled statements	29.50	39.31	9.48	21.28	21.77	16.75	33.78	18.52	6.29	6.11
total sentences completed	16 (2.19)	15.44 (2.22)	17.62 (4.03)	18 (2.44)	17.73 (3.17)	17.61 (3.05)	18.53 (2.29)	16.68 (2.99)	19.54 (1.22)	19.32 (1.13)

Note: The maximum number of statements that can be unscrambled is 20.

In both load and no-load conditions, acutely depressed participants make a higher percentage of negative unscrambled sentences than normal participants ( $P < 0.001$ ). Scheffe's post hoc test showed that the remitted and recovered depressed participants in the no-load condition made fewer negative unscrambled sentences than the acutely depressed participants ( $P < 0.001$  and  $P$

$< 0.03$ , respectively). However, remitted and recovered depressed participants made a higher percentage of negative unscrambled sentences than normal participants ( $P < 0.001$ ). Nevertheless, the post hoc test found that in the mental load condition, the remitted and recovered depressed participants did not have significant differences with acutely depressed participants ( $P > 0.81$

and  $P < 1.00$ , respectively) and made more negative unscrambled sentences than normal participants ( $P < 0.001$ ).

## **Discussion**

Based on our information, the present research is the second effort to reproduce the SST paradigm (26) in acute, remitted, and recovered major depressed patients. The present research was planned to ascertain whether effortful control strategies may contribute to masking interpretation biases in remitted depression (18) by examining whether added cognitive demands in SST could reveal negative cognitions in remitted depressed patients (26).

The findings of the present study are congruent with previous research (18, 27, 29). 1) In a condition where the SST was performed without imposing cognitive demands (no-load condition), remitted-recovered participants did not show significant differences with the normal group of participants in the total score of negatively unscrambled sentences. The two groups compiled fewer negative sentences than currently depressed participants. This result is in line with our expectation that the remitted-recovered participants would not be different from the non-depressed normal participants under ordinary conditions; 2) As anticipated, within the load condition, remitted-recovered participants did not have significant differences in the total score of negatively unscrambled sentences with the acutely depressed participants who created further negatively unscrambled sentences than the remitted-recovered participants within the no-load condition. In this way, though the remitted-recovered patients produced a comparable score of negatively unscrambled sentences to that of non-depressed normal participants within the no-load condition, the same remitted-recovered patients produced a comparable score of negatively unscrambled sentences to that of the acutely depressed participants within the load condition, and 3) As anticipated, the acutely depressed participants showed further negatively unscrambled sentences, which is congruent with the expectation that perhaps the acutely depressed participants have an expanded availability of negative cognition and make an undermined use of effortful mental control, probably as a consequence of expanded depressive mood disorder (26).

These findings corroborate prior research and imply that depressogenic cognition remains hidden until cognitive demands undermine effortful mental strategies (27, 30). The finding which shows that remitted-recovered patients showed more negative thinking than the non-depressed control group might be due to self-focused manipulation (16, 31). According to Watkins (26), self-focused manipulation can extend the alertness of negative cognitions and/or inhibit effortful mental control.

In the no-load condition, remitted and recovered patients demonstrated little evidence of depressogenic thoughts and presented much the same score of benign sentences as normal participants and lower negative sentences than depressed participants. Nevertheless, imposing cognitive demands (load condition) led remitted and recovered patients to generate more negative sentences, indicating a formerly unknown propensity toward depressogenic thinking.

The present research findings support the idea that masked depressogenic thinking could be manifested just after mental load undermines mind control. In the no-mental-load condition, remitted and recovered participants in the SST task did not display any abnormal predisposition to negative thoughts, while currently depressed participants did. These results are in accordance with prior investigations that detected a negative interpretation bias amongst depressed participants but not among remitted and recovered participants. Nevertheless, in the mental load part of the SST, applying a mental load led to a negative change in the remitted and recovered participants' scores, directing them to generate more negative sentences than participants in the non-depressed group.

Remitted and recovered participants' scores in the mental load condition are congruent with the notion that they seek to suppress the intrusion of depressogenic cognitions. Fundamentally, suppression of intruding depressogenic cognitions requires the effortful leading of cognitive resources to more favorable matters. Consuming mental resources may reduce concentration attempts, consequently permitting suppressed issues to intrude into consciousness.

Based on the concept of the present model, all clinical aspects and influence of a suppressed cognitive susceptibility to depressive disorders would appear when cognitive resources were demanded beyond normal limits.

While this research indicates a latent cognitive susceptibility to depressive disorders, long-term investigations are required to discern whether this model mainly contributes to the ultimate formation of depressive disorders.

Depressed people's tendency to think negatively is likely the result of a combination of interpretation biases - which is possible in remitted and recovered participants - and increased access to those depressive cognitions that result from their primarily depressive mood, which does not exist amongst remitted and recovered participants. Efforts of cognitive suppression in acute depressive patients can be debilitated through their affective dysregulation, which is connected to negative cognitions and might handicap their ability to concentrate the benign materials (27, 32). Furthermore, the effective dysregulation related to depressive disorders may undermine effortful control (33). Therefore, either the increased availability of depressive cognitions or the information-processing deficiency related to depressive

disorders may impair effortful control and cause the compilation of more negative unscrambled sentences.

### Limitation

One of the limitations of this study is the small sample size, although the present study has a larger sample size than the previous studies. The second limitation is that the SST was done in a paper-pencil format, while it is better to use a computerized version to increase the validity of the research. The third limitation is that our sample consisted mostly of women; so, it is better to include more men in future researches.

### Conclusion

This study suggests that these mind control considerations are substantial in finding depressogenic thinking templates in people at risk. The results revealed that people who are vulnerable to the depressive disorder are mainly engaged in thought suppression, which can conceal their depressogenic thinking until cognitive requests consume their efforts of mind control (26). Identifying reliable cognitive vulnerability to depressive disorders has substantial practical and theoretical connotations. Empirical evidence of the cognitive forerunner to depressive disorders could offer valuable contribution to their cognitive-based etiology and suggest innovative ideas regarding the connection between emotion and mind control (26).

From an applied perspective, these findings may benefit people whose efforts to suppress intrusive thoughts may actually prolong and possibly exacerbate depression. For operational reasons, these innovative research findings could be helpful for people who try to suppress unwanted thoughts, which in turn may increase the risk of exacerbating and prolonging depression (26). The present research revealed that remitted and recovered participants did not vary within negative unscrambled statements from non-depressed participants in a no-load condition. Congruent with previous research (19, 26) that found that mental load obscured previous negative thinking in dysphoric students, the present research showed that remitted and recovered participants made more negative unscrambled statements in mental load-condition, which was insignificantly different to that observed with the acutely depressed participants. These results align with the supposition that using effortful control procedures could restrict the exposure of negative cognitions in remitted and recovered participants (25).

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### Conflict of Interest

None

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