Journal of Neurodevelopmental Cognition

Journal of Neurodevelopmental Cognition 6(1) (2025) 33-51 10.48308/jncog.2025.238248.1011
ISSN: 2645-565X
http://www.jncog.sbu.ac.ir

The Effect of Mood and Emotion on DRM False Memory: Controlling the Executive Functions and Affective Traits

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Abstract
This study investigates the impact of mood induction on the Deese-Roediger-McDermott (DRM) false memory paradigm, focusing on emotional and neutral wordlists while controlling for executive functions and affective traits. Two experiments were conducted: the first involved validating Persian emotional and neutral DRM wordlists; the second examined how positive, negative, and neutral mood conditions influenced false memory rates for emotional and neutral stimuli. Participants (N = 91) were assigned to mood conditions using a random assignment process, with mood induced through validated music and images. Results revealed significant differences in false memory rates across mood and task conditions. Negative emotional tasks elicited the highest false memory rates, while positive mood induction combined with positive emotional tasks resulted in the lowest rates. Interestingly, mood induction generally reduced false memory, with negative mood demonstrating the strongest effect. These findings challenge existing theories such as the affect-as-information hypothesis, highlighting the nuanced interplay between mood, emotional task load, and cognitive processing. This research underscores the importance of considering both emotional and cognitive factors in understanding memory distortion, particularly in high-stakes contexts like forensic interviews. It further refines the DRM paradigm by integrating culturally validated emotional stimuli and controlling for individual differences.

Keyword: False Memory, Mood Induction, DRM Paradigm, Emotional Valence, Executive Functions

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1. Introduction

Memory is a miracle of the human mind, but an imperfect archive of our experiences. Sometimes people forget the events that they have experienced and sometimes people remember events that never happened (Howe & Derbish, 2010). False memory is defined as the subjective experience of recalling events that did not happen or remembering them differently from the way in which they happened (Roediger & McDermott, 1995).

Over the past three decades, false memory has been studied extensively in psychology. Understanding the conditions under which false memories are most likely to occur is particularly important in forensic contexts (e.g., police interviews, eyewitness testimony in the courtroom) and clinical settings when life histories are taken during the course of psychological treatment. In both contexts, the outcome of false memories is of great concern (Bookbinder & Brainerd, 2016; Howe & Knott, 2015; Otgaar et al., 2018).

Spontaneous false memory is the product of memory mechanisms, as it occurs in the absence of external suggestive information. One of the most commonly used paradigms to test spontaneous false memories is the Deese/Roediger–McDermott paradigm (DRM; Deese, 1959; Roediger & McDermott, 1995). In the DRM procedure, participants are presented with lists of words (e.g., bed, rest, pillow, night, etc.) that are all semantically linked to a critical lure word (e.g., sleep) but that was not originally presented. The typical outcome during a subsequent memory test is that participants often falsely recall and/or recognise the non-presented critical lure. The false memory index is defined by the rate of recalling or recognizing the non-presented critical lure as an old item. That is, participants tend to confuse internally-generated items (critical lure words) with externally-presented items (studied words).

One potential constraint in applying laboratory-based findings to real-world cases of false memory is that, in the real world, false memories often arise and are reported in a highly-emotional context. Thus, it is important to examine how false memory phenomena are influenced by affective states (e.g., Bookbinder & Brainerd, 2016; Howe, 2007; Loftus, 1993; Loftus & Bernstein, 2004). Researchers have shown that affect sometimes increases memory performance (e.g., moderate emotional stress), and sometimes impairs memory performance (e.g., extreme emotional stress; Gray, 2001; Gray et al., 2002; McIntyre et al., 2003; Storbeck & Clore, 2005). With respect to the specific role of emotions in evoking false memories, Bower (1981) argued that memory is a network of both semantic and emotional nodes, in which shared emotional content will connect the information in the memory network. Thus, the incoming information will activate both semantic and emotional memory structures. Consequently, because the emotional node will be activated during processing of the information, people are more likely to retrieve emotion-congruent information. As a result, the emotional content of the stimuli, just like semantic content, will contribute to the spreading activation.

To empirically investigate the effect of emotion on the false memory phenomenon, researchers have taken three different approaches. In the first approach, researchers have examined the effect of the emotional state of the rememberer on their memory of neutral stimuli (i.e., neutral word lists; Corson & Verrier, 2007; Storbeck & Clore, 2005). Thus, they have used mood-induction strategies along with neutral DRM word lists to test the effect of emotional state on false memories. Storbeck and Clore (2005), for example, induced positive or negative mood states in participants and then tested their memory using neutral DRM word lists. Their findings revealed that a positive mood leads people to produce higher rates of false memories. They argued that positive mood encourages “relational” processing, whereas negative mood promotes detailed, or “item-specific” processing (Clore & Storbeck, 2006). More specifically, when people are in a positive mood, they are highly likely to process the information in relation to their own activated schemas and to consider more general features of the information rather than its specific details and this results in an increase in false memory (Fiedler, 2001; Holland & Kensinger, 2010). In contrast, when people are in a negative mood, item-specific processing may reduce false memory (Clore & Storbeck, 2006).

In the second approach, researchers have examined the effect of the emotional valence of the word lists (i.e., positive or negative) on the creation of false memory in the absence of mood induction (e.g., Brainerd et al., 2008; Howe, 2007; Howe et al., 2010). Brainerd, Stein, et al. (2008), for example, presented participants with positive, negative, and neutral word lists. Brainerd, Stein, et al. reported that negative word lists yielded higher rates of false recognition than did positive and neutral word lists. In contrast to how researchers have explained the effect of mood on false memory, Brainerd, Stern et al. had an alternative explanation for the effect of the emotional valence of the word lists on false memory. They argued that negative word lists induced higher levels of meaning familiarity, and participants were less likely to use “item-specific” true memories to inhibit false recognition of negative word lists and this makes a difference in the creation of false memory.

In the third approach, researchers have manipulated both participants’ mood conditions and the emotional valence of the word lists (Bland et al., 2016; Ruci et al., 2009; Zhang et al., 2017). Zhang et al. (2017), for example, developed a series of emotional word lists (i.e., positive, negative, and neutral) in which all of the list words and corresponding critical lures contained the assigned emotional valence (positive, negative, or neutral), and the lists were also matched in terms of arousal level and BAS (i.e., Backward Associative Strength). Zhang et al. used these word lists to examine the effect of mood on true and false memory for emotional word lists. They found that when participants were in a negative mood, they had lower rates of false recognition for the critical lures associated with positive and neutral word lists, but not higher rates of false recognition for negative word lists. In contrast to Brainerd, Stein, et al. (2008), Zhang et al. argued that when participants were in a negative mood, they were more likely to process the information using “item-specific” processing, but only for positive and neutral word lists, which leads to lower rates of false recognition for these two types of word lists and this makes a difference in the creation of false memory.

It is important to note that certain cognitive factors, psychological status, and personality features are associated with a greater likelihood of producing false memories (Liebman et al., 2002; Porter et al., 2000; Zhu et al., 2010). For example, in many studies, researchers have found a positive correlation between false memories and low cognitive abilities (Zhu et al., 2010), personality traits (Salthouse & Siedlecki, 2007), depression (Clancy et al., 2002), anxiety (Zoellner et al., 2000), dissociation (Winograd et al., 1998), and delusions (McKenna, 1991). However, there is no single study that the effect of emotional and neutral stimuli on false memory by controlling the executive functions and affective traits.

Thus, in the current study, we aimed to examine the effect of induced mood on DRM false memory using both emotional and non-emotional wordlists by controlling the effect of consecutive functions. To do this, we conducted two experiments; in Experiment 1, we validated DRM wordlists and in Experiment 2, we used these wordlists to investigate the effect of emotional wordlists on false memory production. More specifically, in Experiment 2, we controlled a series of executive functions (i.e., working memory and attention) and examined whether mood conditions (e.g., positive, negative, neutral) would induce false memory for emotional and neutral information. To do so, we controlled the consecutive factors and compared the rate of false memory in different mood conditions.

2. Method

In this study, we conducted two independent experiments to examine the effect of mood on DRM false memory. In Experiment 1, we constructed and validate the emotional and neutral Persian DRM wordlists. Having compiled the wordlists, in Experiment 2, we then conducted the main experiment in which we controlled a series of consecutive functions to examine whether individuals' mood status would impact false memory for emotional and neutral information using the DRM paradigm.

Experiment 1: Constructing Wordlists

In the current study, we conducted a two-phase preliminary experiment to construct and validate a series of emotionally laden and neutral wordlists. For the first phase of the experiment, we selected 4 positive, 4 negative, and 4 neutral critical lures that have been used in previous studies and have previously demonstrated a high probability of inducing false memory (Chang et al., 2021). We then recruited 20 undergraduate students (xx females; M age = xx, SD = xx) to take part in the experiment. Participants were tested on computer, either individually or in groups. Participants were instructed that they will be shown a series of target words and they would be required to write down at least 5 words that came to mind that were related to the displayed target word. Participants had the option of skipping questions, if they could not think of any response. Finally, participants were asked to complete demographics including age and gender. After correcting the spelling errors and pooling the responses that could be put together, we calculated the frequency of each word that participant wrote down in relation to each target word. Accordingly, we selected the first 15 words with the highest frequency and each list includes 15 top words according to their frequency rate in descending order.

We conducted the second phase of the preliminary experiment to validate the wordlists. To do so, we recruited 20 undergraduate students who have not participated in the first phase of the experiment. Participants were tested individually on a computer. The instructions for the experiment were explained in detail by the experimenter prior to administrating the DRM task. We then presented participants with a total of xx wordlists. Each word was shown for 2 seconds on a computer screen. Following the final word list, participants completed a 5-minute math task. In the recognition test, participants have presented with xx studied words, and xx non-studied wordlists (i.e., xx critical lures and 24 non-related lures that were matched to the valence of wordlists). In the test phase, the presentation order of the xx words was completely random. For the aim of recognition tests, participants were required to make an "Old" decision if they thought that the word has been presented in the study phase, and to make a "New" decision if they thought a word had not been presented before. Based on the results of the second phase, we selected 4 wordlists in each theme to be used in Experiment 2.

Experiment 2

Participants

A total of 110 undergraduate students were recruited for the experiment via online advertisement and recruitment flyers. The final sample (N = 91) consisted of 46 females (Mage = 22.69 years; SD = 3.24); no participants identified as gender-diverse. Participants were all Iranian nationals, and no further data on ethnicity were collected. The inclusion criteria were that participants were native speakers of Persian and had normal or corrected to normal vision. The exclusion criteria were a history of mood disorders, neurological impairment, and less than five hours of night-time sleep before the experiment. Data from 19 participants were excluded from the analysis as they reported having a history of mood disorders. All participants provided written, informed consent and were reimbursed $5 to cover their cost of participating. The research was reviewed and approved by the university's Ethics Committee.

Pre-Assessment

Psychology Experiment Building Language and Test Battery (PEBL; Mueller & Piper, 2014). The PEBL is a free, open-source software system that has been developed to design, run, and share behavioral tests (Mueller & Piper, 2014). In this study, we used two tasks of the PEBL test battery; Numeral Stroop Task and N-Back Task (1-back and 2-back; version 2.0; http://pebl.sourceforge.net/). Participants were tested individually on both tasks. Research on the psychometric properties of PEBL tasks has demonstrated its validity (Piper et al. 2012). See the online supplement for a full description of the PEBL tasks.

Emotional Dot Probe Task (EDPT-P; van Rooijen et al., 2017). The EDPT-P is one of the best-known cueing paradigms to investigate spatial selective attention towards emotional stimuli. In the current study, we used the Iranian normed for this task (Dehghani, 2010). In this task –which is fully administered via computer– participants were presented with two stimuli simultaneously for 500 milliseconds; each stimulus was presented on a different side of the screen We carefully selected the slides that were used in the task to tap to neutral (e.g., van Rooijen et al., 2017) and emotional (e.g., van Rooijen et al., 2017) contents. The dot-probe task consists of 5 test blocks of stimuli, each block contains 10 picture pairs (total of 50 pairs of pictures). The simultaneous presentation of the picture pairs was completely in a random order (neutral-neutral, happy-neutral, and angry-neutral). Once the stimuli disappeared from the screen, a dot-probe emerged either in the location of the neutral or emotional stimuli. Participants were then required to indicate as quickly and as accurately as possible whether the dot emerged on the right or left side of the screen (Kimonis et al., 2006). The rationale behind the task is that participants' reaction time will be faster in detecting the dot which is at the location of the stimuli that attracted more attention (van Rooijen et al., 2017). To calculate the attention bias score, we recorded the average time (in milliseconds) between the presentations of the dot-probe and participants' reactions to its location.

Depression Anxiety Stress Scale-21 (DASS-21; Samani & Joukar, 2007). The DASS-21 is a set of three self-report scales (i.e., each scale contains 7 items) designed to assess the emotional states of depression, anxiety and stress. Participants rated their agreement with each item using a 4-point Likert scale (0 = Did not apply to me at all to 3 = Applied to me very much or most of the time). Higher scores indicate greater levels of anxiety experienced by participants over the past week. The DASS-21 showed high psychometric properties in previous studies using either English-speaking (Henry & Crawford, 2005) or Persian-speaking samples (Samani and Joukar (2007). In this study, the internal consistency (Cronbach's α) of the DASS-21.

Positive Affect and Negative Affect Schedule (PANAS; Bakhshipour & Dezhkam, 2006). The PANAS is a 20-item self-report questionnaire that consists of 10 items to measure positive affect and 10 items to measure negative affect. Participants used a 5-point rating scale (1 = Very slightly or not at all to 5 = Extremely) to rate their mood in the past month. Scores were summed across all the 10 positive and 10 negative affects to provide a total Positive Affect (PA) and a total Negative Affect (NA) score. The PANAS is frequently used in research and has good psychometric properties (Watson et al., 1988). Moreover, the psychometric properties of the PANAS in Persian-speaking samples have been supported by previous studies (Bakhshipour & Dezhkam, 2006).

Developing Mood Induction Protocol

To induce negative and positive emotions, participants were presented with both music and image, simultaneously. Negative and positive music was obtained from Storbeck and Clore (2005), and images were obtained from the Geneva affective picture database (GAPED; Dan-Glauser & Scherer, 2011). The GAPED contains 730 positive and negative images. For validation purposes using the Q-ranking method, we recruited 46 undergraduate students (21 female) to rate 106 negative images to indicate the negative valence for each photo, and to rate 122 positive images). Finally, we chose the first 100 images with the highest rate of ranking for each category (i.e., 50 negative and 50 positive.

Post-Assessment: DRM Paradigm

We used 12 wordlists in the DRM task; 4 negative 4 positive, and 4 neutral wordlists. All the wordlists were developed and culturally validated in the Persian language in a preliminary experiment. Each wordlist was 15 items long and the words on each list were shown in the same serial order to all participants.

We used to present participants with the wordlists (180 words in total). Participants were tested individually in the laboratory. Before conducting the experiment, the experimenter explained the procedure and then participants completed one neutral-word practice list. The presentation order of the wordlists was partially counterbalanced across participants; that is half of the participants studied the negative lists first, followed by neutral lists and then positive lists, and the other half of the participants studied the lists in the reverse order (see also Sajjadi et al., 2021). In the learning phase, participants were instructed to remember all 12 wordlists. Each word was presented for 2 seconds on the computer screen and once all of the words in the list were presented, participants were shown a warning message that the next wordlist was about to appear. Between the learning and test phase, participants were required to complete a 5-minute math question.

In the recognition test, participants were presented with 36 studied words (i.e., serial positions 1, 4, and 8 of each wordlist; see Bower, 1981), and 36 non-studied wordlists (i.e., 12 critical lures and 24 non-related lures that were matched to the valence of wordlists). In the test phase, the presentation order of the 72 words was completely random. For the aim of recognition tests, participants were required to make an "Old" decision if they thought that the word has been presented in the study phase, and to make a "New" decision if they thought a word had not been presented before.

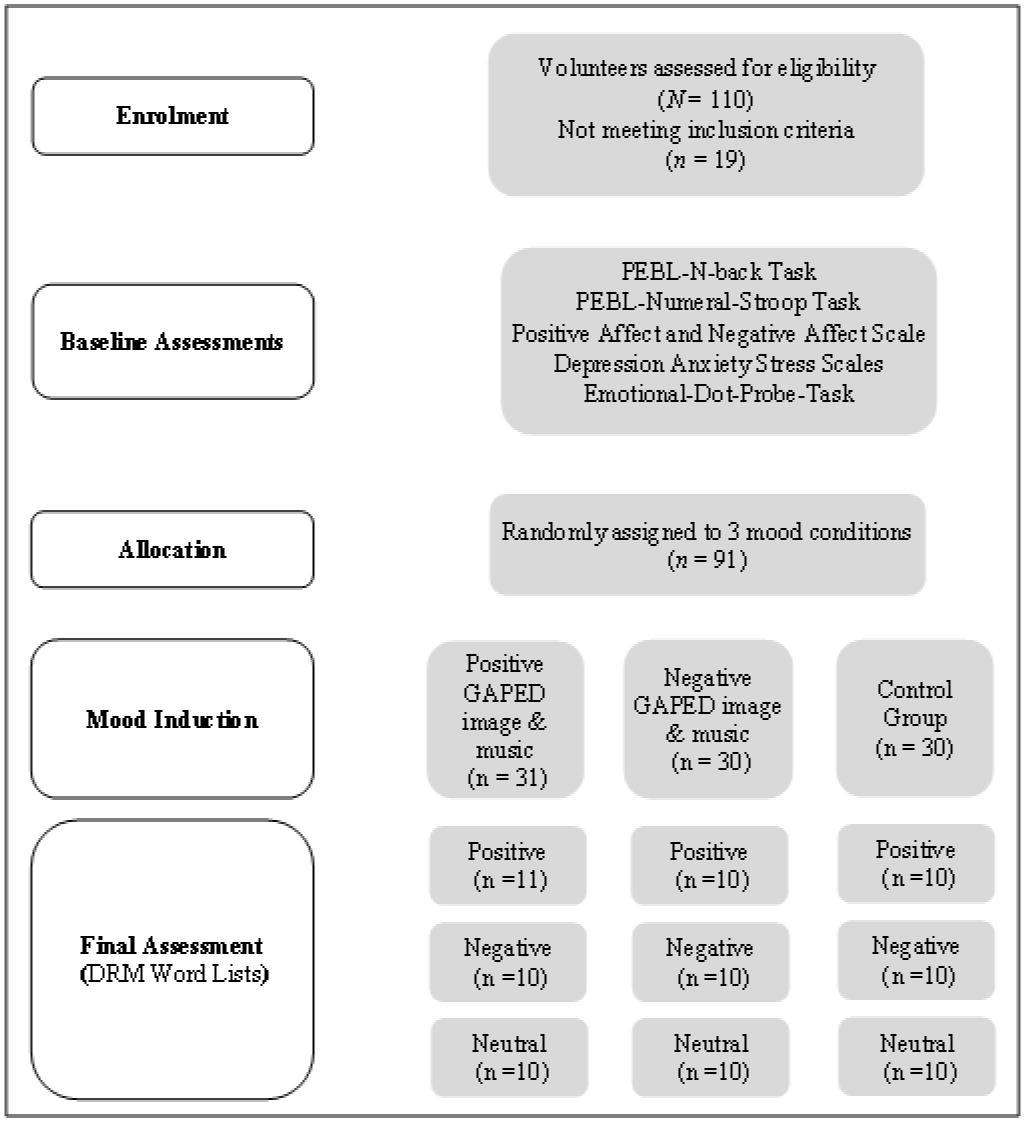
Design and Procedure

To conduct the current study, we used a 3*3 factorial randomized controlled trial design. This three-phase experiment was conducted in the laboratory over two sessions, 24 hours apart. Participants were tested individually, and during each session, they completed different sets of tasks using a desktop computer. In the baseline assessment phase, all the participants were asked to complete a series of cognitive tasks (i.e., N-back Task, Numeral-Stroop Task, and Emotional-Dot-Probe-Task) and questionnaires (i.e., Positive Affect and Negative Affect Scale, Depression Anxiety Stress Scale, and demographic questionnaire). We then randomly assigned participants to one of the three mood conditions (i.e., positive, negative, or neutral, n = 91 participants in each condition) through the selection of random numbers. After receiving the instructions, participants in the positive- and negative- mood conditions listened to the corresponding music and began the memory task once the music was ended. Those participants in the control group received no intervention and simply began the DRM task. As we mentioned earlier, the mood was induced using both music and images. In line with previous studies (e.g., Niedenthal & Setterlund, 1994; Storbeck & Clore, 2005), participants in the positive mood condition listened to Erine Kleine Nacht Musik by Mozart for 8 minutes and participants in the negative mood condition listened to Adagietto by Mahler for 8 minutes. Unlike previous studies (Zhang et al., 2017) where participants were kept playing the sad or happy music throughout the subsequent DRM procedure, we stopped playing music to control for any possible distraction. Simultaneous to music, participants in the positive mood induction were watching a collection of positive images and those in the negative mood induction were watching a collection of negative images. In the final assessment phase, we randomly assigned participants in each mood condition (i.e., positive, negative, and neutral) to three groups of emotional DRM wordlists. Each session took approximately 1.5 hours to complete and participants were debriefed at the end of session 2. Figure 1 illustrates the design of the current study.

Data Analysis

Due to violation of assumptions for parametric statistical tests, we used the H-test of the Kruskal-Wallis test to compare the mean scores of the three independent groups. We also used the Mann-Whitney U test to compare the pairs of subgroups.

Figure 1. *Consolidated Standards of Reporting Trials (CONSORT) flow diagram of the enrollment and random assignment processes.*



3. Results

All the subgroups related to the DRM paradigm (by type of mood induction and emotional load of tasks) had no significant differences, in terms of age, gender, working memory, emotional bias, selective attention, positive and negative affect, depression, anxiety, and stress (see Table 1).

As shown in Table 2, the average rank of the three groups receiving negative, positive, and negative emotional tasks was significantly different in measure of the DRM false memory paradigm (Kruskal-Wallis $H = 9.30$ and $p < .01$). It can be seen that the group receiving the negative emotional task has the highest false memory (average rank = 52.67). While the group receiving the positive emotional task (average rank = 35.06) had the lowest false memory. By observing the results of the Mann-Whitney U test to follow this overall difference and to identify the difference between the two subgroups. A remarkable result is that false memory in a negative emotional task is significantly more than in a positive emotional task (Mann-Whitney U = 278, $p < .01$). The false memory in the negative emotional load does not have a significant difference from the neutral emotional load (Mann-Whitney U = 437, $p > .05$). Finally, false memory in neutral emotional load is significantly more than positive emotional load (Mann Whitney U = 313, $p < .05$).

As shown in Table 3, the average rank of the three groups receiving negative, positive, and negative emotional tasks was significantly different in measure of the DRM false memory paradigm (Kruskal-Wallis H = 6.03 and $p < .05$). It can be seen that the control group has the highest false memory (average ranks = 53.80). While the group receiving positive mood induction (average ranks = 38.24) had the lowest false memory. By observing the results of the Mann-Whitney U to follow this overall difference and to identify the difference between the two subgroups, a remarkable result is that False memory resulting from the negative mood induction and positive mood induction does not have a significant difference (Mann-Whitney U = 381, p = > .05). False memory after positive mood induction was significantly less than the control group (Mann Whitney U = 308.5, $p < .01$). Finally, False memory after negative mood induction and the control group does not have a significant difference (Mann Whitney U = 372.5, $p > .05$).

As shown in Table 3, there is a significant difference between the mean nine-combination (induction * emotional load) DRM false memory paradigm (H-test of Kruskal-Wallis = 17/73 and $p < .01$). The highest false memory was a combination of non-inductive and negative emotional load (average ranks = 62.95). While the combination of positive induction and positive emotional load (average ranks = 27.45) created the lowest false memory.

Table 1. *Descriptive Statistics for demographic, executive functions and affective traits in subgroups of induced mood (positive, negative, and control) and emotional load of the task (positive, negative, and neutral)*

Statistics for demographic, executive functions and affective traits in subgroups of induced mood (positive, negative, and control) and task (positive, negative, and neutral)

		Subgroups for emotional load					Subgroups for induced mood				
		Positive	Negative	Neutral	Statistic	Sig.	Positive	Negative	Control	Statistic	Sig.
	Female	15	16	15	$\chi2_{(5)} = .021$	.989	15	16	15	$\chi2_{(5)} = .021$	.989
	Male	15	15	15			15	15	15		
	Range	18-32	18-33	19-30	$F_{(2, 88)} = .35$	.703	18-32	18-33	18-28	$F_{(2, 88)} = .35$	.703
	Mean	23.17	22.30	22.60			23.10	22.55	22.43		
	St.D.	3.29	3.59	2.86			3.75	3.45	2.47		
	Mean	88.19	89.53	88.77	$F_{(2, 88)} = .318$	.728	87.19	88.87	90.08	$F_{(2, 88)} = 1.96$	.147
	St.D.	4.91	5.75	8.55			8.57	4.29	5.66		
*	Mean	49.86	47.70	48.89	$F_{(2, 88)} = .819$	.444	49.75	47.70	49.08	$F_{(2, 88)} = .762$	.470
	St.D.	7.13	5.58	6.63			7.92	6.09	5.21		
	Mean	213.41	227.35	226.14	$F_{(2, 88)} = .775$	.464	218.43	221.55	226.75	$F_{(2, 88)} = .225$	.799
	St.D.	55.80	49.61	38.42			51.84	44.92	49.47		
	Mean	34.47	34.11	34.63	$F_{(2, 88)} = .062$	.940	34.34	34.62	34.25	$F_{(2, 88)} = .032$	.968
	St.D.	5.31	5.76	6.37			5.92	6.42	5		
	Mean	28.84	26.24	25	$F_{(2, 88)} = 2.25$	.111	27.5	26	26.7	$F_{(2, 88)} = .322$	.726
	St.D.	7.6	7	6.8			6.85	7.6	7.34		
and	Mean	18.72	14.75	16.13	$F_{(2, 88)} = 2.33$	.103	17.81	16.36	17.39	$F_{(2, 88)} = .421$	.658
	St.D.	3.97	3.68	4.08			4.24	4.01	3.81		

tion score to intervention time ratio

Table 2.

The difference between the measure of DRM false memory paradigm in the emotional load of the task (positive, negative, and neutral)

Emotional Load	Average Ranks	Test statistic	Sig.
Positive	35.06	Kruskal-Wallis H = 9.30	.010
Negative	52.67		
Neutral	50.63		
Positive	24.97	Mann-Whitney U = 278	.003
Negative	37.23		
Positive	26.10	Mann-Whitney U = 313	.022
Neutral	36.07		
Negative	30.93	Mann-Whitney U = 437	.835
Neutral	30.07		

Table 3.

The difference between the measure of DRM false memory paradigm in mood induction (positive, negative, and control

Mood Status	Average Ratings	Test statistic	Sig.
Positive	38.24	Kruskal-Wallis H = 6.03	.049
Negative	46.22		
Control	53.80		
Positive	28.29	Mann-Whitney U = 381	.195
Negative	33.80		
Positive	25.95	Mann-Whitney U = 308.5	.017
Control	36.22		

Negative	27.92	Mann-Whitney U = 372.5	. 216
Control	33.08		

Table 4.

The difference between the measure of DRM false memory paradigm emotional load of (positive, negative, and neutral) and mood induction (positive, negative, and control)

Emotional load	Mood Status	Average ratings	Kruskal-Wallis H	Sig.
Positive	Positive	27.45	17.73	.023
Positive	Negative	30.45		
Positive	Control	48.05		
Negative	Positive	43.75		
Negative	Negative	51.30		
Negative	Control	62.95		
Neutral	Positive	44.60		
Neutral	Negative	56.90		
Neutral	Control	50.08		

4. Discussion

In the current study, controlling several cognitive and affective factors, false memory rate was measured according to the DRM paradigm in three types of mood induction (positive, negative, and neutral) and three kinds of emotional load tasks (positive, negative, and neutral). The groups, which received tasks with negative, positive and neutral emotional content showed a significant difference in the false memory rate. Albeit, the group that received tasks with negative emotional valence had the highest false memory degree. In line with current results, Budson et al. (2006) and Monds et al. (2017) concluded that there is no difference between negative and neutral lists in false recognition of critical lures. In contrast, these results are inconsistent with some studies, which speculated that lower false recognition of positive and negative critical lures in comparison with the neutral ones (Brainerd et al., 2008; Palmer & Dodson, 2009; Sharkawy et al., 2008). Conflicting with the current results, Dehon et al. (2010) showed that neutral lists are more prone to misdiagnosis of important deceptions than emotional lists. They explained their results using the paradoxical negative emotions (PNE) hypothesis (Porter et al., 2008). According to the PNE hypothesis, evolution has neurologically prepared humans to better remember negative events to avoid future dangers. This feature encourages humans to enter additional relevant information, although may corrupt memory. In other words, negative information may be more vulnerable to memory distortion. However, consistent with the present study, Monds et al. (2017) showed that the results of the DRM paradigm do not support the PNE hypothesis. In explaining these controversies, it should be noted that regardless of whether false memory has a heterogeneous nature, techniques for the DRM paradigm can be conducted in diverse protocols (Brainerd & Reyna, 2005; Gallo, 2010; Schacter, 2002). On the other hand, some scholars have considered other cognitive factors in the study of memory distortion. For instance, Shah and Knott (2018) have shown that in the case of divided attention compared to full attention, negatively critical lures were more falsely remembered. Kulas et al. (2003) have also shown that in the condition of negative emotional attention bias, remembering negative events is better than positive events. On the other hand, Doerksen and Shimamura (2001) and Mather (2007) have considered the linkage between organizing emotional content and attention processing as the motivating factor of some details and the absence of other details. Supposing that abstract words increase the rate of false recognition (Hirshman & Arndt, 1997; Pérez-Mata et al., 2002), in the current study, the lack of difference between the two groups that received negative and neutral lists may be due to the equivalence in the amount of word abstraction in the negative and neutral lists.

About the effect of mood induction on DRM false memory, in general, mood induction has significantly reduced the amount of false memory. As, the highest false memory was observed in the control group, while the two groups under the induction of negative and positive mood showed much less false memory. The remarkable finding was that the induction of negative mood was followed by the least false memory. In other words, contrary to the hypothesis of affect as information (Schwarz & Clore, 1983), the mood does not affect false memory. In line with the current study, Goernert et al. (2021) have shown that mood states do not affect directional forgetting. This finding supports Golding et al. (1994), who stated about three decades ago that a positive mood may reduce or eliminate directed forgetting because such processing increases encryption between items and thus weakens the separation of memorable and forgotten items. The results are also consistent with (Hourihan & MacLeod, 2008) and (MacLeod & Daniels, 2000), who have argued that a negative mood may focus attention on specific details of items, increasing the likelihood of remembering some of them. However, this finding of the present study is inconsistent with many studies (Gable & Harmon-Jones, 2010; Howe & Malone, 2011; Storbeck & Clore, 2005; Zhang et al., 2018). These controversies may be justified by a multifaceted approach. First, differences in mood induction tools can lead to different consequences. Second, in both positive and negative mood induction, a lower level of arousal lead to a decrease in false memory (Corson & Verrier, 2007; Rivers et al., 2008). Third, the nature of the mood may affect its effectiveness (Goernert et al., 2021). In addition, mood states are often temporary (Clore & Huntsinger, 2009; Storbeck & Clore, 2011). Also, supposing that false memory increases under high arousal conditions compared to low arousal (Corson & Verrier, 2007), in the present study, mood induction in different participants may have created mood states with different levels of arousal.

In general, the accompaniment of the control group (without induction) and the negative emotional load of the task followed by the highest false memory and the combination of induced positive mood along with the positive emotional load of the task generated the lowest false memory. It can be concluded that if the emotional load of the task be negative, the most false memory can be created, regardless of the mood induction. This finding contradicts the results of some studies (Ruci et al., 2009; Zhang et al., 2018) who have shown that if the induced mood matches the emotional load of the task, the most false memory may occur. However, the mediating role of selective attention and emotional bias of attention in the effect of induced mood and emotional load of task on false memory has been confirmed in several studies (Dewhurst et al., 2005; Knott et al., 2018; Shah & Knott, 2018). In summary, the growing trend of research shows that stimuli with negative emotional load with higher arousal are more prone to false memory due to less need for attention and more tendency to automatic neural processing. However, neutral and positive stimuli with low arousal require controlled attention and processing and lead to less false memory (Knott et al., 2018). Given that in the present study, the factors of attention and emotional bias of attention were controlled, it seems that the results of this study are more reliable predictors of false memory.

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