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Effect of Temporary Mood States on Selective Memory About the Self

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This study examined the influence of depressed and elated mood on self-referential memory processes. By means of a hypnotic mood-induction procedure, subjects were made to experience a happy, sad, or neutral state. The study demonstrated that temporary depression caused decreased recall of positive life experiences, weaker memory strength for positive information about oneself, and a bias to recall false negative self-descriptions. Induced elation was associated with decreased recall of negative events and an increased recall of positive events. The results were considered to lend general support for Beck's notion that mood states are associated with distorted information processing about the self. General implications of the findings are discussed.

Clinical investigations have increasingly focused on the relationship of cognitive factors to emotional disorders (Abramson, Seligman, & Teasdale, 1978; Arieti, 1970; Bandura, 1977; Lazarus & Averill, 1970), and some therapists have argued that the alteration of cognitive schemas directly alleviates emotional disorders (Beck, Rush, Shaw, & Emery, 1979; Ellis, 1977; Meichenbaum, 1977). A cognitive theory of emotion has been partially supported by a demonstrated relationship of mood states to memory processes. Studies have shown that depressed patients experience a high frequency of unpleasant thoughts (Beck, 1967; Teasdale & Rezin, 1978), implying that depressed mood in some way increases the accessability of unpleasant memories. Lloyd and Lishman (1975) investigated this possibility by asking depressed patients to recall pleasant and unpleasant memories in response to stimulus words. They found that depression, as measured by the Beck Depression Inventory (Beck, 1967), was positively correlated with speed of recall for unpleasant memories; these results suggest that depressed mood may increase the accessibility of unpleasant memories. In a pair of studies, Mischel, Ebbesen, and Zeiss (1973, 1976) manipulated success–failure experiences and examined the influence of a presumed affective state on selective memory for positive and negative self-referential information. They found that both the experience and the expectation of success caused the individual to favor the recall of positive self-descriptions. A recent study by Isen, Shalker, Clark, and Karp (1978) also examined the relationship of mood state to memory processes. In Isen et al.'s study, mood was induced by means of a win–loss experience in a computer game, and individuals who won the game manifested an increased recall for positive material in semantic memory (subjects were required to recall emotionally ladened words that were previously committed to memory).

The above-cited findings suggest a relationship between memory processes and affective state, and recent studies have examined the influence of directly manipulated moods on the recall of affective stimuli. Teasdale and Fogarty (1979) used the Velten procedure (1968) to induce elation or depression, and subjects were instructed to retrieve pleasant and unpleasant words when prompted with a stimulus word. Their study

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showed that sad subjects retrieved pleasant memories slower than they did unpleasant memories. Bower (1981) also reports that hypnotically induced moods influenced the recall of personal episodes in a similar fashion. Bower showed in two experiments that subjects experiencing temporary elation recalled more happy episodes, and momentarily depressed subjects recalled more unpleasant personal memories.

The purpose of the present study was to clarify the relationship of mood state to specific memory processes. Subjects were made to feel happy or sad by a hypnotic induction protocol and required to (a) recall pleasant and unpleasant memories (this task was included as a replication of Bower's, 1981, findings), (b) rate the intensity of affective stimuli (this task was included so that the differential effect of induced mood on personal and non-self-referential information processes could be assessed), and (c) read and recall a self-description containing positive and negative attributes. Signal-detection measures were used on this last measure and the separate influence of mood on memory strength and memory bias was assessed. Unlike all previously published studies (see above) the present experiment included a control group so that the independent effects of positive and negative mood could be examined.

Method

Subjects

Fifty-four undergraduate volunteers, ages 17 to 32 years, were paid to participate in a 1½-hour study examining "the effects of moods on cognitive processes." Females were used because "they perform consistently better than males in studies involving the induction of affective states" (Gouaux & Gouaux, 1971, p. 341). Subjects were randomly assigned to one of three experimental conditions (induced elation, depression, or neutral mood); 18 individuals participated in each treatment group.

Experimenter

One male experimenter conducted the entire study and gave all of the instructions to the subject. The experimenter guided the subject through the entire protocol and at completion provided the subject with a sealed written explanation of the study. The experimenter was blind with respect to the specific hypotheses of the study.

Mood-Induction Procedure

Each subject was administered a standardized hyponotic induction protocol (Spiegel & Spiegel, 1978) and Velten's (1968) mood-induction procedure alone in the experimental room. Velten's technique required the subject first to read 10 preparatory statements silently and then aloud. Actual induction consists of the reading of 60 self-referent statements (neutral, depressed, or elated). Each statement was typed on a separate card (20 × 25 cm) and presented to the subject for 20 sec. A sample elation statement was, "If your attitude is good, then things are good, and my attitude is good." A sample depressive statement was, "I have too many bad things in my life." Recorded instructions introduced the mood-induction task and also had the subject perform mood verification measures, and a tone sounded every 20 sec that paced the subject through the mood states.

Mood-Verification Measures

Six 7-point semantic differential scales were used (negative–positive affect): weak–strong, dull–loud, sad–happy, tired–alert, slow–fast, bored–interested. The average of these six scales was used as a dependent measure. Previous research (Natale, 1977a, 1977b) has shown these scales to measure changes effected by Velten's mood-induction procedure. A second mood-verification measure was a writing-speed task, which consisted of writing down numbers in descending order from 100 for 1 minute.[1] A recent study (Polivy & Doyle, 1980) has shown the effect of Velten's procedure on mood measures to be significantly influenced but not totally determined by demand characteristics.

Measures of Selective Memory

Free recall. Within a 5-minute period, all subjects were asked to recall happy and sad personal memories. The subject was told that "we are interested in your ability to recall many different events so please do not describe in detail each distinct memory."

Response bias. Each subject received a standardized personality description that contained 90 personality trait words from a list of 555 that had been rated for likeableness by N. H. Anderson (1968): 30 words each were selected from among the 100 most liked words, the 100 least liked words, and the "neutral" words ranked between 220 and 340. A total of 180 items were presented to each subject. Ninety were exact duplicates of phrases from the description (old items) and 90 were new phrases (items) that were not previously seen by the subject. The new items were chosen from the same "likeableness" category used in the original personality description. The subject's task was to identify which of the items they had seen before (these old items were contained in their personality description). The response-bias measure was calculated by examining the ratio of properly identified personality items (hits) to

[1] It must be assumed that performance on this task reflects both motoric and cognitive processes, the latter being used for the required calculations.

improperly identified items (false alarms) (McNicol, 1972, p. 61). A large ratio of hits to false alarms represented a small response bias, that is, the subject "decided" against identifying old items from the personality description. A response-bias measure was calculated for positive, negative, neutral, and total personality items for each subject.

Strength of memory (d'). In the course of identifying new and old personality description items, each subject was required to rate on a 1 to 4 scale the certainty of their judgment. The *d'* statistic is a normalized difference between the average certainty for new and old items and therefore reflects discriminative ability of a subject (McNicol, 1972, p. 57). The bigger the *d'*, the more the subject was able to discriminate between old and new items and, therefore, the better the memory for the information. The *d'* statistic was independent of the response-bias statistic. The *d'* score was calculated for positive, negative, neutral, and total personality items.

Emotional-Intensity Ratings

Each subject was required to rate on a 1 to 5 emotional-intensity scale each unpleasant and pleasant memory from the free-recall task. The subject was also asked to rate on a 1 to 7 anchored scale the intensity of her emotional reaction to 30 pictures (15 in each category of happiness and disgust). Previous research (Graves & Natale, 1979) has verified that each of the slides evoked the appropriate emotional response.

Experimental Procedure

The procedure for each experimental session is summarized in Table 1. On arrival, the subject was told that "we (the investigators) believe that the hypnotic trance enhances a person's capacity to concentrate on a given thought or feeling. I am going to ask you during this experiment to concentrate on statements that are indicative of a given mood and it's our experience that the hypnotic state will increase your ability to enter the mood."

The subject was first asked to respond to Spiegel and Spiegel's (1978) standardized instructions for trance induction. This procedure required the subject to imagine a floating sensation, to roll her eyes upward, to elevate her arms, to experience a tingling sensation in her fingers and arms, and to accept a posthypnotic suggestion for return of normal sensation in her arms and fingers. The hypnotist used a scoring sheet to record the subject's response to the hypnotic induction procedure. After the subject entered the relaxed trance state, she was told, "You will remain in this hypnotic state and experience the mood-induction procedure even after you open your eyes. You will relax and allow yourself to enter the suggested mood state." After opening her eyes the subject was told that she would receive instructions for the mood-induction procedure over a loudspeaker. At this point the subject was left alone in the room. The experimenter entered an adjacent chamber and activated a cassette recording that guided the subject through Velten's (1968) mood-induction procedure. The subject read silently and then aloud 60 self-referent statements, all of which were indicative of depression, elation, or a neutral mood. The automated instructions had the subject complete a pre- and postinduction writing-speed task and semantic differential (mood) scales.

Table 1
Summary of Experimental Procedure for Each Session

Order of events
1. Hypnotic induction
2. Writing-speed task and semantic differential scales
3. Velten's mood-induction procedure[a]
4. Post-mood-induction writing-speed task and semantic differential scales (post-Trial 1)
5. Reading of personality description[b]
6. Free recall of pleasant and unpleasant memories
7. Intensity rating of personal memories
8. Intensity rating of emotional slides (happy and disgust)
9. Selective memory task for personality description
10. Postexperimental writing-speed task and semantic differential scales (post-Trial 2)
11. Debriefing: Normalization of mood and questioning

[a] Velten (1968).
[b] Each subject was informed that the personality description was individualized, as determined from their responses to the hypnotic induction procedure. In actuality, the personality description was standardized for all subjects.

After the subject completed the induction of a mood state, the experimenter entered the room and told the subject, "Researchers have developed various personality profiles that correspond to an individual's hypnotic induction profile. While you were experiencing the mood induction I scored your hypnotic profile, and I will now provide you with an individual assessment of your personality." At this point the subject was given a booklet and asked to read her personality description as quickly as possible.[2] (It should be noted that in actuality every subject received a standardized personality description that contained 90 personality trait words.) After the subject had read through the personality synopsis (after approximately 5 minutes), she was asked to recall happy, sad, and ordinary (neutral) memories for 5 minutes. It was emphasized that there was no preference for the type of recalled memories and that the subject was to produce as many memories as possible within the time limit. The experimenter wrote down a key word for each memory and immediately classified each memory as positive, negative, and neutral.[3] (Previous pilot

[2] No mention was made during the experimental protocol that the subject would be tested for memory of the personality material. Hence, incidental memory may have been tested.

[3] Twenty subjects were also asked after completing the study to classify their memories as positive, negative, or neutral. The subjects' classification had a .95 correlation with the experimenter's classification.

Table 2
Mood-Verification Measures

Mood condition	Trial		
	Pre	Post 1	Post 2
Semantic differential scale[a]			
Elated	4.90	6.33**	5.65*
Depressed	4.64	2.55*	3.80*
	4.22	4.00	4.52
Pre–post change scores of writing-speed task[b]			
Elated	8.64**		6.93*
Depressed	−5.94*		−4.12*
Neutral	1.71		−.98

Note. Means are reported in this table. For the semantic differential scale each posttrial was independently compared to the pretrial within each mood condition. For the writing-speed task, the elated and depressed mood conditions were independently compared to the neutral condition within each posttrial. *t* test for several means was used (Bruning & Kintz, 1968).
[a] Higher score indicates positive affect.
[b] Positive score indicates increased writing speed.
* $p < .05$. ** $p < .01$.

work showed that agreement among pairs of judges was extremely high for this task, $r = .92$.) After having completed the free-recall task (taking about 5 minutes), the subject was asked to rate on a 1 to 5 scale the emotional intensity of each required event.

The subject was now told that slides of emotional pictures would be shown on the wall of the room and that "it is natural to react to these pictures, and I want you to allow yourself to get involved in the way the pictures make you feel. I will leave each slide on for 15 sec and ask you to indicate your response on a scale. I will always ask you if you are ready to move on to the next slide." On completion of this task, the subject was told that she would be tested for the memory she had of her own personality description (it had been read approximately 10 min before). The volunteer was given a list of 180 personality trait words and asked to identify which words had been contained in her own personality description and to make a confidence rating on her judgment.

At this moment all experimental tasks had been performed and it was approximately 1 hour after the mood induction. The subject was asked to re-enter a relaxed trance state and to return to a neutral affective state. The experimenter verified that the volunteer was in a neutral mood state and provided the subject with a sealed written explanation of the study. The subject was also asked if she had believed the personality description to be real or bogus; all participants indicated that they believed the personality description to have been individualized.

Results

Effect of Mood on Verification Measures

Table 2 shows the mean semantic differential scores and writing-speed change score for the pre- and post-mood-induction trials. Induced elation produced more positive mood scores in both postinduction trials, whereas induced depression produced a lowered mood score in both postinduction trials. The neutral mood condition did not significantly offer the subjective feeling ratings. Looking at the pre–post writing-speed change scores, we see that induced elation caused subjects to accelerate. On the other hand, induced depression was associated with psychomotor slowing. The neutral mood condition did not influence the subjects' performance on this task. The findings in Table 2 show that the mood-induction procedure produced appropriate changes in the subjects' behavior and subjective state.

Theoretical Findings

A 3 (mood state) × 3 (memory type) analysis of variance (ANOVA), with repeated measures on the second factor, was performed on the following dependent variables: free recall of affective memories (Table 3), intensity rating of affective memories, memory strength for self-relevant information (Table 4), response bias for self-relevant information (Table 5), and intensity rating of emotional slides.

Concerning the free recall of past experience (see Table 3), mood state (depressed, elated, or neutral) did not influence memory for pleasant or unpleasant events. Memory type strongly influenced recall, $F(2, 98) = 125.98$, $p < .001$; individual comparisons showed positive, negative, and ordinary memories to be recalled in that order of frequency (Newman-Keuls test, $p < .05$). Table 3 shows that induced elation and depression respectively increased and decreased the recall of positive memories ($p < .05$). Table 3 also shows that the recall of negative memories was decreased by the temporary elation condition ($p < .01$). Individual comparisons showed that the recall of ordinary memories was not influenced by mood state. Concern-

ing the subjects' intensity ratings of the recalled memories, the mood factor, the memory-type factor, and the interaction of these factors were not significant.

Table 4 presents the memory strength (d') that individuals manifested for the self-relevant information. Mood state did not have a significant influence on memory strength, but memory type did influence the d' for the personally relevant traits, $F(3, 147) = 28.92$, $p < .001$. The d' was strongest for neutral information (mean $d' = 1.82$), next strongest for negative information (mean $d' = 1.48$), and weakest for positive information (mean $d' = .82$) about the self (Newman-Keuls test, $p < .05$). Individual contrasts showed induced depression to have significantly lowered memory strength for positive as compared to neutral self-referential information (see Table 4).

Concerning a response bias for self-descriptions, the data in Table 5 show that there was a significant influence of information type on the false-alarm identification rate, $F(3, 147) = 4.20$, $p < .01$. The response bias for positive self-referential information was elevated. We also found that induced depression caused a significant response bias for the recall of negative self-descriptions as compared to neutral self-descriptions (see Table 5). The response bias did not differ for total self-descriptions across mood conditions.

Table 3
Mean Frequency of Free Recall for Personal Memories

Memory type	Induced mood state		
	Elation	Depression	Neutral
Positive			
M	13.75*	8.41*	11.00
SD	7.01	4.74	5.38
Negative			
M	4.55**	7.88	8.70
SD	2.71	4.28	3.06
Ordinary			
M	1.20	1.41	2.80
SD	.78	.43	.94

Note. *t* test for several means (Bruning & Kintz, 1968) was used; all tests were one-tailed and performed within each type of affective memory across mood conditions. * $p < .05$. ** $p < .01$.

Table 4
Mean d' *Memory Scores for Each Type of Self-Referential Information in Each Mood Condition*

Self-referential information type	Induced mood state		
	Elation	Depression	Neutral
Positive			
M	.96	.69*	1.01
SD	.63	.63	.65
Negative			
M	1.37	1.65	1.41
SD	.85	.50	.52
Neutral			
M	1.82	2.00	1.65
SD	.99	.71	.80
Total			
M	1.21	1.27	1.19
SD	.57	.31	.36

Note. *t* test for several means (Bruning & Kintz, 1968) was used; one-tailed test. Positive and negative information conditions were independently compared to neutral information condition within each mood state. * $p < .01$.

For the subject's intensity rating of emotional slides, it was found that "disgusting" pictures as compared to happy pictures were rated as more intense, $F(1, 49) = 86.05$, $p < .001$; M (disgust) = 6.02, M (happy) = 4.64. Induced mood had no effect on the emotional-intensity rating of the slides.

Discussion

For personal memories it was demonstrated that induced depression caused a decreased recall of pleasant life experiences and a tendency to recall more unpleasant episodes. Hypnotically induced elation was found to produce a lowered recall of unpleasant memories. Because the recalled memories were "stored" prior to the subjects' participation in the present study, it can be argued that the induced mood states specifically influenced the retrieval process. Bower (1981) obtained similar findings when

Table 5
Response Bias (β) for Each Type of Self-Referential Information for Each Mood Condition

Self-referential information type	Induced mood state		
	Elation	Depression	Neutral
Positive			
M	2.14**	1.57**	1.65**
SD	2.02	.53	.40
Negative			
M	2.57	3.39*	3.09
SD	1.98	1.50	1.81
Neutral			
M	3.88	5.97	4.67
SD	1.82	2.94	2.62
Total			
M	3.80	3.71	3.68
SD	1.57	1.70	1.43

Note. A larger β indicates a smaller bias, that is, a smaller tendency for false self-identification. A one-tailed *t* test for several means (Bruning & Kintz, 1968) was used. Positive and negative β were independently compared to neutral β within each mood state.
* $p < .05$. ** $p < .01$.

subjects were asked to recall childhood memories while experiencing hypnotically induced sadness or happiness. Bower and his associates (Bower, 1981; Bower, Monteiro, & Gilligan, 1978) have argued that these mood-induced retrieval biases are the result of a state-dependency effect, that is, increased recall of affective memories occurs when there is a "mood match" in the subject's experience at the time of storage and retrieval. A state-dependency explanation of the mood-related biases in recall of personal memories is based on the presumption that subjects felt pleasant or unpleasant at the time such incidents were stored.

Traditional network theories of memory (e.g., J. R. Anderson, 1976) posit that an event is represented in memory by a series of propositions and that recall of an event can be accomplished by presentation of the stimulus on its associated thoughts. A state-dependency effect for affective memories suggests that a person's emotional response to an event is part of the associative network generated for long-term memory. This network theory of human memory as applied to emotional experiences can explain the demonstrated influence of mood on memory in various conditions. Lloyd and Lishman (1975) showed that depressed patients recall fewer sad events in response to a neutral word, and Teasdale and Fogarty (1979) found that induced depression caused normals to take more time to associate pleasant memories in response to a stimulus word. In the present study and that of Bower (1981), an influence of mood on recall of personal episodes occurred when subjects had to free recall. Studies have also shown that cycling manic-depressive patients were better able to recall previously generated word associates when the mood state at recall was more similar to the mood state at the time when the associates were generated (Henry, Weingartner, & Murphy, 1973; Weingartner, Miller, & Murphy, 1977). Isen et al. (1978) showed that event-related happiness enhanced a person's ability to recall positive associates to a neutral word that was previously committed to memory. The robustness of the mood–memory findings across different memory tasks and mood conditions supports the notion that mood may be a basic node in the associative network for long-term memory.

The present findings also are relevant to the delineation of the effect of mood on active memory coding of personal information. It was found that induced depression produced a weaker memory strength for positive information about the self and a significant tendency toward false-alarm identifications of negative self-descriptions. Investigators of social cognition (see Kuiper & Derry, 1980, for a review) have argued that the self functions as a cognitive prototype that both facilitates and biases the processing of any personally relevant information. Beck (1967) has provided clinical evidence showing that depressives selectively focus on past and present negative information about the self. The present study showed that temporary depression in normals influences memory strength and response bias for newly presented personal information, and this suggests that mood and the self as prototype have a significant relationship. However, a significant influence of negative mood on the

processing of self-relevant information was not obtained in previous studies (Isen et al., 1978; Mischel et al., 1973, 1976) and was obtained in the present study. These earlier studies manipulated negative mood by a loss on an experimental task, whereas the present study required the subject to concentrate and accept depressed attitudes. The difference in experimental methods used to induce the mood may account for these contradictory findings. It has been documented that normals have an "illusory glow" for judging the degree of contingency between their responses and outcome: People underestimate the relatedness of their behavior to negative outcomes (Alloy & Abramson, 1979). Therefore, it is likely that subjects experiencing manipulated task failures in those earlier studies (Isen et al., 1978; Mischel et al., 1973, 1976) did not attribute the failure to an internal cause and consequently did not experience a negative mood. It should also be noted that these studies did not use measures to assess mood change.

In the present study we found evidence for a self-enhancing bias in the processing of personal information. Independent of mood condition, subjects had an increased tendency to make false-alarm identifications of positive self-identifications. On the other hand, the subject's memory strength for the same positive self-descriptions was weak as compared to negative and neutral personal information, suggesting that self-enhancing memory processes occur mostly at retrieval of personal information. This possibility may explain the common finding that subjects will recall many more pleasant as opposed to unpleasant memories (see Table 2; Bower, 1981; Holmes, 1970; Meltzer, 1930). It may also be the case that increased recall of happy events reflects subjects' average quality of life rather than a faster forgetting of unpleasant memories.

The present findings help support the notion that temporary mood states are associated with biased memory processes about the self and therefore provide general support for Beck's (1967, 1976) cognitive theory of depression. Specific treatment implications do follow from this information-processing model of depression. For example, a cognitive therapist might attempt by means of thought monitoring and behavioral assignments to alter the "distortions" of a patient's view of himself/herself. On the other hand, a traditional psychodynamic approach might be to increase the patient's expression of anger concerning significant others. In current research we are assessing the influence of thought style on arousal to emotional stimuli. Individual differences on this cognitive dimension of the self may be predictive of specific emotional reactions.

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