Emotional Mood as a Context for Learning and Recall

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The question was whether a person's emotional mood could serve as a distinctive context for learning and retrieval of memories. Hypnotized subjects learned a word-list while feeling happy or sad, and recalled it in the same or the opposite mood, either immediately (Exp. 1) or after one day (Exp. 2). Retention proved to be surprisingly independent of the congruence of learning and testing moods. Experiment 3 had subjects learn two lists, one while happy, one while sad. Later recall of both lists while happy (or sad) revealed a powerful congruence effect. Thus, learning mood provided a helpful retrieval cue and differentiating context only in multi-list circumstances where confusions and interference among memories would otherwise obtain.

We are interested in whether a person’s emotional mood serves as a distinctive context for storage and retrieval of specific memories. Many clinical reports suggest that emotions act as powerful releasers for memories stored at earlier occasions of those emotions (see Fischer & Landon, 1971; Rapaport, 1942). Thus, grief at a personal loss in adulthood may revive memories of events associated with a grief of childhood. Another instance is the clinical technique of reviving lost memories of painful events by having the patient reactivate imagery so as to create anxiety (see Stampfl & Levis, 1967). The patient’s current anxiety about one topic supposedly helps reintegrate the target memory of another anxious event, where formerly it was not retrievable to the nonanxious patient. Another example is the observation by Henry, Weingartner, and Murphy (1973) that manic-depressive psychotics gave more identical responses on distributed replications of a word-association test if the two tests occurred while the patient was in the same mood (e.g., manic-manic) rather than different moods (e.g., manic-depressive). Hence, endogenous mood served as a context modifying the free associations to a stimulus word.

The issue of emotional mood as a learning context is closely allied to phenomena of endogenous state-dependent retention (SDR). State-dependent retention refers to the finding that retention is better when training and testing occur under the same “internal state” than under different states. The “states” most often studied have been produced by drugs or deprivation of sleep. The SDR effect has been found in infrahuman organisms and with some centrally active drugs such as curare, alcohol, chlorpromazine, and pentobarbital (see Overton, 1973, for a review). With large dosages and suitable testing conditions, the SDR effect with animals can be quite substantial, amounting to almost total “dissociation” of memories acquired in the drugged and nondrugged states. However, with humans learning word lists, the “dissociation” produced by alcohol (e.g., Storm & Caird, 1967) or marijuana (e.g., Darley, Tinklenberg, Roth, & Atkinson, 1974) is relatively mild, often not symmetric, and present only with recall but rarely with recognition memory tests (see Weingartner, Adefris, Eich, & Murphy, 1976). Clearly, then, the dissociation construct is inadequate to deal
with the complexity of the results. However, this is not to deny that an internal state can sometimes serve as a unique cue distinguishing one learning context from another. But the results from the many studies are sufficiently variable to caution against premature generalizations until further research clarifies major issues.

As noted before, the present experiments attempt to produce an SDR effect through manipulation of emotional mood rather than drugs during training and testing. The basic question is whether memory is superior when the mood state is the same during training and testing than when it differs. Recently, in studies reported after ours were completed, Macht, Spear, and Levis (1977) used fear of electric shock as a mood context for learning and/or recall in rote serial verbal learning. Though looking for an SDR effect, they found rather weak and mixed effects. For example, in post hoc analysis, they found a significant SDR only for male subjects and only for early items of the serial list (which are surely puzzling restrictions). One is left in doubt regarding the effectiveness of the experimental manipulations.

In our experiments, emotional moods were produced by hypnotic suggestions. We chose happiness (euphoria) and sadness (grief) as the moods because they are apparently incompatible opposites. Highly suggestible subjects were induced to feel very happy or very sad during learning of a word list, and later induced again to feel happy or sad during free recall of that list. The issue is whether performance is superior if the same mood prevails during learning and recall. Experiment 1 uses a single learning list and a short retention interval.

**EXPERIMENT 1**

*Design.* One group learned a word-list under hypnosis while in a happy mood; a second group learned while in a sad mood. After a brief interpolated task, they were placed in the opposite mood and asked to recall the word list. Then their original mood was reinstated and they were asked to recall again. The contrast of interest is the first recall in the opposite mood vs the second recall in the same mood as in original learning. Further, half the words in the learning list were pleasant or happy words, and half were unpleasant or sad words. At issue is whether happy subjects recall more pleasant words, and sad subjects recall more sad words.

**Materials**

The word list consisted of 16 nouns chosen to be abstract because Weingartner et al. (1976) found greater SDR effects with abstract rather than concrete nouns. Eight of the words connoted happy things (e.g., humor, pleasure), and eight connoted sad things (e.g., atrocity, misery). These had ratings between 2.00 and 2.25 in the concreteness norms of Paivio, Yuille, and Madigan (1968).

**Procedure**

After establishing rapport and having the subject lie on a couch, the experimenter induced hypnosis using a relaxation and eye-closure method (see instructions in Weitenhoffer & Hilgard, 1962). Then the subject was asked to put himself into a happy (or sad) emotional mood by imagining a scene in which he had been delightfully happy (or grievously sad). If they could call up no such scene from their life, the experimenter helped them construct an imaginary one that would have the intended emotional impact. Often, the happy scene was of a moment of personal success, a beach scene, or carnival; the sad scene was of a personal failure, loss, or death of a loved one. Subjects were told to adjust the emotion until it was intense but not unbearable; we wanted them to be functional for learning rather than dissolving in laughter or tears. The mood-inducing situation was noted and recorded by the experimenter.
After the subject had experienced this mood for about a minute, he was asked to maintain this mood state at a level intensity while he learned the word list which followed. The experimenter then read the 16 words twice through in random order, one every 5 sec. Then the subject was asked to recall orally all the words he could in any order. When he finished, the word list was read to him twice more in new random orders, and then a second recall was requested. During all this time the subject remained hypnotized, lying on a couch with eyes closed, presumably experiencing the suggested happy or sad emotion while learning.

After learning, the subject was brought out of the mood state and given a 6-min interpolated task while still in hypnosis. He was told that he would be unable to say or remember fully the name Kennedy, referring to John F. Kennedy. Then he was asked a series of questions designed to elicit “tip-of-tongue” experiences regarding this name. The questions concerned the number of syllables in the name, its first letter, whether it rhymes with “serendipity,” and the name of a current famous senator from Massachusetts (i.e., Ted Kennedy). We were interested in the type of information available to people having experimentally produced tip-of-the-tongue experiences.

On completion of this task (about 6 min), the subject was instructed to create a new emotional mood, opposite to that experienced earlier (sad or happy). The same situational imagery method was used. Once this mood was recruited and stabilized in intensity, the person was told to maintain this mood while recall instructions and the recall task were given. The recall instructions were always given via a tape recording which, by standardizing the tone of voice, could not subtly convey differential expectations regarding recall in the several mood conditions. The instructions asked the person to maintain his current mood state and to “recall the word list learned earlier,” saying the words in whatever order they came to mind. The subject was given as much time as he wanted for his oral recall; the experimenter recorded the words recalled and their order.

After recall, the mood state was removed, the person was returned to normal hypnotic relaxation, and a second tip-of-the-tongue activity was interpolated. This time the subject was asked to block on the name Ford, referring to ex-President Gerald Ford. The same series of questions then probed for the information available to the subject about the concept and the blocked name of Gerald Ford. This tip-of-the-tongue activity took about 6 min.

After this, the subject was put back into the mood state he had been in during original learning. He was reminded of his situational scene associated with the earlier occurrence of that mood and was told to make up a completely different scene which would elicit the same emotion of happiness or sadness. Thus, if the original scene was a happy beach scene, a later scene by which a subject reinstated happiness might be imagery of an occasion when he won a competitive contest. After the mood was recruited and stabilized, the person was asked to maintain it while he listened again to the tape-recorded recall instructions and while he orally recalled the word list again. Following this second recall, the mood state was removed, the subject was told he would be able to remember what happened to him under hypnosis, and he was awakened. He was then questioned about memory strategies he had used, the moods he had experienced, and any guesses he had about why we were altering his moods. This was done to ascertain whether subjects could guess the experimenter’s hypothesis and thus comply with that implicit suggestion.

Subjects

The subjects were 10 Stanford undergraduates selected for high susceptibility to hypnosis. They had scored from 10 to 12 (maximum) on an earlier test using the
Stanford Hypnotic Susceptibility Scale, Form C (Weitzenhoffer & Hilgard, 1962). They were experienced hypnotic subjects, able to enter trance easily, and to verbally assess the "depth of trance;" they reported vivid emotional experiences when these were suggested. The subjects were run individually in a 1-hour session and were paid for their services.

**Results**

The mood inductions were quite effective, as witnessed by observers as well as by the subjects' assessment. Happy subjects frequently laughed as they found humor in everything; sad subjects were long-faced, morose, slow to respond, and often on the verge of tears.

Initial learning was equivalent for the happy and sad subjects. The level of free recall at the end of training (second recall) was 11.0 (of 16) for the happy subjects and 10.8 for the sad subjects.

The retention test given about 10 min later in the opposite mood showed virtually complete retention of the material recalled at the end of training. Recall scores were 11.8 for the happy learners tested sad and 10.6 for the sad learners tested happy. The groups showed no forgetting nor did they differ reliably from one another. Thus, a switch in mood caused no loss in memory whatsoever.

The return to the original learning mood for the second recall was unable to increase retention scores which were already nearly perfect. The mean words recalled were 11.8 by the happy learners now recalling in a happy mood, and 9.6 by the sad learners now recalling in a sad mood. These means for second recall do not differ reliably from the first-recall means nor from the end-of-learning means. The results thus show no mood-dependent retention effects at all. This was not due to a ceiling on recall, since recall averaged around 65%, but to the fact that items available in immediate recall were still available on the later retention test regardless of the mood state.

We also examined recall of the pleasant and unpleasant words on each trial. These never differed reliably in recall on any trial regardless of the mood. So happy subjects were not more likely to recall happy words, and sad subjects were not more likely to recall sad words. The sole difference that occurred in this respect concerned the order of recall; the first word recalled by subjects matched the mood during recall. Of 40 recall protocols (10 subjects times four recalls each), in 37 the first word recalled matched the mood of the recaller (a highly significant bias).

We may conclude that we have no evidence for a mood-dependent retention effect. The switch to an opposite mood at recall produced no retrieval loss. Except for the mood differences in order-of-recall, the results were uniformly negative and discouraging. There is always the possibility that more sensitive experimental conditions could be arranged to show the SDR effect. This was attempted in the following studies.

**Experiment 2**

It could be argued that the retention of the learned material was far too high in Experiment 1, so that the mood manipulations had no labile memories to shift above or below a recall threshold. Conceivably, a mood-dependent retention effect will show up when there is some forgetting. Accordingly, in Experiment 2, the retention interval was increased to 24 hours to increase forgetting of the word list.

An inelegant feature of the design in Experiment 1 was that all subjects were first tested for retention in the opposite mood and then in the same mood as learning. Thus, match of testing and training moods was confounded with order of recall and retention interval. However, since no forgetting was observed in Experiment 1, the confound is unimportant. But in Experiment 2, we avoided this confound by having half the subjects
tested initially in the same mood as during learning.

**Method**

**Design.** The experiment had a $2 \times 2$ factorial design with four groups of four subjects: happy or sad mood during learning, and happy or sad mood during retention testing the next day. The 20-word learning list consisted of eight happy words, eight sad words, and four neutral words. Thus, word-type was a within-subject variable.

**Procedure**

The general procedure was similar to that of Experiment 1 except 24 hours intervened between the end of learning and the test for retention. Also the word list experiment was run in conjunction with another experiment with the same subjects examining the effect of mood on the perspective reader's adopt while reading a story, and how that influences recall of the story the next day. The two experiments involved parallel events: (1) induction of mood state on Day 1, study of the story, then study of the word list, and awakening from hypnosis; (2) after 24 hours, induction of hypnosis on Day 2, recall of the story, arousal of the mood state, recall of the word list in that mood, and awakening from hypnosis. The story-perspective experiment is reported elsewhere (Bower & Monteiro, Note 1) and will not be mentioned further here.

The experimenter induced a happy or sad mood in the subject by having him imagine a scene associated with that emotion; the scene was noted by the experimenter. During Day 1, after the mood was stabilized in intensity, the subject read the story, filled out an evaluation form on it, received instructions for studying and recalling the word list, and then received two study-recall cycles on the 20-word list. During all this time (approximately 15 min), the subject was frequently reminded to maintain the mood state induced at the outset. The learning trials consisted of handing the subject the printed list of words and letting him study the list for 60 sec; then he recalled the words orally in any order as they came to mind, having up to 2 min to do so. When the subject finished, the mood state was removed, the subject was awakened from hypnosis, and sent away with instructions to return the next day for more experimental tasks. The next day, the subject was hypnotized and put into the mood state designated for his experimental condition. If the mood state for testing were to be the same as for learning, he was nonetheless asked to construct a different eliciting scene in imagination. While this emotion was recruited, he was given the posthypnotic suggestion that he would experience this mood at this intensity later when he was given a green sheet of paper with some instructions on it. (These were in fact the recall instructions for the word list.) An amnesia instruction was also given for this suggestion so the subject would not be aware of why he was feeling happy or sad as he recalled the list. The mood state was then removed and the subject was awakened from hypnosis.

Upon awakening, the subject was given a white sheet of paper and instructed to write on it his recall of the story he had read the day before. When finished, he rested for 2 min and was given the green sheet containing the instructions for recall of the word list. To casual observation, as our subjects read these, they progressively went more “into” the called-for mood of happiness or sadness. After reading the instructions, they wrote the words recalled on the green paper, taking as long as needed to do so. When finished, a posthypnotic cue was given (“That's fine. It's all over.”), which lifted the mood state. The subject was then interviewed about his memory for the mood shifts relative to the learning and testing experiences and probed for any expectations about how well he should have been recalling. Finally, the subject was briefly rehypnotized and the posthypnotic suggestion was removed; he was then awakened and completely debriefed.
Subjects

The 16 subjects were Stanford undergraduates who had scored very high (10 to 12) on a screening with the Stanford Hypnotic Susceptibility Scale. They were experienced in hypnosis, quickly entered trance, could estimate “depth of trance,” and could vividly experience the emotions suggested by the experimenter. The subjects were assigned in random rotation to the four groups defined by the “learning-mood by testing-mood” factors. The subjects were paid at the end of the second session for their participation.

Results

The main results are displayed in Table 1 in terms of the mean words recalled (out of 20) at the end of original learning and on the retention test. First, we note that original learning (OL in Table 1) was about the same for the Happy and the Sad learners, with mean of 11.4 for Happy and 12.6 for Sad subjects. Learning mood had a slight effect on later recall (recall means of 5.3 for Happy and 8.4 for Sad learners); however, this difference is not significant in the factorial analysis of variance \( F(1, 12) = 3.79, p > .05 \). The scores in Table 1 show a slight advantage for tests done in a happy mood, but this effect is far from significant.

A mood-dependent retention effect would be shown by an interaction in the recall scores of Table 1. However, no interaction is apparent. Subjects in the same mood as learning recalled an average of 6.8 words, and those in a different mood recalled an average of 7.0 words. The picture is no better if we examine the percentage retention (viz., the ratio of the test score to the OL score). However, the groups are small (necessarily, since we selected exceptionally susceptible hypnotic subjects) and a few extreme scores here affect the averages considerably.

We examined recall of the happy and sad words from the list during learning and retention testing. As in Experiment 1, the two classes of words were recalled in equal amounts. We also inspected the order of recall, indexed by the first word recalled. If we exclude cases when a neutral word is recalled first, during retention testing 12 of 13 subjects first recalled a word connoting the same mood they felt. Similarly, during the two learning trials, on 23 of 31 occasions the first word recalled was in the same mood as the subject \( z = 3.09 \). The deviations on both learning and testing are highly significant. Again, we have an effect of mood on order of output of the words but not on total recall. The order-effect may simply be a priming or self-cueing effect produced by the subject having just been thinking happy or sad ideas to elicit the mood in himself, and these concepts may associatively arouse list-words of the same emotional class.

Regarding the issue of central concern, however, mood-dependent retention simply did not materialize in any strength in the arrangements of Experiment 2. We were beginning to lose hope!

Experiment 3

As a final venture, we investigated whether hypnotic mood could be used to enhance or diminish the retroactive interference that normally arises when a person learns two lists of words. We took our clue from an earlier experiment by Nagge (1935) who had showed hypnotic trance vs nontrance could serve as

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Average Words Recalled at the End of Original Learning and at Retention Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing mood</td>
<td></td>
</tr>
<tr>
<td>Happy</td>
<td>Sad</td>
</tr>
<tr>
<td>Learning mood</td>
<td>OL Test</td>
</tr>
<tr>
<td>Happy</td>
<td>10.8 5.8</td>
</tr>
<tr>
<td>Sad</td>
<td>12.8 9.0</td>
</tr>
</tbody>
</table>
differentiating states to reduce interference in a two-list experiment. The basic design requires the person to learn List 1 while in mood-state 1, then learn List 2 while in mood-state 2, then later recall List 1 and List 2 while in mood-state 1 or 2. If mood-state provides a distinctive context aiding discrimination of the lists, then minimal interference in recall of List 1 should occur when the List-1 recall mood is the same as the List-1 learning mood but different from the List-2 learning mood. On the other hand, maximal interference in List-1 recall should occur when the recall mood is the opposite for the List-1 learning mood and identical to the List-2 learning mood. In this case, the testing mood is associated with the interfering material of List 2 rather than the target material of List 1. A moment’s thought will show that the test-mood condition that maximizes interference with List-1 recall will minimize interference with List-2 recall; similarly, the test-mood that minimizes interference in List-1 recall will maximize interference with List-2 recall. The increase or decrease in interference in these cases would be assessed relative to a control group that learns both lists in the same mood and that is tested for recall in that mood.

The design can be notated easily by letting S and H represent the Sad and Happy moods, and letting three successive letters represent the mood-states during learning of List 1, learning of List 2, and recall testing, respectively. Thus SSS and HHH are the control groups. Groups SHS and HSH are expected to show minimal interference in recalling List 1 but maximum interference in recalling List 2. Groups SHH and HSS are expected to show maximal interference in recalling List 1 but minimal interference in recalling List 2. The other logical possibilities (i.e., SSH and HHS) were not run since they were of no theoretical interest to us.

**Method**

**Procedure.** The subjects were hypnotized and asked to put themselves into a happy or sad mood (half assigned to each mood at random). The same procedure as detailed before was used to stabilize the intensity of the emotional mood. The subject then received instructions for free recall learning of List 1. He then heard the list read twice through in random order at a 3-sec rate, then free-remembered the list orally. A second such study-recall cycle was then carried out, with the words presented in new random orders. Recall scores on the second cycle were used as a measure of “original learning” of List 1. After the two study-recall cycles on List 1, the subject’s mood was removed and he was instructed to relax.

After a minute, he was asked to recall another emotional experience (happy or sad, as stipulated) and to relive that emotional mood. Once in that mood state, the subject received two repeated study-recall cycles on List 2 using the same procedure as for List-1 learning. After this, his mood state was removed; he was relaxed and instructed to re-enter hypnosis later upon a presentation of a specified cue from the experimenter. Then he was awakened.

After brief conversation, the subject performed an intervening distractor task. He was instructed to read a chapter from Robert Lindner’s “The Fifty Minute Hour” for 10 min with the aim of summarizing it. After 10 min of reading, the subject was stopped and asked to give his summary orally for 2 min.

Next, the posthypnotic cue was presented and the subject re-entered hypnosis. He was then asked to recall a third emotional experience (happy or sad, as required by the experimental design), to relive that emotional mood, and to maintain it at level intensity as he performed the subsequent tasks. He was then asked to recall orally as many words as he could, in any order, from the first list learned. He had 3 min to recall List 1. Then, instructed to maintain hypnotic depth and this emotional mood, he was asked to recall List 2 orally, and again given 3 min. After that, the mood was removed and posthypnotic cue for
re-entry into hypnosis was erased. He was relaxed and then taken out of hypnosis. After debriefing, he was dismissed.

**Materials**

The two 16-word lists were abstract words (rated between 2.0 and 3.0 on concreteness in Paivio et al., 1968). In each list there were eight happy words (e.g., affection, victory, gaiety) and eight sad words (e.g., atrocity, tragedy, misery).

**Subjects**

The subjects were 14 females and 10 males assigned as evenly as possible to the three main experimental conditions. Ten subjects were Stanford undergraduates selected for having scored very high (10 to 12 points) on the Stanford Hypnotic Susceptibility Scale, Form C. The other 14 subjects were non-students selected from a pool of former students in hypnosis workshops conducted by the third author. They were excellent hypnotic subjects; nine were tested on the Stanford Scale, Form C, and all scored in the 10 to 12 range. All subjects were paid $2.00 for their participation in the experiment.

**Design**

There were six experimental conditions. Using first and second letters to denote mood states during learning of List 1 and List 2, and the third letter to denote mood during recall of both lists, the six conditions were: SHH and HSS (Maximum interference for List 1); HHH and SSS (Controls); and SHS and HSH (Minimum interference for List 1). We will refer to these as the Max, Min, and Control groups. Four subjects were assigned in random alternation to the six groups with the restriction that the male–female composition should be nearly the same in each group.

**Results**

The primary results are summarized in Table 2 in terms of average words recalled (out of 16) at critical points in the experiment. Also shown are the percentage retention scores, calculated as the ratio of the recall score to the original learning score for a given list and condition.

A first observation is that the two sub-groups with a given condition hardly differ in original learning or recall. Thus, for example, subgroups SHS and HSH in the Max con-

<table>
<thead>
<tr>
<th>Experimental condition</th>
<th>List 1 OL</th>
<th>Recall</th>
<th>%</th>
<th>List 2 OL</th>
<th>Recall</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum interference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHH</td>
<td>11.0</td>
<td>4.7</td>
<td>43</td>
<td>9.0</td>
<td>8.0</td>
<td>89</td>
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<tr>
<td>HSS</td>
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<td>5.2</td>
<td>48</td>
<td>11.5</td>
<td>10.5</td>
<td>91</td>
</tr>
<tr>
<td>Mean</td>
<td>11.0</td>
<td>5.0</td>
<td>46</td>
<td>10.2</td>
<td>9.2</td>
<td>90</td>
</tr>
<tr>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>HHH</td>
<td>10.0</td>
<td>5.2</td>
<td>53</td>
<td>11.7</td>
<td>6.7</td>
<td>57</td>
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<tr>
<td>SSS</td>
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<td>5.7</td>
<td>56</td>
<td>11.7</td>
<td>6.7</td>
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<tr>
<td>Mean</td>
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<td>5.5</td>
<td>54</td>
<td>11.7</td>
<td>6.7</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>SHS</td>
<td>11.8</td>
<td>8.2</td>
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<td>HSH</td>
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<td>Mean</td>
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<td>7.9</td>
<td>66</td>
<td>11.0</td>
<td>5.3</td>
<td>48</td>
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</tbody>
</table>
Mood and Memory 581

Conditions are quite comparable at all points. This means that mood state per se was not an influential factor during either learning or recall; only the relation of learning to recall moods was influential. Because subgroups within the major conditions were equivalent, they are henceforth pooled and the Max, Min, and Control conditions treated as homogeneous in statistical tests.

Examining average original learning scores, the groups are clearly comparable on List 1 and on List 2. Overall analyses of variance detected no significant differences here. The major differences occur in the retention scores, and these are in the predicted directions in all cases. Statistical analyses were based on the arcsine transformation of individual recall percentages (the scores shown in the fourth and seventh columns of Table 2). The overall analysis of variance for List-1 retention percentages showed a significant effect due to groups \( F(2, 21) = 6.02, p < .01 \). The groups are in the predicted order, with the Max interference group showing poorest List-1 retention (46%), the Control group a moderate amount (54%), and the Minimum interference group showing the best List-1 retention (66%). The predicted linear trend is significant \( F(1, 21) = 4.33, p < .05 \).

A similar overall analysis of variance on percentage recall scores (arc sine transforms) for List-2 declared highly significant group differences \( F(2, 21) = 15.99, p < .001 \), with percentages at 90%, 57%, and 48% for groups Max, Control, and Min, respectively. The predicted linear trend is highly significant \( F(1, 21) = 27.89, p < .001 \).

Another perspective on the data is to compare within each subject his retention percentages for List 1 and List 2. These within-subject comparisons are of interest only for the Max and Min groups; control subjects were expected to have equivalent retention for the two lists, and they in fact did not differ in percentage retention. Comparing List-1 and List-2 retention percentages, all eight Max subjects forgot more of List 1 than List 2; whereas seven of eight Min subjects forgot more of List 2 than List 1. Assigning to each subject the algebraic difference, List-1 minus List-2 retention scores, the Max and Min groups differ significantly on these differences scores \( t(14) = 7.10, p < .001 \). In summary, we may conclude that recall was best when the mood-state during recall was the same as the mood-state during learning of the list being recalled and when the learning mood-state of the interfering list was different (e.g., SHS or HSH). Conversely, recall was poorest when mood during recall differed from that during learning of the to-be-recalled list and when the interfering list was learned in the same mood as the recall mood (e.g., SHH or HSS).

Further Recall Measures

The foregoing results concern correct recall. We also examined other features of recall. One feature is intrusions during recall of a specific list. The intrusions can come from the other list not being recalled or from outside both lists. Although the numbers are small, we found the most intrusions for the Control group that learned the two lists under identical mood conditions and the fewest intrusions for the Minimum Interference group. Mean intrusions per subject on List 1 were 2.12, 1.25, and 0.62 for the Control, Maximum, and Minimum Interference groups, respectively. List-2 intrusions were comparable. These do not differ reliably because of the small samples. About 55% of intrusions came from the other list. Classifying the intruded item as happy or sad, it agreed with the mood of the recaller 63% of the time. We had hoped to find that other list intrusions would be greatest in recalling a list for which interference should be maximal (that is, recall of a happy list while sad, and recall of a sad list while happy). The intrusions averaged .86 per subject for mood-incongruous recalls and 1.00 for mood-congruent recalls. Clearly, then, the congruence of the retrieval mood to the target list did not influence intrusions.

We also examined pleasantness of the words
recalled, but, as before, the happy and sad words did not differ in recall according to the mood state of the recaller. The order of recalling happy vs sad words was indexed simply by the connotative class of the first word recalled. Across all recall trials, there was no tendency for subjects to recall first a word which was congruent with their recall mood. Congruence of the first recalled word was 51%, to be compared to chance level of 50%. Output order seemed determined by primary or recency of the words in the input list, not by recall mood. The result on output-order in Experiment 1 must be considered unreplicable.

Finally we examined whether subjects clustered their free recall according to the happy vs sad word categories. That is, do people recall more than chance in groups of happy words and groups of sad words? We used a “runs” measure of consecutive within-class recall. A clustered recall sequence will have fewer runs than a nonclustered sequence. Given the number of happy and sad words recalled, the probability of observing a given number of runs by chance has been tabulated by Wald and Wolfowitz (see Siegal, 1956). Applying the corresponding test for significant deviation of runs from chance to each subject’s recall (when the amount of recall permitted it), there was no overall tendency for our subjects to cluster by good vs bad words. The number of significantly clustered protocols in the pool hardly exceeded 5%. So, we may conclude that in this experiment subjects are treating the happy and sad words equally, in terms of equal amounts of recall, equal priority in recall order, and equal probability of following a word of one class by recall of a word of the same or the opposite connotative class. From the viewpoint of the subject’s recall, the words were homogeneous.

Recall scores for males and females were also examined. While average levels of learning and recall were comparable, it appeared that males showed a somewhat larger effect of mood congruence than did females. Using only the Max and Min groups, we indexed the mood congruence effect by the percentage retention for the (predicted) minimum interference list (1 or 2) minus that for the (predicted) maximum interference list. This mood congruence index averaged 49% for the seven males (91% vs 42%), and averaged 18% for the nine females (68% vs 50%). A t-test on the arc sine transforms of the congruence indexes concluded that the males’ scores were marginally significantly larger than the females’ [with $t(14) = 1.87, p < .10$ two-tailed test]. The trend in favor of males showing a larger effect is similar to that reported by Macht et al. (1977).

DISCUSSION

In Experiment 3, we finally produced the mood-dependent retention effect for which we had been searching. Recall of a given target list was best when the mood state during recall was the same as that during learning of that list, and worst when the recall mood differed from the mood during learning of the target list. The predictions in terms of the conditions of maximum and minimum interference were confirmed in detail, and the results were very orderly.

The main issue is to reconcile the consistent, strong mood-dependent-retention effect in Experiment 3 with the absence of mood effects in Experiments 1 and 2. The most obvious difference is that Experiment 3 used a two-list, interference design with emotional moods serving as differential contexts for learning; whereas Experiments 1 and 2 employed a single-list design. Suppose that the influence of an emotional mood is primarily to serve as a distinguishing context and that recall will be aided by that only if the learning context by itself is nondistinct, undifferentiated from the mass of past experiences and nonrecoverable. In the single-list designs of Experiments 1 and 2, the list-learning context by itself is perhaps sufficiently distinctive from common experience so that no additional differentiation is
provided by the emotional mood during learning. Adding the mood is like adding a redundant relevant cue to a primary relevant cue (i.e., "The list learned") that is already sufficiently differentiated from past experience. The gain due to the redundant mood cue emerged significantly only when the target learning list was easily confused with other learning material. Understandably, the redundant mood cue most improved the situation when differentiation of the target list from others in memory would have been poor.

List differentiation or context discrimination, however, is clearly not the only factor involved, since recall of lists was influenced markedly by the mood at the time of recall. For example, in condition HSH, List 1 was recalled better than List 2; whereas in condition HSS, the reverse was true. The difference between recall of the two lists cannot be attributed to list discrimination per se. Rather, we must admit that the current mood helps provide selective access to memories stored while in that mood. This could arise if the current mood helps revive the total context in which the target list was learned.

Depending upon one's theory of free recall memory, we can think about the effect of mood on recall in either of several ways. One hypothesis is that verbal items are associated independently to a compound context, consisting of the list number (A or A') and the internal mood (S or H). In this view, the two lists (B and C) of associations may be represented as (A + H) → B and (A' + S) → C, in which the mood is both a discriminating cue and a retrieval cue for its list words. An alternative hypothesis is that of FRAN (Anderson, 1972) or HAM (Anderson & Bower, 1973), in which free recall is the output of a network of tagged associative pathways, representing relations among list concepts that the subject thinks of as he studies the list. In such theories, recall consists of starting from a small recall-set and then searching for other list-words, making especial use of semantic connections tagged as having been thought of during learning of that list. For such a theory, suppose that the subject's mood acts like a constant cognitive element in short-term memory which automatically influences the direction of memory search from the current focus. [See Henry et al.'s (1973) finding that free associates were more similar when manic-depressive patients were retested in the same mood state]. Then, when the mood is the same during recall as during learning, the associative search is biased to proceed along the same conceptual pathways; when the moods differ, the search may be repeatedly shunted down associative pathways not used during learning, with the result that fewer list-words are found for recall. Such a search theory is not rejected by the lack of influence on recall of pleasant vs unpleasant words; associative distance, not evaluative similarity, is the effective factor, and pleasant-unpleasant words often come in closely associated pairs (e.g., comedy-tragedy, love-hate). The more serious problem with the hypothesis of mood-dependent search pathways is that it would seem to predict a mood-dependent retention effect with the single-list conditions of Experiments 1 and 2; whereas no such effect was found. Perhaps further evidence for the effect of mood on selective memory search could be obtained by having subjects "think aloud" and report their free-floating associations while they are trying to recall material while in particular mood states.

We found that emotional mood served as a distinctive learning-and-recall context primarily when the subject had to keep distinct several interfering sets of material. Earlier, Blum (1967) reported similarly impressive state-dependent retention using hypnotic trance "states." On each trial, Blum's well-trained subject listened to a consonant quadragram while hypnotized or awake, then quickly switched "states" to listen to the second quadragram for the trial. He then stayed in the same state or shifted back to the alternative state as he attempted immediate recall of both quadragrams. The subject recalled best that
quadrigram whose input state matched his output state (i.e., an SDR).

Later experiments with this subject (Blum, Graef, & Hauenstein, 1968) showed how rapidly shifting hypnotic contexts served to reduce interference among items being memorized. He was programmed to encode on each trial six new consonant trigrams (one every 5 sec) by encoding the first while in a deep hypnotic sleep, the second while half awake and half asleep, the third while in a posthypnotic dream state, and the final three trigrams while awake. As he took in each trigram, he rehearsed only it in isolation. This subject was programmed to recall the sixth, fifth, and fourth trigram in that order while awake, then re-enter deep hypnotic sleep to recall the first trigram, enter the half-asleep state to recall the second trigram, and finally the dream state to recall the third. By so programming distinctive mental contexts during encoding and their counterparts during recall, Blum's subject achieved spectacular improvements on a difficult task that was formerly insurmountable. Surprisingly, his improved performance was maintained when, after many hypnotic sessions, he was retested without using the hypnotic contexts. Apparently, learning strategies (rehearse one trigram at a time, locate it in its serial position) and recall strategies (recall in a special order) acquired in the hypnotic sessions transferred to elevate waking performance. Our manipulations of hypnotic mood have not produced such spectacular results as Blum observed by varying arousal level. However, Blum studied immediate recall with one highly-selected and practiced subject.

It is interesting to compare the learning-and-recall program of Blum's subject with that of a subject using mnemonic techniques such as pegwords or the method of loci (e.g., Bower, 1970). Subjects programmed to use the "one-bun, two-shoe, three-tree,..." method follow interlocking instructions for learning and recall. First, they call up a known list of distinctive mental contexts (images of a bun, a shoe, etc.) within which to place each successive item to be learned; a typical injunction is that they rehearse each item separately along with its unique context. Second, the subject during recall reinstates each mental context in turn, cueing his recollection of the item placed in that context. If we substitute "hypnotic states" for "images of pegwords" (or "locations"), the similarity of the two procedures is apparent. A possible difference is that hypnotic states are more distinctive, hence less subject to interference, than are mental contexts created by imagining various common objects.

Finally, let us consider the clinical anecdotes about mood-bound memories in light of our findings (see Fischer & Landon, 1971). First, total dissociation of mood-bound memories is probably exceptionally rare (so rare as to make a dramatic clinical anecdote when it is observed). One can seldom rule out the alternate explanation that a normally potent retrieval cue for the "hidden" memory had not been used. Second, a proper theory must also account for the overwhelming number of memories we normally have for events that happened to us while we were in some different mood (e.g., while calm, I can still remember now many unhappy facts of my father's funeral). This is to say that an emotional mood is probably best considered as an extra cue to help retrieve a set of memories, but that they may be retrievable in part in the absence of the mood state. Third, recall of specific incidents of one's life probably more closely approaches the conditions in Experiment 3 than the conditions of Experiments 1 and 2. The person must remember a configuration of actors, actions objects, and results at a specific time and place, and distinguish that configuration from other incidents of his life involving similar actors, actions, and outcomes at similar places (e.g., my father's funeral vs my friend's father's funeral). Alert individuals are always learning something, if only incidentally, about the events of their life. An intense emotion aroused by an event may
firmly lodge that event in memory because the emotion may be distinctive and seldom experienced at this intensity. Moreover, personal emotional events tend to be thought over repeatedly, with the result that the event becomes associated with the persisting mood state (e.g., grief). The associations may be dormant for many years until the intense emotional mood is re-experienced, at which time the person may “spontaneously” come forth with memories of earlier incidents associated with the same mood. The fact that a client spontaneously recalls many mood-relevant memories cannot be taken as evidence of mood-dissociation of memories; the phenomenon is compatible with selective self-cuing of mood-relevant memories and a willingness to follow out mood-modulated associative chains.

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REFERENCE NOTE


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