Mood-state–Dependent Retrieval: The Effects of Induced Mood on Memory Reconsidered

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Analysis of studies investigating mood-state–dependent retrieval identifies methodological problems that may have contributed to the controversy surrounding the reliability of the effect—in particular, the possible confounding of encoding and retrieval in previous studies. Five experiments are reported investigating the effects of mood on learning and recall. Mood-state–dependent retrieval was observed in Experiment 1a (using Velten’s Mood Induction Procedure); Experiment 1b (using a music MIP); and Experiment 1c (using Velten’s MIP at encoding and a music MIP at retrieval). Subjects who learned and recalled in different moods had significantly greater decrements in recall than did subjects in the same moods. Experiments 2 and 3 investigated the effect of observable retrieval cues on mood-state–dependent retrieval. In Experiment 2, the presence of observable retrieval cues at recall overrode state-dependent retrieval. In Experiment 3, by manipulating the presence or absence of observable cues at recall, both the occurrence and the erasure of the mood-state dependency was demonstrated. Mood state during learning and cued recall was also shown to affect performance in a third session under conditions of free recall.

There is considerable controversy surrounding the state-dependent effects of mood on memory (see Blaney, 1986; Kuiken, 1991). Mood-state–dependent retrieval has important implications for theories of context effects in memory (Baddeley, 1982; Bower, 1981, Davies & Thomson, 1988; Eich, 1989; Tulving, 1983; Tulving & Thomson, 1971, 1973) and theories of depression (Beck, 1976; Blaney, 1986; Ingram, 1984; Reus, Weingartner & Post, 1979; Teasdale, 1983), but demonstrations of the phenomenon seem to be elusive and unpredictable and present some embarrassment for these theories. In a critical review of the literature on affect and memory, Blaney (1986) has noted that although the literature demonstrating state-dependence involving drug-induced states is considerable, there are few relevant studies involving elated or depressed mood. Other reviewers have noted that the evidence for the presence or absence of mood-state dependency remains highly equivocal, whereas the evidence for mood congruency is strong (Baddeley, 1990; Bower & Mayer, 1991; Eich, 1989; Ellis & Ashbrook, 1991). Bower (1987) claims to have been “unable to figure out anything systematic that causes these conflicting results” (p. 451). Bower confesses to not having carefully inspected all the varying procedures of the
successes and failures, but concludes that "The effect seems a will-o’-the-wisp that appears or not in different experiments in capricious ways that I do not understand" (Bower, 1987, p. 451). Kihlstrom (1991), however, suggests that no special onus should be attached to the mood memory literature simply because it cannot produce reliable mood-dependent retrieval. Kihlstrom refers to two other classes of experiments, drug-state-dependent retrieval and environment-dependent memory effects, and concludes that such effects have been difficult to observe in humans under any circumstances. To recognize that the effects may have limited reliability and be subtle in their operation seems a more useful view, as it may permit a description of these effects within the limits of their reliability once this has been assessed.

This paper presents a systematic analysis of the reported evidence relevant to the reliability of laboratory demonstrations of mood-state-dependent retrieval and highlights some of the problems that may have contributed to the controversy surrounding it. Bower and Mayer (1991) have concluded that what is needed now is some insightful analysis of the reasons, if any, for the positive and negative results on mood-dependent retrieval. In the domain of psychology, this field is unusual in that the number of published studies reporting null findings is considerably greater than the number reporting positive findings. Mood-state-dependent effects have been reported by Bower, Monteiro, and Gilligan (1978, Study 3); Leight and Ellis (1981); Schare, Lishman, and Spear (1984, Study 3); Mecklenbräuker and Hager (1984), and Gage and Safer (1985). Eich and Metcalfe (1989) reported more pronounced mood-dependent effects in memory for internal (generated items) than for external events (read items); and Eich, Macaulay, and Ryan (1994) demonstrated mood-dependent memory in three studies where subjects generated autobiographical events in response to neutral nouns. Null findings or failures to replicate have been reported by Isen et al. (1978); Nasby and Yando (1982); Bartlett and Santrock (1979); Bartlett, Burleson, and Santrock (1982); Bower et al. (1978, Studies 1 & 2); Schare et al. (1984, Studies 1 & 2); Bower et al. (1981, Study 3); Bower and Mayer (1985); Wetzler (1985); Haaga (1989); and Foa, McNally, and Murdock (1989). To take one example of the preoccupation with null findings in the literature, Ellis and Ashbrook (1991) note that only very limited evidence of state-dependent effects was obtained by Leight and Ellis (1981, Study 2), and that in eight possible instances where state dependency could have been produced, the effect was reliably evident in only one.

It seems therefore, that insightful analysis of the reasons for the positive results on mood-dependent retrieval may be difficult to support with published studies alone. Notwithstanding this, certain methodological considerations have been described which are pertinent to research concerning mood-state dependency. Ellis and Ashbrook (1991) state that the methodological issues in mood and memory research can be categorized according to three topics: subject factors, emotional-state factors, and factors related to the cognitive task. Ellis and Ashbrook (1991) provide a useful review of these issues. However, there appear to be some more fundamental problems that can be identified by reference to studies reporting negative findings. These problems concern the methodological rigour of both the design and the conduct of these experiments.

The first problem concerns the mood manipulation stage of experimentation. Three of the studies that have reported null findings do not provide objective measures of experimentally manipulated mood, leaving open the possibility that subjects may not have been
in the appropriate mood state (same or different), and that mood was not successfully manipulated (Bower et al., 1978; Isen et al., 1978; Nasby & Yando, 1982). Furthermore, studies of mood-state dependency in general have failed to specify a priori criteria that define differences between mood conditions. A failure to find differences between the conditions undertaken in different mood states might therefore simply be the result of an insufficient difference between the manipulated moods, or variance in the mood elicited under a particular condition. Eich and Metcalfe (1989) have noted that by imposing a stringent criterion, the odds of demonstrating mood-dependent memory would be improved. A number of studies have utilized an hypnosis technique to induce mood (Bower, Gilligan, & Monteiro, 1981; Bower & Mayer, 1985; Bower et al., 1978). The limitations of the hypnosis technique have been well documented and include the effects of experimenter bias and demand characteristics as well as selectiveness in subject population (Bower & Mayer, 1991; Goodwin & Williams, 1982; Hasher, Rose, Zacks, Sanft, & Doren, 1985; Nasby & Yando, 1982). Indeed, it is possible that counter-demand may account for some of the observed findings using this technique, where the experimenter inadvertently presents subjects with a “demand not to produce demand effects” (Polivy & Doyle, 1980). With these criticisms in mind, Bower (1981) has repeated certain experiments using happy or sad music in the background as a more unobtrusive form of mood manipulation. Although noted in Bower (1981), the data from these music mood induction experiments are not reported or referenced. Other studies of mood-state-dependency have used the Velten technique (as described later on) to induce elated, depressed, or neutral mood states (Velten, 1968), but they have only provided one mood group for comparison with a neutral group (e.g. Schare et al., 1984; Leight & Ellis, 1981). The inclusion of a second, more distinct mood group might have permitted state-dependent effects to emerge.

A more major problem with these studies however, is the possible confounding of encoding and retrieval. First, few studies report measures of the level of initial learning, and they do not appear to have controlled for the fact that some subjects may learn less than others initially. When initial learning is not measured objectively, there is no way to separate the effect of mood on learning from the effect of mood on retrieval; the confounding of encoding and retrieval in many studies is a serious flaw. Secondly, subjects in one group learning less initially than subjects in another group may lead to the asymmetrical dissociations at recall that have been reported in a number of studies, where state dependency has only been observed for positive mood states (Bartlett et al., 1982; Bartlett & Santrock, 1979; Mecklenbrauker & Hager, 1984), a possible inference being that there was less initial learning in the negative mood-states. Further support for this conclusion is provided by Leight and Ellis (1981) who observed an asymmetrical mood-state-dependent effect using the Velten mood induction procedure. They report that the initial learning scores of depressed and neutral-mood subjects differed significantly, with depressed subjects learning less than neutral-mood subjects. In a pilot study we investigated the effects of alcohol on state-dependent retrieval (Kenealy, 1982). Alcohol affected rate of learning with subjects in the alcohol group learning less in Trial 1 and 2 than sober subjects. In Experiment 1a reported here, the same pattern was observed with mood affecting rate of learning. On Trial 1, elated subjects learnt significantly more (mean = 12.01) than depressed subjects (mean
= 6.50); in further trials the effects of mood did not appear to be linearly related to rates of learning. Designing experiments to ensure equivalence of initial learning by all subjects appears to be an important factor in demonstrating symmetrical state-dependent learning, a point noted by Overton in 1974 but largely ignored by contemporary experimentalists in this area. It may be that many experiments cannot be discounted on these grounds (e.g. Bower, personal communication 1994); however, data on the rate and equivalence of learning have not always been reported, so the problem cannot be entirely dismissed.

Bower et al. (1978) appear to have provided the clearest demonstration of mood-state-dependent effects, although the phenomenon was observed only under the enhanced interference of two-list conditions. Blaney (1986) notes that evidence on this point is also mixed. It is claimed that mood-state-dependent findings with interference designs have been difficult to replicate (Bower & Mayer, 1985; Wetzler, 1985), although these attempts appear to have been modified replications. Blaney (1986) concluded that “Even this effect, when evident, might be obtainable only when exposure and recall moods are induced by procedures that are somewhat similar to one another” (p. 231). Haaga (1989) pointed out that when the mood induction procedure is the same at learning and recall, there is no way to separate the effect of mood similarity at learning and recall from that of induction procedure similarity. However, in an experiment using different induction techniques (the Velten technique and an autobiographical recollection procedure), Haaga concluded that similarity of mood induction procedures did not affect recall. Nonetheless, mood-state-dependent retention was not demonstrated.

The purpose of this article is not to present a detailed review of the mood-state-dependent literature; adequate accounts may be found elsewhere (e.g. Blaney, 1986; Peeters & d’Ydewalle, 1987). However, it does seem that a number of important factors and serious flaws in experimental design have contributed to the equivocal nature of the findings concerning mood-state dependency. In summary, all of the studies previously mentioned have one or more of the following problems: designs that have confounded encoding and retrieval by not measuring (or reporting) initial learning scores; a lack of objective measures of mood manipulation; the use of the same method of mood induction at encoding and retrieval, so confounding the effect of mood and the effect of the induction procedure. The evidence available at present, therefore, does not allow definitive statements to be made concerning the generality and reliability of mood-state-dependent retention. Although other factors such as those mentioned by Ellis and Ashbrook (1991) may clearly be important, experimental evidence that takes account of the more fundamental problems of design inherent in the previous work needs to be provided. The experiments reported here were designed with these issues in mind. Investigation of the issues required various levels of control and involved proceeding through a number of stages of research. In all experiments, objective measures of mood induction were provided; the first two experiments (1a and 1b) addressed the problem of confounding encoding and retrieval; the third experiment (1c) addressed the issue of confounding the effects of mood and of the induction procedure; and the fourth and fifth experiments investigated some of the interesting questions concerning the nature of retrieval cues in mood-state-dependent retrieval.
Kihlstrom (1991) points out that the hypothesis of mood-state-dependent retrieval is based on an analogy with state-dependent memory produced by pharmacological substances such as alcohol, barbiturates, amphetamines, and marijuana. Some of the methodological problems associated with previous state-dependent experiments have been noted by Overton (1974)—in particular, the issue of asymmetrical or one-way dissociation of learning. In a review of the effects of alcohol on memory, Ryback (1971) noted that such state dependency tends to be asymmetrical—that is, subjects who learn in an intoxicated state and recall in a sober state forget more than subjects who learn in a sober state and recall in an intoxicated state. Overton (1966) also observed this asymmetrical dissociation of learning. Berger and Stein (1969) proposed a neural model to explain the observation that subjects going from a drug to a non-drug state forget more than do subjects going from a non-drug to a drug state (referred to as “one-way dissociation of learning”). Whether the explanation of one-way dissociation lies in the structure of the brain or in the design of the test situation (or both) is open to question. It may be that subjects “taught” under the influence of alcohol have learned less at the end of the “training” than the groups not taught under alcohol. Overton (1974), in a review of the experimental methods used to study state-dependent learning, has pointed out that we must be sure that an equivalent amount of learning occurs in all conditions before we claim that the condition “causes” amnesia and not simply poorer learning initially. By analogy, it is entirely possible that different mood states may similarly lead to poorer learning initially, and it may be that individual differences will also contribute to the variance in initial learning. In any case, without an objective measure of initial learning, the effects of mood on memory at encoding will be confounded with the effects of mood at retrieval. Reference to the problems encountered in drug-induced-state-dependent experiments (Overton, 1974) suggests the need for an improved design that takes into account the initial learning of all subjects.

**Method**

The design, materials, and procedures for Experiments 1a, 1b, 1c are presented together.

**Design**

In each experiment a $2 \times 4$ experimental design was employed. In Experiment 1a, on Day 1, half the subjects learned the memory task after the elation version of the Velten mood induction procedure [Groups 1 (EE) & 2 (ED)], and half the subjects learned the task after the depression version [Groups 3 (DD) & 4 (DE)]. On Day 2, half the subjects recalled after induction of the same mood with the Velten procedure [Groups 1 (EE) & 3 (DD)], and half the subjects recalled after induction of a different mood [Groups 2 (ED) & 4 (DE)]. In Experiments 1b and 1c, the design was identical, except that happy and sad music mood inductions were used [Group 1 (HH); Group 2 (HS); Group 3 (SS); Group 4 (SH)].

It was hypothesized that if similarity of mood state at learning and recall facilitates remembering, subjects learning and recalling in an induced elated/happy mood and subjects learning and recalling in an induced depressed/sad mood would have significantly lower (less) decrements in recall than
subjects recalling in a different induced mood from that in which they learned the material. Formulating the mood-state-dependent retrieval hypothesis so as to require a direct test of the difference in the decrement in recall between the same-mood and the changed-mood groups allows for the possibility that there may be significant shifts even for those groups learning and recalling in the same mood state because of the usual decrements that occur between sessions (see Westermann & Hager, 1983).

In addition, provided a condition of equivalence of initial learning was met by all subjects (elated/happy and depressed/sad), it was expected that the state dissociation decrements would be symmetrical in nature—that is, the number of items forgotten would be about the same, whether subjects learned in an induced elated mood and recalled in an induced depressed mood or learned in an induced depressed mood and recalled in an induced elated mood.

**Mood Inductions**

**Velten Mood Induction Procedure.** As a number of studies have used the Velten mood induction procedure to investigate the effects of mood on memory, a modified version of the Velten procedure was used in the initial Experiment 1a. The mood induction procedures were the same as those used by Teasdale and Taylor (1981), a modified version of those used by Velten (1968). For each mood induction, subjects read 12 cards bearing typed self-referent statements. For the elation induction, the statements used were: I feel pretty good right now; I feel happy; I feel cheerful, confident; I can think quickly and clearly right now; Right now, I feel very contented; Right now, I feel like smiling; I feel alert, happy and full of energy; I have a feeling of lightness and joy; I really like this light-hearted feeling; I can feel a smile on my face; I feel so good I almost feel like laughing, and It feels great to be alive! For the depression mood induction, the statements used were: I feel unhappy; I feel sad and blue; I feel fed up; I feel pretty low; Things seem futile, pointless; I feel hopeless; I feel down-hearted and miserable; I feel so tired and gloomy that I would rather just sit than do anything; I feel heavy and sluggish; It seems such an effort to do much, and I’m fed up with it all.

**Music Mood Induction Procedure.** In Experiments 1b and 1c, a music mood induction procedure identical to that reported by Kenealy (1988) was used. Music selections were recorded on tape and consisted of a happy selection from Coppelia ("Mazurka") by Delibes, and a sad selection, Adagio in G minor, by Albinoni. These two selections had been shown differentially to affect self-reported mood and behaviour in the desired way by previous research, and the music affected subjects' moods in the absence of instructions to try to change their moods (Kenealy, 1988, Parrott & Sabini, 1990).

**Mood Measures.** As a measure of the effect of the mood induction procedures, subjects were asked to rate their mood on three 0–100-line scales. Each scale was 10 cm long with the 0 end labelled I do not feel at all X, and the 100 end labelled I feel extremely X. On the three scales “X” was Happy, Anxious, and Despondent in Experiment 1a, and Happy, Anxious, and Sad in Experiments 1b and 1c. AT THIS MOMENT was typed at the top of each sheet to indicate that it was instantaneous mood that was to be rated. These measures have been used in previous studies to measure the effect of mood-induction procedures (Teasdale & Fogarty, 1979; Teasdale & Taylor, 1981; Teasdale, Taylor, & Fogarty, 1980).

**Mood Acceptance Criterion.** Because the interest of these experiments was in inducing two different mood states a criterion was chosen, before the experiments began, to define an adequate difference in mood between the two mood conditions. This was that there should be at least a 20-point difference between the happiness and despondency ratings immediately after mood induction.
on each day. This criterion was used by Teasdale and Fogarty (1979), Teasdale, Taylor, and Fogarty (1980), and Teasdale and Taylor (1981) to define an adequate difference in mood between two mood conditions. In addition, for subjects in the different mood groups (ED and DE) the criterion was that there should be at least a 20-point difference between the happiness (or despondency) rating on Day 1 and the happiness (or despondency) rating on Day 2.

**Memory Task**

A memory task that could be used in a controlled laboratory situation was constructed. Subjects were asked to memorize a simple geographical map, visually displayed, together with an auditorially presented 22-item set of directions concerning a particular route. The series of directions represented affectively neutral material that would avoid confounding state-dependent retrieval with mood congruency explanations of the findings. Subjects were presented with a stylized “map” that showed a route comprised of 11 segments. The ends of each segment were associated with a landmark (pub, library), which was indicated by a simple line drawing on the map and was also labelled. The direction of turn of the route was also shown at the end of each segment. The “map” was present throughout a description of the route, which was read to the subject (“Proceed to the supermarket; turn left again; continue to the sports centre; . . .”). The “map” was then removed, and the subjects were asked to provide a free recall of the 22 elements of the route (landmarks and directions of turn). The resulting score was the number of elements recalled, irrespective of order. The task was designed to provide a natural analogue to that of remembering and giving directions for a route through a city.

**Initial Learning Criterion.** A score of one was given for each item correctly learned. In order to ensure equivalence of initial learning, an arbitrary criterion of at least 18 items correct was adopted as a learning criterion. Each subject was allowed 4 learning trials to reach this criterion. If after 4 trials the criterion was not attained, then the largest number correct in any one trial would be taken as the subject’s performance score.

**Procedures.** On Day 1, the mood scales were shown and explained to subjects. The overall procedure was then summarized, and subjects were told that the experiment was concerned with mood and learning styles. For the Velten mood induction procedure, the importance of trying to become fully involved in the mood induction procedure was emphasized. Subjects were told they should try as hard as possible to feel the mood suggested by the statements; it was stated that this might take some effort and that it was a crucial part of the experiment. In Experiment 1a, subjects were then asked to read the statements silently, at their own speed, returning to the beginning of the pile if they reached the end. They were told to stop reading after 5 min.

For the music mood induction procedure, subjects were escorted into a sound-proof room and seated comfortably. The experimenter then made an excuse of having something urgent to attend to and left the room, leaving either the happy or the sad music playing quietly in the background. The experimenter returned to the room after approximately 5–8 min.

All subjects were then asked to memorize the geographical map, visually displayed, together with the auditorially presented 22-item set of directions concerning a particular route. The following standard set of instructions was given to each subject:

> “Here is a picture of a map. I would like you to look at the map while I read you a series of instructions which will enable you to get from one place to another on the map. I will then take away the map, and ask you to recall as many of the instructions as you can remember.”
In Experiment 1a, subjects rated their mood on the three scales at the following points in the experiment:

1. immediately after the 5-min mood induction;
2. after the first learning trial, in order to verify that the subject's mood state had not changed significantly.

In Experiments 1b and 1c, subjects rated their mood immediately following the music mood induction. One measure of the effect of the mood induction procedure was considered sufficient, because the procedure had been shown previously to affect mood significantly (Kenealy, 1988).

Subjects were then thanked for their help and asked to return at the same time on the following day, on the pretext of having to complete a few more learning tasks. On Day 2 (24 hours later), after the appropriate mood induction, subjects rated their mood on the three scales and were then asked to recall as many of the instructions that accompanied the map as they could remember from the day before, without again referring to the map. The number of items correctly named by each subject was taken as their recall score.

**EXPERIMENT 1A**

**Method**

Thirty-two first- and second-year undergraduate students—14 males and 18 females—were recruited. The age of the 24 subjects meeting the acceptance criterion for the study ranged from 19 to 39 years, with a mean age of 24.8 years.

**Results**

**Mood Measures.** Eight subjects failed to reach the mood acceptance criterion. Table 1 shows the effect of the elation and depression mood inductions as rated by subjects on the three 0–100 mood scales. The results shown are the mean ratings on the three scales from the two occasions of measurement following mood induction on Day 1 and Day 2. Subjects in the same mood groups (EE & DD) showed no significant differences in ratings on the three mood scales, confirming that they had learned (on Day 1) and recalled (on Day 2) the memory task in the same mood state, which is crucial to the experiment. Subjects receiving different mood inductions on Day 1 and Day 2 (ED & DE) showed significant differences in ratings on the “happiness” and “despondency” mood scales, confirming that subjects recalling on Day 2 were in a different mood state from the one in which they learned the memory task on Day 1. There were no significant differences between subjects’ ratings on the anxiety scale on Day 1 and Day 2 in any of the four groups. The pattern of results with respect to mood manipulation was identical in Experiments 1a, 1b, and 1c, as shown in Table 1.

**Mood and Memory.** Mood induction did not differentially affect learning performance on Day 1: there was no significant difference between the learning scores of depressed (mean = 18.6, \(SD = 1.16\)) and elated (mean = 19.4, \(SD = 1.31\)) subjects on Day 1, \(t(22) = 1.65, p > .05\). Thus, the condition of equivalence of initial learning by subjects in the different mood groups had been met. Mood induction did not differen-
tially affect overall recall performance on Day 2 either: there was no significant difference between recall scores of depressed (mean = 15.3, $SD = 3.86$) and elated (mean = 15.5, $SD = 4.03$) subjects on Day 2, $t(22) = 0.10$, $p > 0.05$. However, an independent $t$ test analysis showed that the decrement in recall of the same-state groups (EE + DD), mean = 0.42 items, compared to the decrement in recall of the changed-state groups (ED + DE), mean = 6.8 items, was significantly different. The changed-state groups forgot significantly more items than did the same-state groups, $t(22) = 9.979$, $p < .001$. Table 2 shows the learning and recall scores from the four groups of subjects, together with the mean decrements in recall for the same-state groups and the changed-state groups.

Furthermore, the dissociation decrements were about the same, whether the transfer was from elation induction on Day 1 to depression induction on Day 2 [Group 2 (ED): mean decrement = 7.2, $SD = 2.14$], or from depression induction on Day 1 to elation induction on Day 2 [Group 4 (DE): mean decrement = 6.3, $SD = 2.26$]. There was no significant difference in the number of items forgotten by subjects in these two groups, $t(10) = 0.62$, $p > .05$.
The results indicated a mood-state-dependent retrieval effect. Subjects who learned and recalled in the same mood forgot significantly fewer items than did subjects who learned and recalled in a different mood; changing subjects’ mood state at recall produced significantly greater decrements in recall. In addition, the number of items “forgotten” by subjects was about the same, whether transfer was from elation induction on Day 1 to depression induction on Day 2 or from depression induction on Day 1 to elation induction on Day 2, indicating a symmetrical mood-state-dependent retrieval effect.

With respect to the mood inductions, reading self-referent statements successfully induced elation and depression in subjects. Mood induction did not differentially affect subjects’ ability to learn the memory task on Day 1. Depressed subjects did not require more trials overall to achieve the learning score criterion, as might have been expected from the findings of Leight and Ellis (1981); the mean number of trials to reach the criterion was 3.9 for depression-induction subjects and 3.8 for elation-induction subjects; however, on Trial 1 elated subjects learned significantly more (mean = 12.01) than did depressed subjects [(mean = 6.50), t(22) = 2.92, p < .01]. Mood induction was shown not to have differentially affected recall performance on Day 2 either, indicating that the observed state-dependent retrieval effect was due to similarity or dissimilarity of subjects’ mood states at the time of learning and recall and not to the mood-induction procedures affecting subjects’ ability to perform during the learning and recall testing sessions. The
memory task proved relatively easy to score, interscorer reliability showed 99.4% agreement on items, and forgetting and remembering of items was randomly distributed throughout the task, apart from a trend for all subjects to remember the first and last items in the task.

It appears therefore in this initial experiment that a design that ensured equivalence of initial learning and examined decrements in recall between learning and recall sessions successfully facilitated the demonstration of mood-state-dependent retrieval.

It is important to investigate how learning and memory are affected by the relatively common occurrence of transient fluctuations in mood, and the Velten mood induction procedure allows for such investigations. However, a number of authors have pointed out the disadvantages of this procedure. Clark (1983) has noted that a major problem with the Velten procedure is that 30% to 50% of subjects fail to respond to it. In the experiment reported here, 25% (n = 8) of subjects failed to respond to the procedure and did not meet the criterion used to define an adequate difference between the mood states of elation and depression. In addition, the Velten procedure places a strong emphasis on subjects trying hard to get into the desired mood, and it is possible that some subjects may have reported feeling elated or depressed after the induction procedures, when in fact they have not felt the moods suggested by the statements. A number of authors have addressed the issue of the contribution of demand characteristics to the Velten mood induction procedure (e.g. Buchwald, Strack & Coyne, 1981; Polivy & Doyle, 1980). Kenealy (1986) reviewed 46 published experiments that had used the Velten procedure and concluded that the findings relating to the procedure’s effectiveness were equivocal, as were assessments of the contribution of demand characteristics to the procedure.

Taking these factors into account, it therefore seemed advisable, in order to continue this line of research, to use an alternative method of mood induction. The use of music to induce mood states appeared to be a suitable alternative to which subjects might respond more easily, and it has been used in several laboratory experiments investigating the effect of mood on memory (Bower & Mayer, 1991; Clark, 1983; Clark & Teasdale, 1985; Parrott & Sabini, 1990). Thus, a musical procedure was used as a more subtle method of mood induction to investigate the generality and reliability of mood-state-dependent retrieval.

**EXPERIMENT 1B**

This experiment attempted to replicate the mood-state–dependent retrieval effect observed in Experiment 1a. The same design and memory task were employed, but a music mood-induction procedure (Kenealy, 1988) was used to induce “happy” and “sad” moods. The purpose of the experiment was to investigate the generality and reliability of the mood-state–dependent retrieval effect, using a different method of mood induction. It was felt that replication of the previous finding was necessary in order to establish whether the phenomenon of mood-state–dependent retrieval could be demonstrated using different methods of mood induction.
Method

Thirty first- and second-year female undergraduate students were recruited. The age of the 28 subjects meeting the acceptance criterion for the study ranged from 19 to 26 years, with a mean age of 22.9 years. A stereo cassette deck connected to two free-standing speakers, was used to play two selections of music for the “happy” and “sad” mood inductions, as already described.

Results

Mood and Memory. One subject failed to reach the mood acceptance criterion, and one subject failed to return on Day 2. Mood induction did not differentially affect learning performance on Day 1; there was no significant difference between the learning scores of sad (mean = 18.6, SD = 1.22) and happy (mean = 18.8, SD = 1.01) subjects on Day 1, $t(26) = 0.34$, $p > .05$. Mood induction did not differentially affect recall performance on Day 2 either; there was no significant difference between recall scores of sad (mean = 14.3, SD = 3.73) and happy (mean = 14.7, SD = 3.68) subjects on Day 2, $t(26) = 0.30$, $p > .05$.

Independent $t$ test analysis showed that the decrement in recall of the same state groups (HH + SS), mean = 0.86 items, compared to the decrement in recall of the changed state groups (HS + SH), mean = 7.29 items, was significantly different. The changed-state groups forgot significantly more items than did the same-state groups, $t(26) = 12.19$, $p < .001$. Table 2 shows the learning and recall scores from the four groups of subjects, together with the mean decrements in recall for the same-state groups and the changed-state groups.

As in the previous experiment, the dissociation decrements were about the same whether the transfer was from happy induction on Day 1 to sad induction on Day 2 (group 2: HS; mean decrement = 7.3, SD = 1.60), or from sad induction on Day 1 to happy induction on Day 2 (group 4: SH; mean decrement = 7.6, SD = 1.80). There was no significant difference in the number of items forgotten by subjects in these two groups, $t(12) = 0.19$, $p > .05$.

Discussion

The symmetrical-mood-state-dependent retrieval effect observed in the previous experiment was replicated using a different method of mood induction. Subjects learning and recalling on Day 2 in different mood states had significantly greater decrements in recall than did subjects learning and recalling in the same mood states. All subjects except one were affected by the procedure. The music procedure proved to be a more subtle method of mood induction and easier to administer than the modified Velten (1968) technique.

The laboratory situation provides a very different context for the individual from the contexts experienced in everyday life, which are rarely identical on any two occasions. Indeed, it is possible that the effects observed here were due to the laboratory procedures of mood induction rather than to the mood effects themselves. Demand characteristics are inherent in any laboratory experiment, and although explicit demands
can be controlled to an extent, there still remain implicit demands in such situations to which subjects may respond (for a detailed discussion of demand characteristics see Kenealy, 1988). The two selections of music used in the procedure described here had been validated previously (Kenealy, 1988) using a similar procedure to that described by Velten (1968), with the addition of two counter-demand groups identical to those of Polivy and Doyle (1980). Polivy and Doyle hypothesized that if demand characteristics are responsible for the mood effects found, subjects in the counter-demand groups would show a reversed emotion effect in the opposite direction. Kenealy (1988) found no reversed emotional effects with the procedure used in Experiments 1a and 1b. However, in these two experiments there was no way to separate the effect of mood similarity at learning and recall from that of induction procedure similarity (Haaga, 1989). As a solution to the problem of whether the mood-state–dependent effects observed in the previous experiments were attributable to the procedures used or to the moods themselves, Experiment 1c attempted to demonstrate mood-state–dependent retrieval using different methods of mood induction at learning and recall; results might then be more convincingly interpreted in terms of the effects of mood rather than of procedure.

**EXPERIMENT 1C**

The issue of confounding the effects of mood and of the induction procedure was addressed by using the Velten mood-induction procedure and the music mood-induction procedure described previously.

**Method**

The design, memory task, and general procedure were identical to those used in Experiments 1a and 1b. Subjects received the Velten mood-induction procedure during learning on Day 1 and the music mood-induction procedure during recall on Day 2. Forty-two first- and second-year undergraduate students—20 males and 20 females—were recruited as subjects. The age of the 40 subjects who met the criterion ranged from 18 to 38 years, with a mean age of 22.6 years.

**Results**

**Mood and Memory.** Two subjects failed to reach the mood acceptance criterion. There was a significant difference between the learning scores of sad (mean = 18.5, \(SD = 1.05\)) and happy (mean = 19.3, \(SD = 1.20\)) subjects on Day 1, \(t(38) = 2.23, p < .05\). However, mood induction did not differentially affect recall performance on Day 2—there was no significant difference between recall scores of sad (mean = 14.6, \(SD = 3.65\)) and happy (mean = 15.2, \(SD = 4.03\)) subjects on Day 2, \(t(38) = 0.49, p > .05\).

The decrement in recall of the same-state groups (HH + SS), mean = 0.80 items, was significantly less than the decrement of the changed-state groups (HS + SH), mean = 7.10 items. The changed-state groups forgot significantly more items than did the same-
state groups, \( t(38) = 14.18, p < .001 \). Table 2 shows the learning and recall scores from the four groups of subjects, together with the mean decrements in recall for the same-state groups and the changed-state groups.

As in the previous experiments, the dissociation decrements were about the same whether the transfer was from happy induction on Day 1 to sad induction on Day 2 (group 2: HS; mean decrement = 7.8, \( SD = 1.89 \)), or from sad induction on Day 1 to happy induction on Day 2 (group 4: SH; mean decrement = 6.9, \( SD = 1.66 \)). There was no significant difference in the number of items forgotten by subjects in these two groups, \( t(18) = 0.50, p > .05 \).

Discussion

The mood-state-dependent hypothesis was supported, with subjects in the changed-mood groups forgetting significantly more items than subjects in the same-mood groups. This effect was demonstrated when different mood-induction procedures were used at learning and recall; it therefore seems more likely that the effects on memory are attributable to mood rather than to the procedures used to induce mood.

In the three experiments reported here, mood-state-dependent retrieval has appeared to be a reliable phenomenon. In view of the previous literature in this area, perhaps the most interesting observation is not that the effect has been demonstrated, but why it has been demonstrated so reliably. The previous inconsistencies in the literature have been discussed in the introduction, and a number of problems that may, at the very least, have contributed to the inconsistent nature of findings in this area were identified. The experiments reported here were designed to address these problems. Specifically, objective assessment of mood with an a priori criterion specified to define differences between mood conditions confirmed that subjects were in the appropriate mood states. Assessment of mood has been acknowledged as necessary (Ellis & Ashbrook, 1991) in order to eliminate the possibility that a failure to demonstrate mood-state-dependency is due to an insufficient difference between the manipulated moods, or variance in the mood elicited under a particular condition. The mood-state-dependent effects observed in the first two experiments are open to the criticism that the use of the same method of mood induction at encoding and retrieval confounded the effect of mood and induction procedure. Experiment 1c addressed this problem. It may be that the memory task was a critical variable in facilitating the state-dependent effect. Ellis and Ashbrook (1988; 1991) argue that episodic memory tasks with less meaningful and less structured material are more susceptible to mood effects, although they believe that the results argue against any simple pattern of memory decrements across the board, regardless of the type of memory task employed (Ellis & Ashbrook, 1991, p. 12).

It is clear through all this discussion that there is a critical methodological issue that previous research appears to have failed to address—the issue of experimental designs confounding encoding and retrieval by not measuring (or reporting) initial learning scores. In the experiments reported here, the design ensured equivalence of initial learning by all groups of subjects, and the mood-state-dependent retrieval hypothesis was formulated so as to require a direct test of the difference in the decrement in recall
between the same-mood and the changed-mood groups. This allowed for the possibility that there may be significant decrements for same-mood groups because of the usual decrements that occur between sessions (Westermann & Hager, 1983). Interestingly, in Experiment 1c this was indeed the case. Subjects who received the Velten happy mood induction learned significantly more items than did subjects in the Velten sad mood induction. However, the mood-state–dependent hypothesis was supported because these subjects did not forget significantly more items than did the sad induction group. A more stringent test of the hypothesis would have been to demand that the changed-mood groups show a significant difference between learning and recall scores; and that the same-mood groups should show no significant difference between learning and recall scores. The “strict” mood-state–dependent hypothesis could not have been supported in Experiment 1c; further analyses revealed that there were significant differences between the learning and recall score for subjects in the same-mood groups, Group HH: \( t(9) = 2.45, p < .05 \); Group SS: \( t(9) = 2.75, p < .05 \). We must conclude, therefore, that the way in which the mood-state–dependent hypothesis is stated is critically important in determining whether or not the effect has been demonstrated. Perhaps the most critical factor contributing to the unreliable findings of mood-state dependency is the operational definition of the mood-state–dependent retrieval effect.

The experimental findings reported here indicate that the accessibility of retrieval cues and therefore the demonstration of state-dependent retrieval depends, in part, on the experiential context of the individual on different recall occasions; on the degree of correspondence between the environmental (laboratory) contexts for the individual on different occasions; and on the interaction between the experiential and environmental situations on each occasion, both of which make up the total context. Demonstrations of the generality and reliability of mood-state–dependent retrieval provide a basis of empirical support from which investigations concerning the nature of retrieval cues in mood-state–dependent retrieval may proceed.

Eich, Weingartner, Stillman, and Gillin (1975) have stated that one of the keys to understanding human state-dependent learning is the elucidation of the nature and cause of retrieval failure. They note that to the extent that successful retrieval depends on the restoration of the original encoding state, decrements in recall performance associated with different state conditions (e.g. learn “happy”—recall “sad”) must reflect a failure on the part of the retrieval mechanism to find relevant information that is otherwise accessible for recall under same-state conditions (e.g. learn “happy”—recall “happy”). As the deleterious effect of a state change on recall performance reflects a problem in retrieval rather than in the storage of information, and as all acts of recall can be considered as being mediated by retrieval cues (Tulving & Madigan, 1970), Eich et al. (1975) argue that the crux of the problem would seem to lie in the process through which the cues essential for recall of available information are subjectively generated. If this is the case, then the provision of powerful retrieval cues at the time of recall should effectively negate any difference in recall brought about by state manipulations.

In their study of the effects of marijuana on memory Eich et al. (1975) discovered that state-dependent retrieval was restricted to the nominally non-cued test of free recall and was not apparent when recall was prompted with appropriate extralist retrieval cues (category labels of word lists). They suggested that a change in the experiential contexts
of subjects may interfere with the accessibility of retrieval cues that presumably mediate free recall but not cued recall. Eich (1980), after reviewing studies of drug-state–dependent retrieval, concluded that of the variables considered to play key roles in the occurrence of the state-dependent retrieval phenomenon, the presence or absence of discretely identifiable retrieval cues in the cognitive environment of the rememberer was revealed to matter most. Eich (1980) demonstrated that, with very few exceptions, failures to demonstrate drug-state–dependent retrieval are confined to conditions in which retrieval is tested in the presence of explicit reminders, or “observable” cues—for example, category name cues (“list” cues), or literal copies of the items or events to be remembered (“copy” cues)—and successful demonstrations are confined to conditions in which testing takes place in the absence of observable cues but in the presence of “invisible” cues such as similar experiential contexts.

The experiments previously reported here demonstrated mood-state–dependent retrieval under conditions of free recall—that is, in the absence of any “observable” cues related to the memory task. Kihlstrom (1991) suggests that when rich, informative cues are provided by the retrieval environment or can easily be generated by the individual, the effect of state cues will be relatively weak. The next experiment, therefore, investigated the assumption that subjects learning and recalling in the same mood states, as in the previous experiments, utilized “invisible” cues during recall, and that a change of mood state interfered with the accessibility of these retrieval cues, leading to significantly poorer recall by subjects who learned and recalled in different mood states. If this assumption is correct, then the provision of “observable” retrieval cues at the time of recall should effectively negate any difference in recall resulting from a change of mood state. Within Eich’s terminology, this represents a failure to demonstrate state-dependent retrieval, as it is a cue-dependent phenomenon; and the question here was whether mood-state–dependent retrieval is cue-dependent in the same manner as drug-state–dependent retrieval appears to be (Eich, 1980). Eich and Birnbaum (1987) have also suggested that the state-dependent memory effects produced by psychoactive drugs are mediated by their affective properties. The results of a study by Bartlett and Santrick (1979), examining mood-state–dependent retrieval in young children under conditions of free recall and cued recall, mirrored the findings of Eich et al. (1975) and are consistent with such reasoning. It was suggested by these authors that a change in mood reduced the children’s ability to generate appropriate retrieval cues in a free-recall test, and that drugs are not necessary to create this effect. The purpose of Experiment 2 was to investigate the effects of induced mood on memory under conditions of cued recall.

EXPERIMENT 2

The music mood-induction procedure was used to induce happy and sad mood states in subjects. The design, memory task, and general procedure were identical to that of Experiment 1, except that subjects were presented with an observable “copy” cue at the time of recall on Day 2. It was predicted that providing subjects with a discretely
identifiable retrieval cue at time of recall would "override" the deleterious effects of a change of mood state at recall. With respect to the issue of what constitutes an effective cue for the recovery of information rendered inaccessible for recall as a consequence of a change of mood state, the encoding specificity hypothesis (Thomson & Tulving, 1970) holds that only those cues present at encoding will be effective retrieval cues. It was therefore decided to use the basic visual outline of the map presented to subjects in the initial memory task, without the names and visual representations of items, as an observable "copy" cue at the time of recall on Day 2. It was hypothesized that providing subjects with a visual "cue" at time of recall would facilitate remembering regardless of mood state; subjects learning and recalling material in different mood states would not have significantly greater decrements in recall than would subjects learning and recalling in the same mood states.

Method

Subjects

Twenty-five first- and second-year female undergraduate students were recruited as subjects. The age of the 24 subjects who participated in the experiment ranged from 20 to 25 years, with a mean age of 21.5 years.

Procedure

When they returned on Day 2, after the appropriate mood induction, subjects were shown the basic visual outline of the map that they had learnt the day before, with names and visual representations of items excluded. They were asked to recall as many of the instructions that accompanied the map as they could remember from the day before. The map cue was present for 1 min and was then removed before subjects' cued recall. The number of items correctly named by each subject was taken as their recall score.

Results

Mood Measures. One subject failed to reach the mood acceptance criterion and did not return on Day 2. Table 3 shows the effect of the happy and sad mood inductions as rated by subjects on the three 0–100 mood scales. The pattern of results with respect to mood manipulation was identical to that found in Experiment 1.

Mood and Memory. Mood induction did not differentially affect learning performance on Day 1—there was no significant difference between the learning scores of sad (mean = 18.7, SD = 0.78) and happy (mean = 18.5, SD = 1.15) subjects on Day 1, t(22) = 0.21, p > .05. However, mood induction did differentially affect recall performance on Day 2—there was a significant difference between recall scores of sad (mean = 14.8, SD = 2.83) and happy (mean = 17.8, SD = 1.14) subjects on Day 2, t(22) = 3.40, p < .01.

Independent t test analysis showed that the decrements in recall of the same-state groups (HH + SS), mean = 1.67 items, compared to the decrements in recall of the
changed-state groups (HS + SH), mean = 3.08 items, were not significantly different. As predicted, cueing overrode the state-dependent effect on recall, \( t(22) = 1.378, p > .05 \). However, the decrement in recall of subjects who learned in a happy mood and recalled in a sad mood (HS), mean = 5.67 items, was significantly greater than that of the other three groups [comparison with same-state group (SS), mean = 2.5 items, \( t(10) = 2.65, p < .05 \)]. Table 4 shows the learning and recall scores from the four groups of subjects, together with the mean decrements in recall for the same-state groups and the changed-state groups.

There was a significant difference in the dissociation decrements of subjects in the two groups who recalled in a mood state different from the one in which they had learned. Subjects who learned in a happy mood and recalled in a sad mood (group 2: HS; mean decrement = 5.7, \( SD = 1.63 \)) forgot significantly more items than did subjects who learned in a sad mood and recalled in a happy mood (group 4: SH; mean decrement = 0.8, \( SD = 0.41 \), \( t(10) = 7.35, p < .001 \)).

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**Table 3**

Effects of Happy and Sad Mood Inductions

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<tr>
<th>Measure*</th>
<th>Experiment 2</th>
<th>Experiment 3</th>
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* Mean of subjects’ ratings on 0–100 scales.
** Significant difference between mood ratings on Day 1 and Day 2, \( p < .001 \).
Discussion

Mood-state-dependent retrieval was not demonstrated under all the conditions of cued recall. Changing mood state at recall produced an asymmetrical dissociation of material from memory. Subjects learning in a happy mood and recalling in a sad mood had significant decrements in recall, even though they were provided with a visual cue at time of recall. However, presentation of a visual cue at time of recall provided subjects learning in a sad mood and recalling in a happy mood with an effective cue that enabled them to retrieve material from memory despite a change of mood state at recall; these subjects did not have significant decrements in recall.

The observed asymmetrical dissociation cannot be explained by a difference in the initial learning scores of subjects in the different groups, as mood on Day 1 did not affect learning scores; there was no significant difference in the learning scores of happy and sad subjects.

Mood-state-dependent retrieval, then, appeared to be cue-dependent under certain conditions of mood state. Providing a visual cue at the time of recall enabled happy-mood subjects to remember material that they learned while in a sad mood but appeared not to enable sad-mood subjects to remember material learnt whilst they were in a happy mood. It may be that subjects in a sad mood are particularly suspicious of experimental “aids”, or lack the motivation to utilize such cues effectively. It has been suggested that depression might not fundamentally impair the resources required for good performance on unintentional learning tasks (Hertel & Rude, 1991), but that depression may affect the initiation of cognitive processes, such as spontaneous use of strategies and the motivation to utilize external cues effectively (Hertel & Hardin, 1990).

An alternative explanation for these findings is that the “cue” may have been so obvious that subjects were able to work out from the visual representation of the map those items that contained directional components (“turn right”; “turn left”, etc.). In order to determine whether this might account for the high recall scores of some subjects on Day 2, the seven items containing only directional information were removed from the data, which were then re-analysed. Essentially the same pattern concerning differences emerged. The visual outline of the map did not therefore constitute a recall test where subjects were merely presented with the “correct” items, as the data remain essentially the same when these items are discounted; the “cue” also appeared to have facilitated recall of the non-directional items.

It seems intuitively likely that sad-mood subjects, being in a negative mood state, might more readily wish to utilize an appropriate retrieval cue in order to recall material from a happier, more positive time, because an effective cue may not only bring to mind the material encoded with the cue but also the memory of the particular mood state in which it was encoded. However, the findings observed in this experiment are not consistent with this supposition. In the event, before coming to any firm conclusions regarding the issue, it was decided to replicate this experiment in part in order to investigate the reliability of the findings.
In the previous experiment the conditions of retrieval with respect to the presence or absence of explicit ("observable") cues were held constant—all subjects retrieved material in a cued recall condition with the provision of an observable "copy" cue. In addition to investigating the reliability of the previous experimental findings, the present experiment concerns the effects of varying the retrieval conditions in a within-subject design, which would allow for an investigation of the nature of retrieval cues and their transfer effects.

Leicht and Ellis (1981), using the Velten mood-induction procedure, have previously investigated the role of depressed mood induction on the transfer of coding strategies. They found that the mood state induced on Day 1 recall determined subsequent recall of a new list 24 hours later, indicating the transfer of coding strategies. They suggest that training under a depressed mood resulted in the adoption of inefficient coding strategies, which were transferred to second-list learning regardless of mood state on the second day; and that neutral mood in training enabled subjects to adopt a more efficient organizational strategy, which persisted into the transfer task even when transfer followed a depressed mood induction. The interest in the previous experiment reported here was in retrieval processes rather than encoding strategies (as an initial learning criterion was imposed in these experiments), but it seems likely that if subjects are presented with an effective retrieval cue at the time of recall (cued-recall) that is capable of negating the effects of a change of mood state, utilization of such a cue may transfer to later recall conditions where a cue is not explicitly presented (free-recall) and lead to effective retrieval of material regardless of mood state.

Eich (1980) has noted that by manipulating the presence or absence of explicit list cues (e.g. category names) in the cognitive environment of the rememberer, it is possible to demonstrate both the occurrence and the erasure of state dependence within one and the same experiencing individual. Eich et al. (1975), studying the effects of marijuana states, have demonstrated state-dependent retrieval under conditions of free recall and erasure of the state-dependent effect under conditions of cued recall, with the presence of observable cues. Similar interactions have been observed by Swanson and Kinsbourne (1976),
whose experiment focused on the state-dependent effects of methylphenidate (Ritalin) in hyperactive children, and by Weingartner (1978) in a study of eserine-produced state-dependent retrieval in adults. Having demonstrated mood-state-dependent retrieval in a free-recall situation followed by erasure of the effect in a cued-recall situation, the question of interest, then, is whether material remains mood-state-dependent in a later free-recall situation, or whether the previous experience of an effective cue will enable the individual effectively to retrieve information again at a later time, regardless of mood state.

Within everyday learning and remembering terms, this may be seen as analogous to a situation where an individual in a sad or depressed mood who consistently remembers events and episodes that occurred previously in a similar mood state is presented with a cue (e.g. a photograph, or some other memorabilia) which effectively enables them to recall incidents that occurred in happier mood states. Although it is acknowledged that the experiments here refer to a highly specific set of items, this analogy suggests that it may then be possible for such an individual to self-generate appropriate retrieval cues, should they once more find themselves in a sad or depressed mood, which will enable them effectively to recall incidents from a happier time.

The purpose of Experiment 3, then, was to investigate the cue-dependent nature of mood-state-dependent retrieval using a within-subjects design. All mood-induced subjects were asked to recall under three conditions: free recall, followed by cued recall (with presentation of a visual cue), followed by free recall again.

The general hypothesis investigated was whether material that appears inaccessible to subjects who free-call in a different mood state to that in which they learn the material (state-dependent retrieval) becomes accessible under conditions of cued recall, regardless of a change of mood state at the time of recall (erasure of state-dependent retrieval) and remains accessible in a later free-recall situation, through the transfer of efficient retrieval strategies.

Method

Subjects

Twenty-five first- and second-year female undergraduate students were recruited. The age of the 20 subjects who participated in the experiment ranged from 20 to 36 years, with a mean age of 23.3 years.

Procedure

The same mood induction procedure was used to induce happy and sad mood states in subjects. The design, memory task, and general procedure were identical to the previous experiments, with the exception of the recall session on Day 2.

On Day 2, after the appropriate mood induction, subjects were asked to recall as many of the instructions that accompanied the map as they could remember from the day before, without again referring to the map. Immediately after this free-recall session they were shown the visual outline of the map (names and visual representations of items were excluded) and were asked again to recall as many of the instructions that accompanied the map as they could remember from the day before (cued recall). The duration of map cueing was 1 min—the same as in Experiment 2. After an interval
of approximately 10 min, during which time the appropriate music was playing quietly in the background, subjects were again asked to free-recall as many of the instructions as they could remember without again referring to the map. The number of items correctly named by each subject in each condition was taken as their recall score for that particular condition.

Results

Mood Measures. Two subjects did not meet the mood acceptance criterion, and three subjects failed to return on Day 2. Table 3 shows the effect of the happy and sad mood inductions. The pattern of results with respect to mood manipulation was identical to that found in Experiments 1 and 2.

Mood and Memory. Table 4 shows the mean learning and recall scores for subjects in the three conditions of recall. Mood induction did not differentially affect learning performance on Day 1—there was no significant difference between the learning scores of happy (mean = 18.7, SD = 0.82) and sad (mean = 18.3, SD = 1.25) subjects on Day 1, t(18) = 0.84, p > .05. A percentage score was derived for each subject. The number of items correctly recalled by each subject on Day 2 was expressed as a percentage of the number of items learnt by that subject on Day 1. The percentages in Figure 1 refer to the mean percentage (unweighted) scores of subjects in each group. Subjects who learned and recalled in the same mood states had essentially similar recall scores in all three conditions, and the recall scores on Day 2 ranged from 15 items to 20 items. The mean percentage of items learnt on Day 1 that were correctly recalled by subjects who learned in a sad mood and recalled in a happy mood on Day 2 was 71.6% of items in the first free-recall session; this was improved to a mean of 92.2% in the cued-recall session and maintained at a mean of 91.4% correct in the second free-recall session. However, the mean percentage of items learnt that were correctly recalled by subjects who learned in a happy mood and recalled in a sad mood on Day 2 was 75.2% of items in the first free-recall session, which improved to a mean of 96.8% correct in the cued-recall session, but which was not maintained in the second free-recall session, where the mean percentage recall was only 74.2% of the items learnt on Day 1.

Adopting the previous hypothesis-driven analysis for Experiment 3 was insufficient because of the possibility of carry-over effects from the first recall condition to the cued recall and from the cued recall to the second free-recall condition. This rationale led to a change of approach and statistical analysis of data from this experiment. The significance of the pattern of results shown in Figure 1 was tested in a three-way analysis of variance, with repeated measures on one factor; with mood on Day 1 (Factor A), mood on Day 2 (Factor B), and condition of recall (Factor C). The repeated-measures Factor C had three conditions (levels) of recall: free recall (1) vs. cued recall vs. free recall (2). The dependent variables were the numbers of items correctly recalled in each of the three conditions on Day 2 as a percentage of the number of items learnt by each subject on Day 1 (recall scores).

There were no significant main effects of mood on Day 1 or on Day 2. However, there was a significant effect of recall condition on Day 2, F(2, 32) = 20.22, p < .001, a
significant interaction between mood on Day 1 and mood on Day 2, $F(1, 16) = 25.30, p < .001$; a significant interaction between mood on Day 1 and recall conditions on Day 2, $F(2, 32) = 9.63, p < .01$, a significant interaction between mood on Day 2 and recall conditions, $F(2, 32) = 7.10, P < .01$, and, finally, a highly significant three-way interaction between mood on Day 1, mood on Day 2, and recall condition on Day 2, $F(2, 32) = 31.08, p < .001$.

In order to explore the three-way interaction $(A \times B \times C)$ in greater detail, tests of simple main effects were used (Kirk, 1968, p. 291). These post hoc comparisons of means contrasted same-mood and changed-mood subjects separately for each memory test.

**Between-groups Analyses.** The between-groups analyses revealed that the difference on Day 2 between recall of subjects in group HH (happy on Day 1, happy on Day 2) and subjects in Group HS (happy on Day 1, sad on Day 2) was significant in the first free-recall condition, $F(1, 3) = 35.01, p < .01$, was not significant in the cued-recall condition, $F(1, 3) < 1$, and was significant in the second free-recall condition, $F(1, 3) = 49.2, p < .01$.

Turning to subjects in the group SS (sad on Day 1, sad on Day 2) and group SH (sad on Day 1, happy on Day 2), the difference on Day 2 between subjects’ recall in these two groups was significant in the first free-recall condition, $F(1, 3) = 36.2, p < .01$, and was
Within-groups Analyses. The within-groups analyses examined the recall of subjects within the four groups across the three conditions of recall on Day 2. This revealed that the recall of subjects in different mood states on Day 2 differed significantly across conditions: Group HS, $F(2, 32) = 71.35, p < .001$, and group SH, $F(2, 32) = 59.59, p < .001$; whereas recall of subjects in the same mood states on Day 2 did not differ across conditions: group HH, $F(2, 32) = 3.01, \text{n.s.}$, and group SS, $F(2, 32) = 2.05, \text{n.s.}$

To explore the significant effects in greater detail, a series of Newman-Keuls’ comparisons were conducted on the means of each condition for Groups HS and SH separately, with $p$ set at .05. These revealed that, for group HS, cued recall was superior to each of the free-recall conditions, $p < .05$, which themselves did not differ, $p > .05$. For group SH, cued recall was superior to the first free-recall condition, $p < .05$, but did not differ from the second free-recall condition, $p > .05$, and this second free-recall condition was superior to the first free-recall condition, $p < .05$ (see Figure 1).

Discussion

The results showed that listening to music successfully induced happiness and sadness in subjects. Mood induction did not differentially affect subjects’ ability to learn the task on Day 1—there was no significant difference between the learning scores of happy induction and sad induction subjects on Day 1.

The prediction of this experiment was that the first free-recall performance of subjects would show a state-dependent retrieval effect and that cued-recall performance would not. The data from the between-groups analyses support this prediction; a state-dependent retrieval effect was observed in the first free-recall condition, with subjects who learned and recalled in the same mood states recalling significantly more items than subjects who learned and recalled in different mood states. This state-dependent effect was not apparent in the cued-recall condition, where there were no significant differences between the recall scores of subjects who recalled in the same mood states and subjects who recalled in different mood states (to those of Day 1), indicating that the provision of a “copy” cue at time of recall enabled all subjects to retrieve material effectively regardless of a change of mood state. The finding of Experiment 2, that the cue was effective for subjects who learned in a sad mood and recalled in a happy mood but not for subjects who learned in a happy mood and recalled in a sad mood was not replicated here; indeed, Table 4 shows that not only was the cue more effective for subjects in group HS in this experiment compared with subjects in the previous experiment, but also that subjects in this group had higher mean recall scores in the cued condition than did subjects in group SH. The data may be accounted for by the fact that subjects were required to free-recall in this experiment before being presented with a retrieval cue, and this initial recall may have enabled them to use the cue more effectively in the cued-recall session.

With respect to the transfer of effective retrieval strategies, the question investigated was whether the state-dependent retrieval effect erased in the cued-recall condition would
reappear in a second free-recall condition, or whether subjects would be able to utilize the
effective retrieval cue provided in the cued-recall condition to negate the deleterious
effect of a change of mood state. The between-groups analysis indicates the re-emergence
of the state-dependent effect for subjects who were recalling in a sad mood after having
learned in a happy mood—their percentage recall was significantly lower than that of
subjects who had learned and recalled in a happy mood state. However, the percentage
recall scores of subjects who learned in a sad mood and recalled in a happy mood were not
significantly different from those of subjects who learned and recalled in the same sad
mood states.

Thus it appeared that providing an observable retrieval cue to subjects in a sad mood
enabled them to recall material learnt whilst in a previously happy mood, but subjects
appear to be unable to transfer this ability to situations where the cue is not explicitly
presented. The within-group analyses support this explanation in that subjects who
learned in happy mood and recalled in a sad mood showed significantly better recall in
the cued-recall condition compared to the first free-recall condition, but that this
improvement was not sustained in the second free-recall condition, where percentage
recall reverted to the poor performance observed in the first free-recall condition—that
is, recall was again affected by a change of mood state from the initial learning mood state.
By comparison, subjects who learned in a sad mood and recalled in a happy mood showed
significantly superior recall in the cued condition compared to the first free-recall con-
dition, and this improvement in recall was maintained in the second free-recall condition,
where percentage recall scores were significantly higher than those of the first free-recall
condition. For subjects in this group, the provision of an observable “copy” cue enabled
them effectively to override the deleterious effects of a change of mood state and to
maintain this effective retrieval of material in a further free-recall condition.

In conclusion, the somewhat unreliable nature of the effectiveness of observable
“copy” cues to override the deleterious effects of a change of mood state warrants further
investigation; cues were shown to be effective in this experiment, but not under all
conditions in Experiment 2. The findings reported here suggest that making accessible
to subjects in a sad mood material that they previously encoded in a happy mood does not
enable them to self-generate appropriate retrieval cues to access that same material at a
later time. By analogy, the results may also suggest that once someone in a happy mood is
able to retrieve material encoded in a sad mood, the accessibility of this material is
retained or transferred to subsequent occasions of recall, regardless of the dissimilarity
between encoding and retrieval mood states.

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