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# Mood Congruent and Dependent Retrieval for Generated and Read Words

by

Dawn Leigh Macaulay

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B K Sinha
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Supervisor

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Date.....August 9, 1990.....

## DEDICATION

This thesis is dedicated to the memory of Brian Harder. He will inspire me to step beyond the bounds of convention in my future undertakings, and he will be missed.

## ABSTRACT

Recently, some researchers have proposed that internally originating events, such as those arising from reasoning or thought, may be more closely associated with one's mood than are externally originating events. In a series of studies, Eich and Metcalfe (1989) showed that, in general, the recall of generated (internal) words was more disrupted by a change in mood than was the recall of echoed (external) words. That is, there was greater mood dependent retrieval for internal than external events. If these results are due to a stronger association to mood, then internal events should also show a greater advantage for the recall of mood congruent over incongruent material than external events. In order to replicate Eich and Metcalfe (1989) and to evaluate the extension of their proposal to mood congurent retrieval, two studies were performed in which subjects heard a musical mood induction and were presented with material to either read (external) or generate (internal). The results support the proposal that generated words would show greater mood effects than would read words. Discussion is centered upon the introduction of a new proposal to account for these results and on suggestions for future research.

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# INTRODUCTION

In 1981, Bower published an influential article dealing with affect and cognition. In it he described two phenomena which exemplify the impact that emotions may have on cognitive processing. The first, mood dependent recall, is evident when subjects experiencing a similar mood at time of learning and time of test can recall more of the material than can those subjects experiencing dissimilar moods. The second, mood congruent recall, is evident when subjects recall more material that is toned similarly to the mood that they are experiencing.

In this article, Bower also proposed a model that conceptualized affect in terms of an associative network. In the theory, emotions were represented as nodes in the semantic network. Nodes were thought to be connected to the concepts associated with a particular emotion including physiological reactions, verbal labels and life events (Bower, 1981). When a person learns something such as a list of words while experiencing a particular mood state, the words become associated with that emotion node. At recall, the person uses the context of the learning experience. (i.e., I saw a word list), as a retrieval cue (Bower, 1981). If, at recall, the person was also experiencing the same emotion, then activation from the emotion node would spread to its associated concepts and in cases of overlap would summate with any subthreshold

activation from the context cues. Thus, there should generally be an advantage for recall under similar mood conditions. Bower also suggests that his model could account for mood congruent recall via selective reminding (1981). The selective reminding hypothesis states that thinking about a sad event, in a story for example, is more likely to activate a memory of a similar event in one's own life when in a depressed mood than when in an elated mood. This reminding may result in greater elaboration of the event (Bower & Gilligan, 1979) leading to its enhanced recall. The theory, due to its spreading activation nature and assumption of subthreshold activation, also led to predictions of shorter recognition latencies, perceptual "pop-out" and shorter lexical decision times for mood congruent material.

A wealth of research from investigators of psychopathology and of memory processes emerged over the next years with mixed results. In 1986, Blaney thoroughly reviewed the literature and commented on methodological and theoretical weaknesses in the field.

Mood Congruence: Individual Difference Studies

Blaney reviewed the mood congruence literature under two categories; namely individual difference and mood induction studies. He reviewed studies in which the experimenters had compared the performance of individuals that were identified as depressed, either via self-report

or clinical diagnosis, with the performance of individuals that were not depressed. These individuals were compared on their performance on various tasks such as estimating the proportion of successes or failures after receiving predetermined feedback on a series of tasks, recalling personal memories from some logged period, and recalling words that varied on affective valence. Blaney presented results that were fairly consistent. Depressed individuals tended to estimate a greater proportion of failures than did non-depressed individuals. They also tended to recall more negative material and less positive material than did control subjects. Blaney noted that the results were often strongest amcng cases where subjects were required to make some judgements about the self-relevance of adjectives or descriptions, that is, they performed self-referenced processing. He explained the few contradicting results by noting that in these cases the circumstances around the presentation of the material to be remembered discouraged self-referenced processing (e.g., the subjects named the colour of the words). This implies that some types of processing of material may be more conducive to the production of mood congruent retrieval than others.

There have been few recent studies of mood congruence using the individual difference approach. MacLeod, Tata and Mathews (1987) published a study in which they examined the performance of clinically depressed and control

subjects on a lexical decision task for emotionally valenced words. There were no differences across word valence for either group. The authors suggested that studies in which mood biasing had been reported employed tasks which tap episodic rather than semantic memory (MacLeod, Tata & Mathews, 1987).

Bargh and Tota (1988) examined depressed and nondepressed students' ability to make judgements about the suitability of emotionally valenced adjectives as descriptors of themselves or others. Some subjects were concurrently holding six digits in memory to be recalled after the judgement. This task was used to examine the assumption that depressed persons automatically process negative material that is part of many depression theories (e.g., Beck, 1967). The number of adjectives recalled showed no mood congruent effect. The reaction times for depressed subjects' self-judgements of depressed adjectives did not differ for those with versus without the memory load. Among nondepressed subjects, the same held true for nondepressed adjectives. Among other-referent judgements, the memory load interfered with both depressed and non-depressed subjects' judgements. While at first glance these results appear to support the proposition of automatic processing of depressed words among depressed subjects, their reaction times for depressed adjectives did not differ from or were significantly longer than their

reaction times for nondepressed adjectives. This makes interpretation of the results in terms of automaticity of processing very difficult. Though depressed subjects showed less interference of the concurrent task to their self-referenced judgements of depressed words, they were not faster than judgements of nondepressed words. It may be beneficial to use a within-subject comparison of the load effect in the future. Although they cannot be interpreted in terms of the automaticity assumption, these results support the proposal that the type of processing of material (e.g., self versus other) has an impact on mood congruence studies.

Mood Congruence: Induction Studies

Turning to the mood induction studies, Blaney reviewed studies in which the experimenter had employed one of many mood induction techniques, including music, hypnosis, memory of personal experiences, posturing of a subject's face and/or body by the experimenter, success or failure on a task, or the Velten (1968) procedure, to manipulate subjects' mood states. The dependent variables and tasks employed varied widely across the studies. Of the 40 reported studies, 8 failed to show mood congruent biasing, and 1 showed mood congruence among females but not males. Two of these contrary studies were concerned with input processing and used lexical decision latency or recognition threshold as the dependent measures. Blaney suggested that

mood congruence may be a mnemonic bias rather than an input processing one. He also noted that the other contrary studies employed methodologies that were not conducive to self-referenced processing.

Blaney critisized the mood induction studies on methodological grounds. Each of the inductions employed has its particular set of associated advantages and problems. He suggested that a problem common to many of the induction types is the possibility of the results being at least partially due to subject compliance. In particular, he was referring to those that require active participation of the subject to experience a given mood state. These include memory elicitation, hypnosis, the Velten procedure and typically, music. The knowledge that the experimenter is concerned with subject mood may lead subjects to hypothesize about the types of results the experimenter is expecting. The success or failure manipulation may reduce the possibility of simple compliance but has other associated problems. These include that subjects may focus more attention on negative material after a failure "in order to rebut or neutralize it" (Blaney, 1986, p. 238), or in order to "overcome their own weaknesses" (Blaney, 1986, p. 238). Though posturing of subjects by the experimenter avoids these problems, it may lead to subject's searching for an explanation of their internal cues. This could cause them to focus on the

congruent material as an explanation of their feelings.

More recently, experimenters have been examining these possible confounds. In their first experiment, Alexander and Geunther (1986) replicated mood congruent results where mood was induced via the Velten procedure and subjects were asked to recall personal experiences. Subjects also were asked to recall a set of traits that they had read earlier as a bogus result of a personality test. In their second experiment, the researchers informed half the subjects that induced people tended to recall congruent material, and the other half that people tended to recall incongruent material. The results of those given information about congruent recall matched the results of those in the first experiment. However, those given information about incongruent recall showed mood congruent recall of personal experiences but equal recall of positive and negative traits. The authors presented various explanations of these results including that demand characteristics influence storage but not recall (Alexander & Geunther, 1986). An alternate explanation of the effect may be that the Velten procedure, by use of its self-evaluative statements, (e.g., "Looking back on my life, I wonder if I have ever accomplished anything worthwhile"), reminds us of situations in our personal history, and may thus directly prime those experiences making them more accesible at recall.

Rholes, RisKind and Lane (1987) examined the effect of two types of mood induction on retrieval. Specifically, they compared the latency of retrieval of personal memories for subjects who had been induced via self-evaluative statements from Velten's procedure with the retrieval latency for subjects who had been induced via descriptions of somatic states. They reported that those subjects reading self-evaluative statements showed faster congruent recall regardless of mood intensity. In contrast, subjects induced via somatic statements showed faster congruent recall only if they also showed a large amount of mood change due to the induction. The authors suggest that the production of biased retrieval that does not vary with mood may be more directly related to cognitions that accompany particular inductions, in this case, self-evaluative statements.

Perrig and Perrig (1988) investigated the possibility that rather than mood accounting for congruent results, it is people's knowledge about mood states that influences their biased recall. They had subjects learn a list of words while simulating a particular mood. If, upon answering a post-experimental questionnaire, the subjects mentioned mood congruity as something the experimenters could be expecting, they showed strong "mood" congruent recall. In a second experiment, the researchers had subjects learn a list while simulating a particular mood

and had half the subjects try to recall the list in the same simulated mood and the remaining half try to recall the list in the opposite simulated mood. Those in the matching simulated moods tended to recall more congruent items. Those in mismatching simulated moods tended to recall near equal amount of positive and negative words. In sum, Perrig and Perrig replicated "mood" congruent results without subjects experiencing a change in mood. They suggest that mood is a sufficient rather than necessary cause of biased recall. Our knowledge of mood states may also be sufficient to lead us to produce "mood" congruent recall in the absence of mood.

Results of these types of investigations lead Erlichman and Halpern (1988) to examine the use of pleasant and unpleasant odors as a mood induction procedure with relatively little possibility of cognitive priming. In the presence of an odor, subjects were asked to recall a personal experience associated with a neutral word as quickly as possible. Latency of recall and ratings of the happiness or unhappiness of the personal experiences were recorded. Happy and unhappy experiences were recalled equally quickly for those in both the pleasant and unpleasant odor conditions. Those subjects that perceived the odors as at least moderately pleasant or unpleasant, showed mood congruent effects on the number of happy or unhappy personal events they recalled. The researchers

suggest that, though the odor did cause congruent effects, there is some question of odor operating through mood. Perhaps there is simply a tendency for people to match on the basis of hedonic value (Erlichman & Halpern, 1988). Due to the lack of a manipulation check there is no information about the mood of the subjects in the presence of various odors. Although the interpretation of the results is not clear, it seems at least possible to produce congruent recall via an induction which minimizes subject compliance as an alternate explanation.

Fiedler, Pampe and Scherf (1986) examined the effects of the organization of material on the production of mood congruent recall. Subjects were shown descriptions of behaviours when some had previously been induced to a positive mood and others would be induced only at recall. Each set of descriptions included information about six social behaviours. Each set was selected such that there were five positive or five negative behaviours with the remaining behaviour being opposite in valence. The researchers reported no congruent effects of mood induction on recall. The authors suggest that the overall lack of differences between the induction groups is further evidence for the restraints on mood congruent recall via organization of the information. This suggestion was further supported in a study by Fiedler and Stroehm (1986) in which they had elatedly and neutrally induced subjects

attempt to recall the names of pictures previously presented in a random order. Some of the pictures were conceptually grouped with similar partners, others were conceptually distinct. Mood congruence was evident only for the pictures that subjects categorized as distinct.

In a somewhat similar vein, Salovey and Singer (1989) examined mood congruent recall of personal memories. They hypothesized that older memories (i.e., from childhood) would be more "well rehearsed and perhaps more elaborated" (Salovey & Singer, 1989, p. 99) than recent memories and, due to this organization, should be less influenced by mood. In a series of three studies they found no mood congruent effects for childhood memories but strong effects for recent ones.

In sum, it appears that mood congruent effects are fairly reliable across both individual difference and induction studies with some restrictions. These restrictions are based on the organization of the material to be recalled and the type of processing the subject performs on the material, such that information that is less well organized or self-referently processed appears to be most likely to produce mood congruent effects.

Mood Dependence

Turning to mood dependent retrieval, Blaney reviewed 20 studies of which only 7 supported Bower's earlier claims. Blaney concluded that mood dependent retrieval was

an unreliable phenomenon. He also concluded that it had been replicated, only rarely, in studies in which the subjects had learned more than one set of material and in which they retrieved the sets via free recall in one particular mood.

Recent researchers have attempted to replicate those successful studies. Johnson and Klinger (1988) had subjects experience either success or failure on a pursuit rotor task before learning one list of words, again before learning a second list of words and again just prior to recall. The authors reported no evidence of dependent effects.

Haaga (1989) noted that state dependent retrieval had been reported for some subtle changes in subject's learning context (e.g., cigarette smoking, Peters & McGee, 1982). He noted that previous successful studies of mood dependence had employed exactly the same inductions at learning and recall and he proposed that the matching or mismatching of inductions may have caused the dependent effects. He suggested that the biased recall was not due to mood but rather was simply due to context. He had subjects experience similar or dissimilar moods via similar or dissimilar inductions. Not only did those subjects experiencing matching moods via different inductions fail to show mood dependent recall, but those in matching moods via the same induction also failed to show the effect.

This suggests that simply the use of the same induction is not sufficient to produce mood dependent retrieval.

Bower and Mayer (1989) reported six studies in which they attempted to replicate mood dependent retrieval. All of the studies involved their previous interference approach. In this approach, each subject was induced to a series of both positive and negative moods and was presented with material in each mood. Each subject was then asked to recall the material from all the lists while in a particular mood state. In only one experiment did they report any mood dependent retrieval effects. In this experiment, subjects had learned four lists and attempted to recall them in mismatching or matching moods. Unfortunately, these results did not replicate in the very next experiment. Thus, there appears to be sufficient evidence to support Blaney's (1986) suggestion to discount mood dependent retrieval effects.

Eich and Metcalfe (1989) noted that the tasks that seem most sensitive to mood are "word association, narrative construction and interpersonal assessment" (p. 443). They drew upon the work of Johnson and Raye (1981) who suggest that events arising as a result of internal thought are better remembered than are events arising as a result of perceiving the external environment. The hypothesis of Eich and Metcalfe was that such internal processing may be more closely associated to mood. And

whereas internal events should generally be better recalled than those arising externally, they should also be more disrupted by a change in mood.

In their first experiment, subjects were induced via continuous music and memory of personal experiences. The experimenter orally presented them with a category name, an exemplar and either a second exemplar which they simply echoed (external) or the first letter of the second exemplar so that they had to produce the response (internal). Some examples are "ice cream flavors:chocolate - VANILLA" and "musical instruments: drum - G". The results indicated a clear advantage for the recall of generated words, a mild mood dependent effect for the recall of echoed words and a strong mood effect for the recall of generated words. Because of the small proportion of echoed words recalled, the researchers repeated the experiment having subjects generate responses once but echo responses thrice. This substantially increased the recall of echoed responses and nullified the mood dependent effects in their recall without changing the effects for generated words. The researchers then hypothesized that repetition may also nullify dependent retrieval for generated words, and so repeated the experiment with subjects echoing and generating each word thrice. Contrary to their expectations, they reported mood dependent retrieval for both thrice echoed and thrice generated

words. In a fourth experiment they had subjects either echo or generate words, some words thrice other words once. Again the authors reported significant mood dependent effects for both echoed and generated words. In stark contrast to previous studies, these authors were reporting mood dependent effects where they were expecting to nullify them.

Perhaps their methodology was especially conducive to the production of dependent retrieval. Subjects rated themselves as either very happy or very sad before the encoding or retrieval tasks began so those in mismatching mood conditions generally experienced a large change in mood. The continuous music, evaluated by periodic retesting of mood, appeared to keep subjects moods relatively stable over each session. Another possibility is that task demands influenced subjects' results. Although this alternative would be somewhat more compelling in a study of mood congruence, it is still possible, given the focus on mood, that subjects were hypothesizing about probable effects.

In sum, though there have been many failures to replicate mood dependent retrieval the apparent robustness of the finding for Eich and Metcalfe (1989) leaves room for further investigation. And in particular, the evaluation of the proposition that internally originating material should be highly influenced by mood.

Overview

Given this new framework, a re-evaluation of previous results is in order. We will compare the relative rate of production of mood biasing results for studies employing internally originating events versus studies of externally originating events. Studies which employ the recall of personal memories, generation of word associations, or generation of words to fit some context, as the dependent measure will be included as "internal". Studies which employ the recall of some set of previously presented material as the dependent measure will be included as "external".

Past researchers of mood dependent effects often employed recognition measures of retention. At present, it is generally accepted that state dependent retrieval in general is more readily shown for free recall (Eich, 1980). Of the 17 studies Blaney (1986) reviewed that used free recall as the dependent measure, only one used material that was clearly generated internally. This study was a successful replication of mood dependent effects, (Weingartner, Miller & Murphy, 1977). Of 12 recent opportunities with externally originating events, there were four successful replications and of five opportunities with internal events there were four successful replications. These results are by no means conclusive, but do indicate promise for this intriguing new approach.

Of the 27 individual difference studies Blaney (1986) reviewed in terms of mood congruent recall, 11 clearly employed material that originated internally. Each of these studies reported mood congruent effects. Three studies employed material that was clearly external and each of these studies failed to find congruent effects. Many of the remaining studies, most of which were successful, had subjects judge the suitability of positive and negative traits as descriptors of themselves or of others. One could argue that because these words are being evaluated rather than simply read, they are being processed in a more "internal" than "external" manner, but we will not include these studies in the final tally.

Of the 30 mood induction studies Blaney (1986) reviewed, 21 used externally originating material and 19 used internally originating material. Researchers reported failure to replicate mood congruent recall in 7 of the "external" cases and in 1 "internal" case. More recently, of 5 opportunities with external material 3 resulted in no congruent effects, whereas of 15 opportunities with internal material 4 resulted in no congruent effects.

Viewed in total, of 29 opportunities to show mood congruent recall with clearly external material 13 failed, whereas of 45 opportunities with clearly internal material only 5 failed. Although this re-examination is not overwhelming, one implication is clear. The use of

internally originating material may be more conducive to the production of both mood congruent and mood dependent retrieval effects than is the use of externally originating material.

Present Study

The present study is a conceptual replication of Eich and Metcalfe (1989) and an extension of their work to the examination of mood congruent recall. Specifically, we had mood induced subjects generate or read emotionally valenced material and had them attempt to recall the material at a later time. In this study we were interested in the possibility that internally generated events would be more closely associated to mood than external events. If so the recall of these events would be both more disrupted by changes in mood and more likely to be congruent with current mood. To avoid some of the methodological problems and confounds previously discussed, we employed a musical mood induction that previously had been shown to influence people's mood when they were simply told to listen carefully to the music (Pignatiello, Camp & Rasar, 1986). To have subjects do this, we ran the experiment under the guise of a music appreciation investigation. Subjects were asked to say aloud emotionally valenced words that they simply read (similar to echo condition) and their solutions to word fragments (similar to generate). Subjects were asked to recall any of the words presented on the computer

monitor or said aloud by them. They were asked to recall all of these words to remove any decision they may have had to make about recalled words (i.e., is this word a just cue or a response that I said aloud?) because this type of decision may also be impacted upon by the mood induction. Upon their return to a second session, subjects were induced into similar or dissimilar moods and were asked once again to recall the words.

We hypothesized that there would be strong mood congruent effects evident for the first recall. Based on previous results (Perrig & Perrig, 1988), we predicted that the bias would be evident for read words, but hypothesized that the effect may be stronger for generated words. We also hypothesized that for the second recall there would be evidence for mood dependent retrieval among generated but not read words. We further hypothesized that there would be evidence for mood congruent retrieval for the second recall, such that there would a strong tendency to recall items that match the second mood regardless of its matching or mismatching the first mood.

# EXPERIMENT #1

## Method

### Stimuli.

Emotional content words were adjectives selected from Dahl and Stengel's (1980) classification of emotion words. The selection criteria were that 90 percent of Dahl and Stengel's (1980) rating sample rated both a word and its synonym as either positive or negative and that words were included in Anderson's (1968) likableness ratings. Thirty-two positive words (16 synonym pairs) were found in Anderson (1968) from the first third of the list and 32 negative words (16 synonym pairs) were found in the last third. These word pairs were matched such that over lists there was no significant difference in average word frequency (Kucera & Francis, 1967). Neutral words and synonyms were not required to be in the Dahl and Stengel (1980) list, but were drawn from the middle third of Anderson (1968). Fragments were created for each of the 64 positive and negative content words by dropping some vowels and/or consonants. These fragments were pretested by having third and fourth year psychology students attempt to complete the fragments (e.g., happy - g_a_). New fragments were created for those words below 90 percent completion. Four presentation lists consisting of 32 pairs of positive and negative words, (16 pairs each), were then created such that each word appeared once as the fragment (e.g., happy -

g_a_), once as the second word (e.g. happy - glad), and twice as the first word where its synonym was the fragment or second word (e.g., glad - ha__y, glad - happy). One set of 16 neutral pairs was created to be used with each of the four presentation lists. Each final list consisted of 16 pairs of each of negative, neutral and positive content words (see Appendix 1). Fragment completion was required for 24 of the pairs, with the remaining 24 pairs requiring simple reading. Lists were randomized for each subject and were counter-balanced across conditions.

Procedure.

Seventy-two introductory psychology students, (36 males and 36 females), participating for course credit, were randomly assigned to one of nine conditions in a 3 X 3 design. Types of musical inductions for session 1 (elated, neutral, depressed) and session 2 (elated, neutral, depressed) were the between-subject factors. Affective content of the words (positive, neutral, negative), processing of words (cues, responses) and processing of pairs (generate, read) were the within-subject factors.

Subjects were informed that the experiment was designed to examine musical appreciation and would therefore require them to listen to a collection of songs. The experimenter then took them into a sound proof room and placed a tape in a cassette recorder. Subjects were told to listen carefully to the music, to form opinions or

impressions of the music, and to be prepared to answer questions about their impressions when they came out. The experimenter then turned on the tape and closed the door, leaving the subject alone. The selections of music had been previously shown to influence people's rated mood (Pignatiello, Camp & Rasar, 1986). There was one tape for each of elated, neutral, and depressed mood inductions. Tapes were labelled such that experimenters were blind to the music on any tape. After approximately 20 minutes, subjects came out of the sound proof room and were asked to sit at the computer. The instructions for the second task were on the monitor. Subjects were told that they would be presented with pairs of synonyms and would be required to say the second words aloud to the experimenter. Subjects were instructed to read both words to themselves before responding. They were instructed that they would either simply say the second words, or would have to "fill-in-the-blanks" to complete the second word as a synonym to the first. Subjects then went through three example trials after which the correct answers were supplied. Each pair was presented for approximately four seconds with a pause between trials of approximately one second. Subjects began the 48 experimental trials by pressing a key and attempted to say the second words aloud to the experimenter. The experimenter followed a subject's progress on a printout of that particular randomization of the list and wrote in

solutions to the fragments. This task required approximately 10 minutes. Subjects were then required to answer questions about their impressions of the music (see Appendix 2). The first question was a checklist which asked them to indicate the words that corresponded with the way the music made them feel. This checklist was a short form of the Multiple Affect Adjective Checklist (Zuckerman & Lubin, 1965) and was used as measure of their mood. Other questions asked about their recognition of the songs and their previous musical experience or training. Upon completion of the questions, subjects were asked to recall the words presented on the computer. After 5 minutes of free recall, all subjects read a short form of the Velten (1968) mood induction procedure in order to counterinduce those who had experienced the negative music. Subjects were then excused and were reminded of the time and date of their second appointment which was within one week.

Upon their return, subjects were asked to listen to a second collection of music. Some subjects heard the same musical selection and others heard a different selection. After listening to the music for approximately 20 minutes, subjects came out of the sound proof room and were asked to recall the words presented on the computer in the first session. After 5 minutes, they were asked to rate how the music of the second session made them feel. They then read the shorten Velten (1968) mood induction procedure.

Finally, subjects were debriefed and the reasons for the manipulations were explained. All subjects indicated an understanding of the rationale of the study.

## Results and Discussion

### Generation Errors.

The average number of correct solutions to the 8 fragments for each word valence is reported for each mood group in Table 1. There were no reliable differences in the solution rate across groups, $F(2, 69) < 1$, $p > .05$, or across word valence, $F(2, 138) < 1$, $p > .05$.

### Recall #1: Mood Ratings.

The shortened adjective checklist was scored by summing the number of checked positive words and by subtracting from that total twice the number of checked negative words, as per Pignatiello, Camp and Rasar (1986). The mean mood score for those subjects hearing the depressed induction music ($M = -3.00$) differed significantly from both those hearing the neutral induction music ($M = 4.04$) and those hearing the elated induction music ($M = 2.75$), $ts(46) > 5.70$, $p < .05$, whereas there was no difference between the rated mood of the neutral and positive induction groups. The correlation between induction type and rated mood was significant, $r(70) = .3797$, $p < .001$.

Recall #1: Mood Congruence.

The mean proportions of items recalled (items recalled over items generated or read), across the various item types and mood groups are reported in Table 2. The data were analyzed via analysis of variance in a 3 X 2 X 2 X 3 (Induction X Cue X Process X Word Valence) mixed design. The analyses disclosed (a) a main effect of cue type, $F(1, 69) = 148.01$, $p < .001$, such that responses ($M = 16.4$) were recalled more often than were cues ($M = 7.1$), (b) a main effect of pair processing, $F(1, 69) = 68.21$, $p < .001$, such that words in pairs involving generation ($M = 15.5$) were recalled more often than were words in pairs involving simple reading ($M = 8.0$), and (c) a main effect of word valence, $F(2, 138) = 5.34$, $p < .006$, such that negative words ($M = 13.7$) were recalled more often than were both neutral ($M = 10.1$), $t(574) = 4.31$, $p < .05$, and positive words ($M = 11.3$), $t(574) = 2.96$, $p < .05$.

Significant interactions were explored using Scheffé comparisons in order to control the experimentwise error rate. The analyses disclosed an interaction between cue type and pair processing, $F(1, 69) = 27.42$, $p < .001$, such that the recall of responses was more enhanced by the generation condition than was the recall of cues. There was also an interaction between pair processing and word valence, $F(2, 138) = 10.38$, $p < .001$, such that under the generation condition, positive ($M = 16.80$), $t(286) = 3.42$,

$p < .05$, and negative words ($M$ = 18.55), $t(286) = 4.47$, $p < .05$, were better recalled than were neutral words ($M$ = 11.1), whereas there were no significant differences across word valence under the read condition ($M$s = 5.7, 8.9, 9.2 respectively).

The above interactions are qualified by the cue type, pair processing and word valence interaction presented in Figure 1. These factors interact $F(2, 138) = 4.74$, $p < .01$, such that (a) for generated responses, the recall of positive ($M$ = 23.7), $t(142) = 5.04$, $p < .05$ and negative words ($M$ = 26.3), $t(142) = 6.60$, $p < .05$, was significantly better than for neutral words ($M$ = 15.3) whereas (b) for read responses, the recall of neutral words ($M$ = 13.0) $t(142) = 3.00$, $p < .05$, was significantly better than for positive words ($M$ = 8.0), but not negative words ($M$ = 12.0), and such that (c) for cues there were no significant differences between the recall of positive, negative and neutral words under the generation condition ($M$'s = 9.9, 10.8, 6.9 respectively) nor under the read condition ($M$'s = 3.5, 5.4, 5.9 respectively).

Further analyses were performed to examine the recall of read and generated responses for mood congruent effects. The Newman-Keuls test was used to examine the means within groups. For read responses the groups showed no significant differences in recall across word valence. For generated responses (see Figure 2), the analyses revealed

that (a) subjects induced via the neutral music recalled more positive ($\underline{M}$ = 25.2) and negative ($\underline{M}$ = 25.8) words than neutral words ($\underline{M}$ = 14.7), (b) subjects induced via the elated music also recalled more positive ($\underline{M}$ = 25.0) and negative words ($\underline{M}$ = 23.5) than neutral words ($\underline{M}$ = 13.2), and (c) subjects induced via the depressed music recalled more negative ($\underline{M}$ = 28.1) than neutral ($\underline{M}$ = 18.0) but not positive words ($\underline{M}$ = 22.4).

The lack of mood congruent recall for the positively induced subjects indicated that induction type may have been too gross a measure of mood to show congruent recall. Thus, we reanalyzed the data using rated mood as the criterion measure. Subjects were included in the depressed mood group if their mood score was below zero, they were included in the elated mood group if their score was above four and in the neutral mood group if their score fell from zero to four. The data are presented in Table 3. The reanalysis indicated no differences in the recall of read responses for the mood groups. It further revealed (see Figure 3) that among generated responses (a) subjects in a neutral mood (n = 23) recalled significantly more negative ($\underline{M}$ = 25.3) than neutral ($\underline{M}$ = 14.9) but not positive words ($\underline{M}$ = 20.6), (b) subjects in an elated mood recalled more positive ($\underline{M}$ = 26.9) and negative words ($\underline{M}$ = 22.4) than neutral words ($\underline{M}$ = 14.2), and (c) subjects in a depressed mood recalled more negative words ($\underline{M}$ = 31.4) than either

neutral ($\underline{M}$ = 16.9) or positive words ($\underline{M}$ = 23.4).

We decided to further breakdown the groups by gender to determine if this pattern held for the recall of generated responses for both males and females. We used the Newman-Keuls test to disclose (see Figure 4) that females in an elated mood recalled more positive ($\underline{M}$ = 26.7) than neutral words ($\underline{M}$ = 9.7) whereas females in depressed or neutral moods did not show any significant differences in recall across word valence. Closer examination of the means for females in a depressed mood reveals a large but non-significant enhancement in their recall of negative words ($\underline{M}$'s = 24.1, 25.8, 38.5). This difference does not reach significance. This may be due to the small number of subjects (n = 9).

The analyses also indicated that males in a depressed mood recalled more negative ($\underline{M}$ = 27.1) and positive words ($\underline{M}$ = 23.0) than neutral words ($\underline{M}$ = 11.5) and that there were no significant differences across word valence for males in elated or neutral moods.

In the analysis based on induction groups, mood congruent recall was evident only for those hearing the depressed induction. Both the elated and neutral groups recalled equal proportions of positive and negative words. The mood congruent recall of the depressed induction group (see Figure 2) appears to be an enhancement of the recall of negative words rather than simply a drop in the recall

of positive words as has been noted in the literature (Blaney, 1986).

The equal performance of both the neutral and elated induction groups may be an indication of the failure of the induction to produce strong positive mood effects. The mean mood scores did not differ for these two induction groups. This problem lead to the reanalysis of the data. The use of rated mood rather than induction type to divide the groups exaggerated the tendency for the congruent recall of negative material to be an enhancement of the recall of negative material. This is somewhat surprising because the previously noted tendency is thought to occur in both induced and clinically depressed subjects (Blaney, 1986). We must, however, be cautious in our interpretation of these results because any list effects are no longer counter-balanced across groups. In fact, some such artifact may be contributing to the enhanced recall of negative words for neutral mood subjects.

The results of the elated mood group were not different from those of the elated induction group. It is possible that the elated induction was not successful at inducing a strong positive mood for even the selected subset of subjects. The examination of the mood scores for the induction groups indicated that there was much overlap between the elated and neutral groups. The cutoff scores employed in the reanalysis were somewhat arbitrary and may

have weakened any evidence of congruent recall for the elated mood group by the inclusion of people in a relatively neutral mood. This hypothesis may also explain the overall better recall of negative words. If we have only induced a strong depressed mood, then it is not surprising that there is a general advantage for negative but not positive words. This problem is somewhat unusual. Blaney (1986) suggested that researchers often have problems inducing depressed but not elated moods. Perhaps it is only a problem to induce elation when subjects are not asked to actively participate in the mood induction.

Whereas we had predicted mood congruent recall for both read and generated words, biased recall was only evident among generated words. Further, the prediction of congruent recall was strongly supported for elated females and marginally supported for depressed females whereas it occured marginally for depressed males only. This sex difference does somewhat concur with that reported in the previously noted study reviewed by Blaney (1986) (cf. Clark & Teasdale, 1985) in which females but not males evidenced mood congruent recall. It is also further support for Ellis and Ashbrook's (1989) note that gender difference may be an important factor to consider in future mood research. It is not clear whether the reported difference is due to different memory biases per se or if it is due to differential responding to some other aspect of the

experiment. For example, one hypothesis for the gender difference is that the effects of musical inductions may differ for males and females or may fade more quickly for males. By dividing the groups on rated mood rather than only induction type, we had hoped to minimize any of these differences.

This discrepancy also may have contributed to the enhanced overall recall of negative words. We were expecting the recall of both positive and negative words to be enhanced over that of neutral words due to congruent biases. The fact that males showed enhanced recall of negative words but not enhanced recall of positive words may also have contributed to the main effect of word valence.

Recall #2: Mood Ratings.

The mean mood scores for subjects hearing the negative induction music ($M$ = -3.63) differed significantly from both those hearing the neutral induction music ($M$ = 2.42), $t(46) = 6.04$, $p < .025$, and those hearing the positive induction music ($M$ = 4.13), $t(46) = 7.75$, $p < .025$. The correlation between induction type and rated mood was significant, $r(70) = .4251$, $p < .001$.

Recall #2: State Dependence.

The mean proportions of items recalled (items recalled over items generated or read), across item types and mood groups are reported in Tables 4a and 4b. The data were

analyzed via analysis of variance in a 3 X 3 X 2 X 2 X 3 (Induction 1 X Induction 2 X Cue X Process X Word Valence) mixed design. The analyses showed many similar results to those of recall #1 including (a) a main effect of cue type, $F(1, 63) = 138.25$, $p < .001$, such that responses ($M = 11.2$) were recalled more often than were cues ($M = 4.4$), (b) a main effect of process, $F(1, 63) = 46.73$, $p < .001$, such that words in generate pairs ($M = 10.6$) were recalled more than were words in read pairs ($M = 5.0$), and (c) a main effect of word valence, $F(2, 126) = 4.48$, $p < .001$, such that positive ($M = 8.5$), $t(574) = 2.63$, $p < .05$, and negative words ($M = 9.5$), $t(574) = 3.54$, $p < .05$, were recalled more often than were neutral ($M = 5.4$) words.

Significant interactions were explored via Scheffé comparisons to control the experimentwise error rate. The analyses showed an interaction between cue type and pair processing, $F(1, 63) = 22.73$, $p < .001$, such that responses showed greater enhancement of recall under the generation condition than did cues. The analyses also indicated an interaction between pair processing and word valence, $F(2, 126) = 6.56$, $p < .002$, such that under the generation condition, positive ($M = 12.7$) and negative words ($M = 12.7$), $t's(286) = 5.43$, $p < .05$, were better recalled than were neutral words ($M = 6.3$), whereas there were no significant differences across word valence under the reading condition ($M's = 4.2, 6.4, 4.4$ respectively). The

previous results are all qualified by a significant cue type, pair processing and word valence interaction, $F(2, 128) = 5.14$, $p < .007$, (see Figure 5), such that under generation conditions the enhanced recall of positive and negative words over neutral words was greater for responses ($M$'s = 18.1, 18.3, 9.1), $t$'s(142) > 7.64, $p < .05$, than for cues ($M$'s = 7.3, 7.1, 3.5), $t$'s(142) > 3.05, $p < .05$, whereas under read conditions, there were no significant differences across word valence for responses or cues.

The significant induction 1 by induction 2 by cue type by pair processing interaction, $F(4, 63) = 3.92$, $p < .007$, was also examined (see Table 5). The examination of performance across the different word valences for each induction group revealed that there were no differences in recall across cues, and that there were only two groups which showed any significant differences across responses. The elated-elated and the neutral-depressed groups both showed enhanced recall of generated over read responses. The other pairwise differences were between generated responses and the cues from read pairs. These differences are expected and probably emerge due to the extremely low rate of recall of read cues for most groups.

We then further analyzed the performance of the separate induction groups for dependent recall. In particular, we wanted to compare the total proportion of words recalled by matching and mismatching groups for

generated (M's = 13.9 vs. 14.3) and read responses (M's = 6.2 vs. 7.6). We were expecting to see significantly greater recall for subjects in similar inductions especially for generated words; however, there were no significant differences between the groups. We then dropped neutrally induced subjects from the analyses in order to compare subjects that should be experiencing the greatest change in mood. The mean recall of similarly induced subjects (i.e., elated-elated and depressed-depressed) did not differ from the mean of those dissimilarly induced (i.e., elated-depressed and depressed-elated) for generated (M's = 15.4 vs. 14.4) nor read words (M's = 6.0 vs. 9.6). The mean recall of subjects reporting similar or dissimilar mood ratings also did not differ for generated (M's = 15.4 vs. 15.4) nor read responses (M's = 9.0 vs. 6.9).

Within each induction group we then compared across generated and read responses of different valences. There were no significant differences in recall for read responses across word valences. For generated responses, the depressed-neutral induction group recalled more positive than neutral words, and the depressed-elated group recalled more negative than neutral words. No other pairwise comparisons were significant. We then repeated this analysis for mood groups (see Table 6). The neutral-neutral and elated-depressed mood groups recalled

significantly more positive and negative words than neutral words. The depressed-elated group recalled significantly more positive than neutral words and the depressed-depressed group recalled significantly more negative words than either positive or neutral words. There were no differences across word valences for read responses. It appears that most of the mood effects are evident only when the depressed groups, defined either via induction or rated mood, are involved in the contrast. Unfortunately no other consistent pattern emerges for the performance on recall #2.

One hypothesis for the failure to find state dependent effects is that recalling on two separate occasions interferes with mood dependent retrieval. Consider, for example, those reporting an elated then depressed mood, who recalled equal amounts of positive and negative words for recall #2. This group recalled more positive material on the second recall than we would have predicted. The high level of recall performance may have been due to previously recalling the positive material in the first session when it was congruent with mood at recall. Another possibility is that our groups were not experiencing a very strong shift in mood due to our apparent inability to induce an elated mood. This reasoning lead to the decision to run a second experiment which would entail only one recall, after the second mood induction. We decide to use only the

elating and depressing inductions in order to maximize the differences in mood that the groups would experience. We predicted that there would be evidence of congruent and dependent recall especially for generated words.

## EXPERIMENT #2

### Method

Sixteen introductory psychology students, participating for course credit, were randomly assigned to experience either matching or mismatching mood inductions over two experimental sessions. Instructions and tasks were nearly identical to those of experiment #1. In session 1, all subjects listened to the elating music, performed the generation and read task and answered questions about the music. They were then excused and were reminded of the time of their second appointment which was 24 hours later.

Upon their return, subjects were randomly assigned to hear either the elating induction music (i.e., match), or the depressing induction music (i.e., mismatch). After listening to the music, the subjects were asked to recall the words presented on the computer in the first session. After 5 minutes of free recall, subjects answered questions about the music and read the shortened Velten (1968) mood induction to counterinduce those who had heard the negative music. Finally, subjects were debriefed, and the reasons for the manipulations were explained. All subjects

indicated an understanding of the rationale of the experiment.

Results and Discussion

Generation Errors.

The average number of correct solutions to the fragments did not differ across word valence, $F(2, 28) = 2.40$, $p > .05$, ($M$'s = 6.63, 6.75, 6.06).

Mood Ratings.

The mean mood score for the first session (i.e., elating induction) was 4.19. For the second session, the average score for those hearing the elating music ($M$ = 3.87) differed significantly from that of those subjects hearing the depressing music ($M$ = -5.25), $t(14) = 6.47$, $p < .024$.

Recall.

The mean proportions of items recalled (items recalled over items generated or read), across item types and induction groups are reported in Table 7. The lack of variance within some of the cue cells (i.e., no subject recalled any of that word valence) required that cues be dropped from the analyses. We examined significant interactions with the Neuman-Keuls statistic to control the experimentwise error rate. The analyses of the responses revealed (a) a significant main effect of process, $F(1, 14) = 30.68$, $p < .001$, such that generated words ($M$ = 14.4) were recalled more often than were read words ($M$ = 4.2),

(b) a marginal main effect of induction similarity, $F(1, 14) = 4.33$, $p < .056$, such that subjects experiencing similar inductions ($M = 11.2$) tended to recall more than subjects experiencing dissimilar inductions ($M = 6.9$), and (c) a significant interaction between word valence and induction similarity, $F(2, 28) = 3.73$, $p < .037$, (see Figure 6) such that those experiencing different inductions (i.e., elated-depressed) recalled more negative ($M = 11.6$) than neutral ($M = 2.5$) but not positive words ($M = 6.4$), whereas those experiencing similar inductions (i.e., elated-elated) recalled significantly more positive ($M = 16.1$) than negative ($M = 7.5$) but not neutral words ($M = 11.1$). We further examined this effect for generated and read words separately (see Figure 7). The groups showed no differences in their recall of read words but did show significant differences in their recall of generated words. Specifically, analyses of mood effects within groups indicate that those in the matching group recalled more positive ($M = 26.1$) than negative ($M = 10.3$) but not neutral words ($M = 17.6$) and that those in the mismatching groups recalled more negative ($M = 20.2$) than neutral ($M = 2.1$) but not positive words ($M = 9.8$).

The results of this experiment supported our predictions. Congruent effects of recall mood were evident in the performance of both the elated and depressed induction subjects. The effects were evident overall but

resulted from the recall of generated rather than read words. Mood dependent retrieval effects were also evident in the recall of generated but not read words. The better overall recall for the matching induction group (see Figure 7) appears to be a general recall advantage for those in the matching inductions for both positive and neutral words. This advantage is eliminated for the recall of negative words by strong mood congruent recall of the negative items for the mismatching group.

## GENERAL DISCUSSION

Overall the results of these two studies are somewhat contradictory. Experiment #1 failed to show any mood dependent retrieval and showed only mild to moderate mood congruent effects for some of the mood groups. Experiment #2, in contrast, provided some evidence of both mood effects. We have suggested that the use of two recall sessions in the first experiment combined with our apparent inability to induce an elated mood may have diminished our ability to detect any mood effects. Beyond this discrepancy, both studies support the fact that mood induction can occur in situations which lessen the possibility that subject compliance or induction associated cognitions are causing the results. The guise of a music appreciation study may also allow researchers to employ continuous music to keep subject mood stable over longer intervals. The importance of keeping experimenters blind

to subject condition and subjects blind to the experimenter's hypothesis can not be over stressed. This is especially true given how often "mood" congruent results have been reported in studies where mood was not manipulated (e.g., Perrig & Perrig, 1988; Polivy & Doyle, 1980).

The studies were also consistent in the support provided for the hypothesis that mood effects would generally be more evident in the recall of generated words than of read words. Not only were the effects more evident among generated words, they were almost exclusively confined to generated words. This very strong support is puzzling given the strength of the mood dependent retrieval for echoed words reported by Eich and Metcalfe (1989) and the numerous reports of mood congruent results for read material (e.g., Bower & Mayer, 1989). The read words in these studies were recalled very poorly, so poorly in fact that a floor effect may have prevented us from detecting any differences.

Some investigators of the enhanced recall of generated material (e.g., Kolers & Roediger, 1984) have suggested that the enhancement is simply due to searching through memory to generate candidates that fit the contextual restraints and recognizing the correct response. That is, performing the generation during learning is simply a "dressed rehearsal" for the later recall test. Though

there is much argument about the cause of the generation effect in the literature, Kolers and Roediger's (1984) idea may prove relevant for mood related research.

Baddeley (1982) proposed a two-stage model of recall such that individuals first generate possible candidates and then recognize those that fit the contextual constraints. If we accept such a model, then generation is, in fact, a preview of recall. If we also accept the idea that previously recalled items are more easily recalled, then we could account for the generation effect. To apply this to mood research we must return to Perrig and Perrig's (1988) study in which, to account for a "mood" congruent effect for subjects simulating a mood, they suggested that subjects' knowledge of mood and the organizing effect of this knowledge could be influencing the generation of candidates during recall. They suggested that this effect would occur "whether one asked the subjects to use it or not" (Perrig & Perrig, 1988, p. 106). We could extend this by suggesting that the experience of mood itself may make this knowledge available thus influencing generation. Perhaps we see greater mood influences among generated words because these words are twice as often processed via the "biased generator" as are read words. If subjects are experiencing the same mood and/or its organizing effects at both learning and test we should see strong congruent recall, if not then we shoud

see a drop in the recall of previously congruent words and a rise in the recall of presently congruent words. An advantage of this hypothesis is that it also explains why we see mood effects in recall but not among recognition measures. It would also suggest that well organized information would not be as influenced by mood because its more salient organization would provide better cues than could mood, thus nullifying any mood effects. Further, if subjects are given self-referent processing instructions then their experience of mood, or the knowledge that is available due to this experience, may be more likely to influence generation than when they are given other-referent processing instructions.

The network theory of affect is hounded by contradictory results (i.e. Bower & Mayer, 1985). These contradictions have included, but are not restricted to, the inability of researchers to replicate results of faster processing of congruent items assumed to be due to subthreshold priming. The present hypothesis does not make "spread of activation" predictions and only suggests that mood biases occur during generation. If mood does bias the generation process then we may see faster recall of congruent items because there would generally be more congruent items available as data for the recognition decision.

If, as we have suggested, mood effects occur because

of a bias or influence on the generation of candidates for recall, then we may also see some effects of this bias during initial generation. A crucial test of this hypothesis would be to have subjects, experiencing an elated or depressed mood, perform two types of trials, specifically lexical decisions about affectively laden material and generation of laden material given an ambiguous context. The subjects could be readied for either type by a cue (i.e., "WORD?" or "SOLVE"). On lexical decision trials subjects would see a word or non-word and say aloud whether the stimilus was a word or not with their response time being recorded via a voice activated relay. On "SOLVE" trials, subjects would see a word fragment that they would try and solve as quickly as possible. The fragment would be able to be solved for either a positive or negative word, (e.g., a _ u s e: abuse or amuse; l o _ e l y: lonely or lovely). Both their solutions and response times would be recorded.

If subjects solved more fragments congruently and faster than those they solved incongruently, there would be support for both network theory and the generation hypothesis. If, however, they also recognized incongruent and congruent material at the same rate, then the results would be more supportive of the generation hypothesis than network theory. This is because where network theory makes the prediction of faster generation reaction times due to

priming, (which should also occur during recognition), the generation hypothesis predicts faster recall only as a result of the bias in the generation process.

Future researchers may have to propose alternate explanations of how affect influences recall given the inability to replicate faster reaction times to congruent material predicted by network theory. A more detailed examination of the processes involved in recall, and how affect could influence these processes, is required for the presented hypothesis. Whereas the proposed mechanism is able to explain some of the discrepancies in the literature it does not give a very detailed picture of how mood would influence generation. In spite of this weakness, the hypothesis may still prove valuable, both as a suggestion that a particular process is being influenced, and as a shift away from the rather inclusive network theory.

TABLE 1. Fragment Solution Rates for Induction Groups.

| | Word Valences | | | |
|---|---|---|---|---|
| Induction | Neutral | Positive | Negative | Total |
| Neutral | 6.83 | 6.67 | 6.54 | 6.68 |
| Elated | 6.67 | 6.75 | 7.04 | 6.82 |
| Depressed | 6.92 | 6.46 | 6.54 | 6.64 |
| Total | 6.80 | 6.63 | 6.71 | 6.71 |

TABLE 2. Experiment 1 Recall 1: Percentage of Material Recalled for Induction Groups.

| | Responses | | | | Cues | | | |
|---|---|---|---|---|---|---|---|---|
| Induction | neut | pos | neg | tot | neut | pos | neg | tot |
| Neutral | | | | | | | | |
| gen. M | 14.7 | 25.2 | 25.8 | 21.9 | 7.8 | 12.5 | 8.9 | 9.7 |
| SD | 16.4 | 18.3 | 15.7 | | 10.9 | 16.5 | 10.1 | |
| read M | 11.5 | 9.4 | 12.0 | 11.0 | 6.2 | 5.2 | 5.7 | 5.7 |
| SD | 12.2 | 9.2 | 9.4 | | 9.8 | 7.3 | 8.2 | |
| Elated | | | | | | | | |
| gen. M | 13.2 | 23.5 | 25.0 | 20.6 | 3.6 | 8.9 | 11.5 | 8.0 |
| SD | 15.2 | 15.7 | 18.4 | | 5.8 | 10.1 | 10.4 | |
| read M | 15.1 | 7.8 | 14.1 | 12.3 | 6.2 | 3.6 | 7.8 | 5.9 |
| SD | 15.2 | 10.3 | 13.4 | | 9.0 | 5.8 | 9.6 | |
| Depressed | | | | | | | | |
| gen. M | 18.0 | 22.4 | 28.1 | 22.8 | 9.4 | 8.3 | 12.0 | 9.9 |
| SD | 14.6 | 18.6 | 13.9 | | 11.8 | 10.2 | 10.7 | |
| read M | 12.5 | 6.8 | 9.9 | 9.7 | 3.6 | 1.6 | 4.2 | 3.1 |
| SD | 12.2 | 8.2 | 12.2 | | 9.4 | 4.2 | 7.1 | |
| Total | | | | | | | | |
| gen. M | 15.3 | 23.7 | 26.3 | 21.8 | 6.9 | 9.9 | 10.8 | 9.2 |
| SD | 15.2 | 17.4 | 16.0 | | 10.0 | 12.6 | 10.3 | |
| read M | 13.0 | 8.0 | 12.0 | 11.0 | 5.4 | 3.5 | 5.9 | 4.9 |
| SD | 13.2 | 9.2 | 11.8 | | 9.3 | 6.0 | 8.4 | |

TABLE 3. Experiment 1 Recall 1: Percentage of Responses Recalled for Mood Groups divided by Sex.

| | | Generate | | | | Read | | | |
|---|---|---|---|---|---|---|---|---|---|
| Mood | | neut | pos | neg | tot | neut | pos | neg | tot |
| **Neutral** | | | | | | | | | |
| Male n=10 | M | 10.4 | 19.9 | 21.9 | 17.4 | 6.2 | 8.7 | 7.5 | 7.5 |
| | SD | 13.8 | 13.9 | 15.1 | | 8.8 | 10.3 | 8.7 | |
| Female n=13 | M | 18.3 | 21.1 | 27.9 | 22.4 | 14.4 | 3.8 | 12.5 | 10.2 |
| | SD | 13.7 | 12.7 | 16.1 | | 11.2 | 7.9 | 12.5 | |
| **Elated** | | | | | | | | | |
| Male n=11 | M | 19.9 | 27.2 | 28.0 | 25.0 | 15.9 | 10.2 | 9.1 | 11.7 |
| | SD | 22.9 | 16.2 | 18.8 | | 14.9 | 10.9 | 8.1 | |
| Female n=14 | M | 9.7 | 26.7 | 18.0 | 18.1 | 15.2 | 11.6 | 15.2 | 14.0 |
| | SD | 11.2 | 24.9 | 12.3 | | 14.9 | 7.7 | 10.0 | |
| **Depressed** | | | | | | | | | |
| Male n=15 | M | 11.5 | 23.0 | 27.1 | 20.5 | 10.8 | 5.8 | 12.5 | 9.7 |
| | SD | 10.6 | 14.2 | 12.9 | | 13.3 | 6.5 | 13.4 | |
| Female n=9 | M | 25.8 | 24.1 | 38.5 | 29.5 | 15.3 | 8.3 | 13.9 | 12.5 |
| | SD | 14.4 | 21.7 | 17.8 | | 15.0 | 12.5 | 17.1 | |
| **Total** | | | | | | | | | |
| Neut | M | 14.9 | 20.6 | 25.3 | 20.3 | 10.9 | 6.0 | 10.3 | 9.1 |
| | SD | 14.1 | 12.9 | 15.6 | | 10.9 | 9.1 | 11.1 | |
| Elat | M | 14.2 | 26.9 | 22.4 | 21.2 | 15.5 | 11.0 | 12.5 | 13.0 |
| | SD | 17.7 | 21.1 | 15.9 | | 14.6 | 9.1 | 9.5 | |
| Depr | M | 16.9 | 23.4 | 31.4 | 23.9 | 12.5 | 6.8 | 13.0 | 10.8 |
| | SD | 13.8 | 16.9 | 15.6 | | 13.8 | 9.0 | 14.5 | |

TABLE 4a. Experiment 1 Recall 2: Percentage of Material Recalled for Induction Groups (generate only).

| | Responses | | | | Cues | | | |
|---|---|---|---|---|---|---|---|---|
| Induction | neut | pos | neg | tot | neut | pos | neg | tot |
| **Neutral** | | | | | | | | |
| Neut M | 6.7 | 14.4 | 11.6 | 10.9 | 1.6 | 14.1 | 6.2 | 7.3 |
| SD | 7.2 | 13.3 | 10.1 | | 4.4 | 21.6 | 6.7 | |
| Elat M | 16.3 | 20.7 | 15.5 | 17.5 | 6.2 | 6.2 | 1.6 | 4.7 |
| SD | 17.6 | 15.6 | 8.6 | | 6.7 | 9.4 | 4.4 | |
| Depr M | 15.0 | 19.5 | 19.1 | 17.9 | 6.2 | 6.2 | 3.1 | 5.2 |
| SD | 21.9 | 18.1 | 15.2 | | 13.4 | 9.4 | 5.8 | |
| **Elated** | | | | | | | | |
| Neut M | 6.7 | 13.0 | 23.2 | 14.3 | 1.6 | 6.2 | 12.5 | 6.8 |
| SD | 12.8 | 15.7 | 15.0 | | 4.4 | 9.4 | 9.4 | |
| Elat M | 7.4 | 22.5 | 20.1 | 16.7 | 3.1 | 6.2 | 6.2 | 5.2 |
| SD | 8.3 | 14.5 | 10.9 | | 5.8 | 13.4 | 9.4 | |
| Depr M | 8.0 | 13.9 | 16.1 | 12.7 | 1.6 | 7.8 | 10.9 | 6.8 |
| SD | 13.4 | 14.9 | 19.4 | | 4.4 | 9.3 | 10.4 | |
| **Depressed** | | | | | | | | |
| Neut M | 9.6 | 25.7 | 13.3 | 16.2 | 3.1 | 9.4 | 3.1 | 5.2 |
| SD | 15.6 | 26.2 | 9.1 | | 5.8 | 12.9 | 5.8 | |
| Elat M | 7.0 | 16.3 | 25.1 | 16.1 | 1.6 | 7.8 | 12.5 | 7.3 |
| SD | 10.1 | 13.3 | 11.0 | | 4.4 | 9.3 | 11.6 | |
| Depr M | 5.1 | 16.8 | 20.8 | 14.2 | 6.2 | 1.6 | 7.8 | 5.2 |
| SD | 10.4 | 15.5 | 25.6 | | 6.7 | 4.4 | 6.5 | |
| **Total** | | | | | | | | |
| M | 9.1 | 18.1 | 18.3 | 15.2 | 3.5 | 7.3 | 7.1 | 6.0 |
| SD | 13.5 | 16.3 | 14.6 | | 6.7 | 11.6 | 8.6 | |

TABLE 4b. Experiment 1 Recall 2: Percentage of Material Recalled for Induction Groups (read only).

| | | Responses | | | | Cues | | | |
|---|---|---|---|---|---|---|---|---|---|
| Induction | | neut | pos | neg | tot | neut | pos | neg | tot |
| **Neutral** | | | | | | | | | |
| Neut | M | 6.2 | 6.2 | 7.8 | 6.7 | 0.0 | 1.6 | 4.7 | 2.1 |
| | SD | 13.4 | 9.4 | 6.5 | | 0.0 | 4.4 | 6.5 | |
| Elat | M | 14.1 | 9.4 | 4.7 | 9.7 | 1.6 | 1.6 | 7.8 | 3.7 |
| | SD | 12.4 | 12.9 | 6.5 | | 4.4 | 4.4 | 9.3 | |
| Depr | M | 1.6 | 4.7 | 9.4 | 5.2 | 0.0 | 6.2 | 6.2 | 4.1 |
| | SD | 4.4 | 6.5 | 8.8 | | 0.0 | 9.4 | 6.7 | |
| **Elated** | | | | | | | | | |
| Neut | M | 4.7 | 6.2 | 7.8 | 6.2 | 1.6 | 3.1 | 4.7 | 3.1 |
| | SD | 6.5 | 9.4 | 13.3 | | 4.4 | 5.8 | 6.5 | |
| Elat | M | 6.2 | 3.1 | 1.6 | 3.6 | 1.6 | 0.0 | 3.1 | 1.6 |
| | SD | 9.4 | 8.8 | 4.4 | | 4.4 | 0.0 | 5.8 | |
| Depr | M | 9.4 | 10.9 | 12.5 | 10.9 | 4.7 | 6.2 | 6.2 | 5.7 |
| | SD | 14.6 | 12.4 | 9.4 | | 9.3 | 9.4 | 6.7 | |
| **Depressed** | | | | | | | | | |
| Neut | M | 4.7 | 3.1 | 9.4 | 5.7 | 1.6 | 4.7 | 4.7 | 3.7 |
| | SD | 9.3 | 5.8 | 14.6 | | 4.4 | 6.5 | 9.3 | |
| Elat | M | 14.1 | 6.2 | 4.7 | 8.3 | 3.1 | 0.0 | 0.0 | 1.0 |
| | SD | 12.4 | 6.7 | 6.5 | | 5.8 | 0.0 | 0.0 | |
| Depr | M | 4.7 | 3.1 | 17.2 | 8.3 | 0.0 | 0.0 | 3.1 | 1.0 |
| | SD | 6.5 | 5.8 | 17.6 | | 0.0 | 0.0 | 5.8 | |
| **Total** | | | | | | | | | |
| | M | 7.3 | 5.9 | 8.3 | 7.2 | 1.6 | 2.6 | 4.5 | 2.9 |
| | SD | 10.6 | 8.9 | 10.9 | | 4.7 | 5.9 | 6.7 | |

TABLE 5. Experiment 1 Recall 2: Means Involved in Induction 1 by Induction 2 by Cue Type by Pair Processing Interaction.

| | Responses | | Cues | |
|---|---|---|---|---|
| Induction | generate | read | generate | read |
| **Neutral** | | | | |
| Neut | 10.9 | 6.7 | 7.3 | 2.1 |
| Elat | 17.5ab | 9.4 | 4.7a | 3.7b |
| Depr | 17.9abc | 5.2a | 5.2b | 4.1c |
| **Elated** | | | | |
| Neut | 14.3 | 6.2 | 6.8 | 3.1 |
| Elat | 16.7ab | 3.6a | 5.2 | 1.6b |
| Depr | 12.7 | 10.9 | 6.8 | 5.7 |
| **Depressed** | | | | |
| Neut | 16.2a | 5.7 | 5.2 | 3.7a |
| Elat | 16.1a | 8.3 | 7.3 | 1.0a |
| Depr | 14.2a | 8.3 | 5.2 | 1.0a |

Note: Means within groups marked by the same letter differ significantly

TABLE 6. Experiment 1 Recall 2: Percentage of Responses Recalled for Mood Groups.

| | | Generate | | | | Read | | | |
|---|---|---|---|---|---|---|---|---|---|
| Induction | | neut | pos | neg | tot | neut | pos | neg | tot |
| **Neutral** | | | | | | | | | |
| Neut | M | 8.9 | 21.4 | 20.2 | 16.8 | 5.7 | 1.1 | 5.7 | 4.2 |
| | SD | 14.6 | 11.6 | 13.8 | | 11.7 | 3.8 | 6.5 | |
| Elat | M | 5.2 | 8.2 | 14.7 | 9.4 | 10.7 | 5.4 | 5.4 | 7.2 |
| | SD | 9.0 | 11.4 | 15.9 | | 11.2 | 6.7 | 6.7 | |
| Depr | M | 10.0 | 21.4 | 11.5 | 14.3 | 0.0 | 5.0 | 10.0 | 5.0 |
| | SD | 16.3 | 21.1 | 11.4 | | 0.0 | 6.8 | 10.5 | |
| **Elated** | | | | | | | | | |
| Neut | M | 15.6 | 17.5 | 14.8 | 16.0 | 8.3 | 14.6 | 2.1 | 8.3 |
| | SD | 18.3 | 10.6 | 10.7 | | 6.5 | 14.6 | 5.1 | |
| Elat | M | 15.8 | 21.4 | 14.5 | 17.2 | 9.4 | 6.2 | 7.3 | 7.6 |
| | SD | 18.7 | 16.2 | 11.2 | | 13.2 | 8.4 | 8.4 | |
| Depr | M | 4.1 | 19.0 | 20.5 | 14.5 | 3.6 | 8.9 | 10.7 | 7.7 |
| | SD | 10.8 | 19.7 | 13.4 | | 6.1 | 9.4 | 4.7 | |
| **Depressed** | | | | | | | | | |
| Neut | M | 8.2 | 21.1 | 22.6 | 17.3 | 15.0 | 5.0 | 0.0 | 6.7 |
| | SD | 12.6 | 27.5 | 6.7 | | 13.7 | 6.8 | 0.0 | |
| Elat | M | 8.3 | 21.1 | 19.4 | 16.3 | 6.2 | 4.7 | 7.8 | 6.2 |
| | SD | 9.6 | 20.8 | 6.3 | | 9.4 | 6.5 | 13.3 | |
| Depr | M | 4.7 | 12.1 | 23.7 | 13.5 | 6.8 | 5.7 | 19.3 | 10.6 |
| | SD | 6.6 | 12.7 | 25.9 | | 11.7 | 11.7 | 17.1 | |
| **Total** | | | | | | | | | |
| | M | 9.1 | 18.1 | 18.3 | 15.2 | 7.3 | 5.9 | 8.3 | 7.2 |
| | SD | 13.5 | 16.3 | 14.6 | | 10.6 | 8.9 | 10.9 | |

TABLE 7. Experiment 2: Percentage of Material Recalled for Induction Groups.

| | | Responses | | | Cues | | |
|---|---|---|---|---|---|---|---|
| Induction | | neut | pos | neg | neut | pos | neg |
| Elated-Elated | | | | | | | |
| gen. | M | 17.6 | 26.1 | 10.3 | 0.0 | 6.3 | 7.8 |
| | SD | 14.9 | 17.3 | 12.0 | 0.0 | 6.7 | 9.3 |
| read | M | 4.7 | 6.2 | 4.7 | 1.6 | 1.6 | 1.6 |
| | SD | 6.5 | 9.4 | 9.3 | 4.4 | 4.4 | 4.4 |
| Elated-Depressed | | | | | | | |
| gen. | M | 2.1 | 9.8 | 20.2 | 0.0 | 0.0 | 3.1 |
| | SD | 5.9 | 12.3 | 19.6 | 0.0 | 0.0 | 5.8 |
| read | M | 3.1 | 3.1 | 3.1 | 1.6 | 4.7 | 1.6 |
| | SD | 5.8 | 5.8 | 5.8 | 4.4 | 6.4 | 4.4 |
| Total | | | | | | | |
| gen. | M | 9.9 | 18.0 | 15.2 | 0.0 | 3.1 | 5.5 |
| | SD | 13.6 | 16.7 | 16.5 | 0.0 | 5.6 | 7.9 |
| read | M | 3.9 | 4.7 | 3.9 | 1.6 | 3.1 | 1.6 |
| | SD | 6.0 | 7.7 | 7.5 | 4.3 | 5.6 | 4.3 |

FIGURE 1. Experiment 1 Recall 1: Cue Type by Pair Processing by Word Valence Interaction

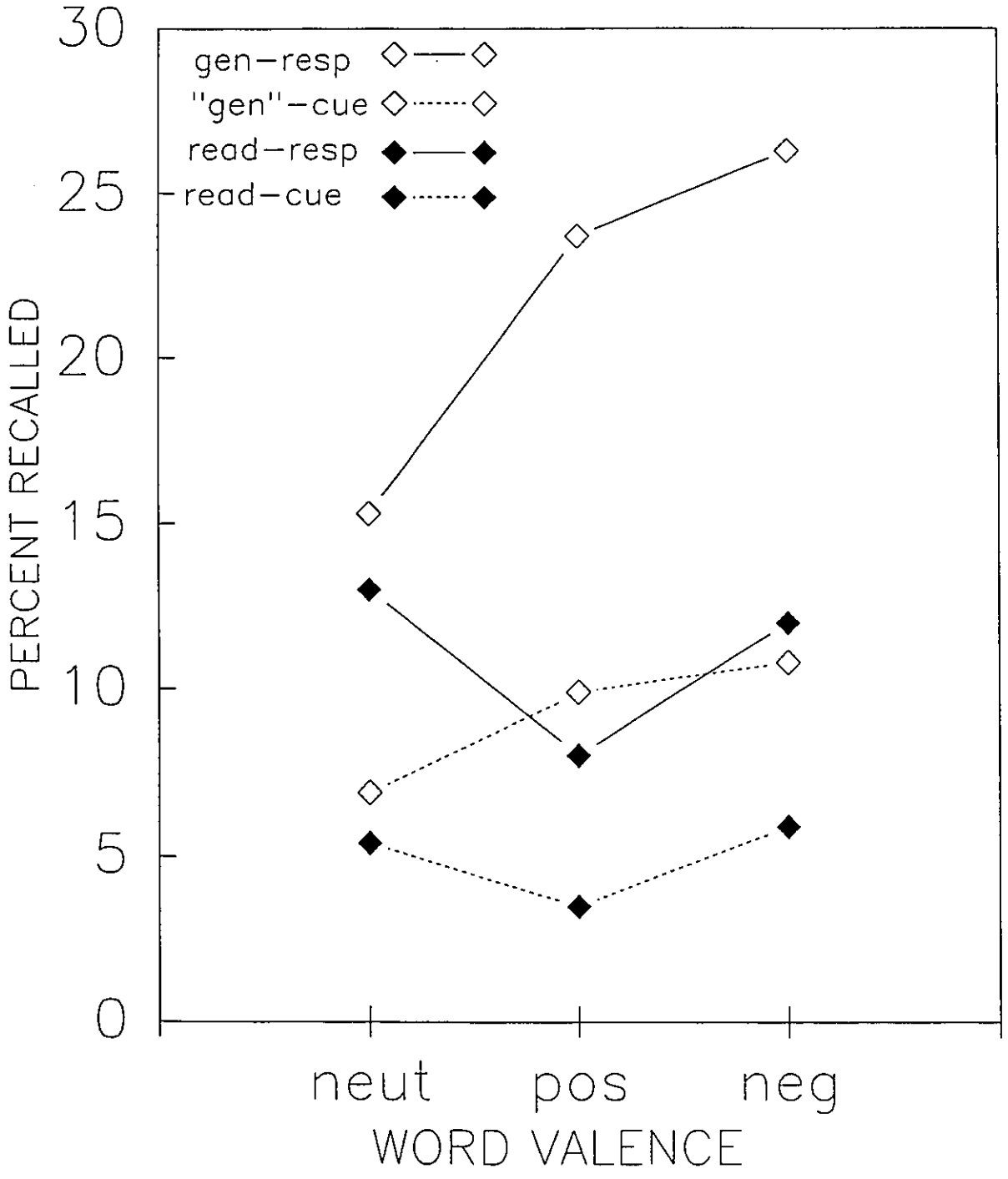


FIGURE 2. Experiment 1 Recall 1: Percentage of Responses Recalled for Induction Groups (generate only)

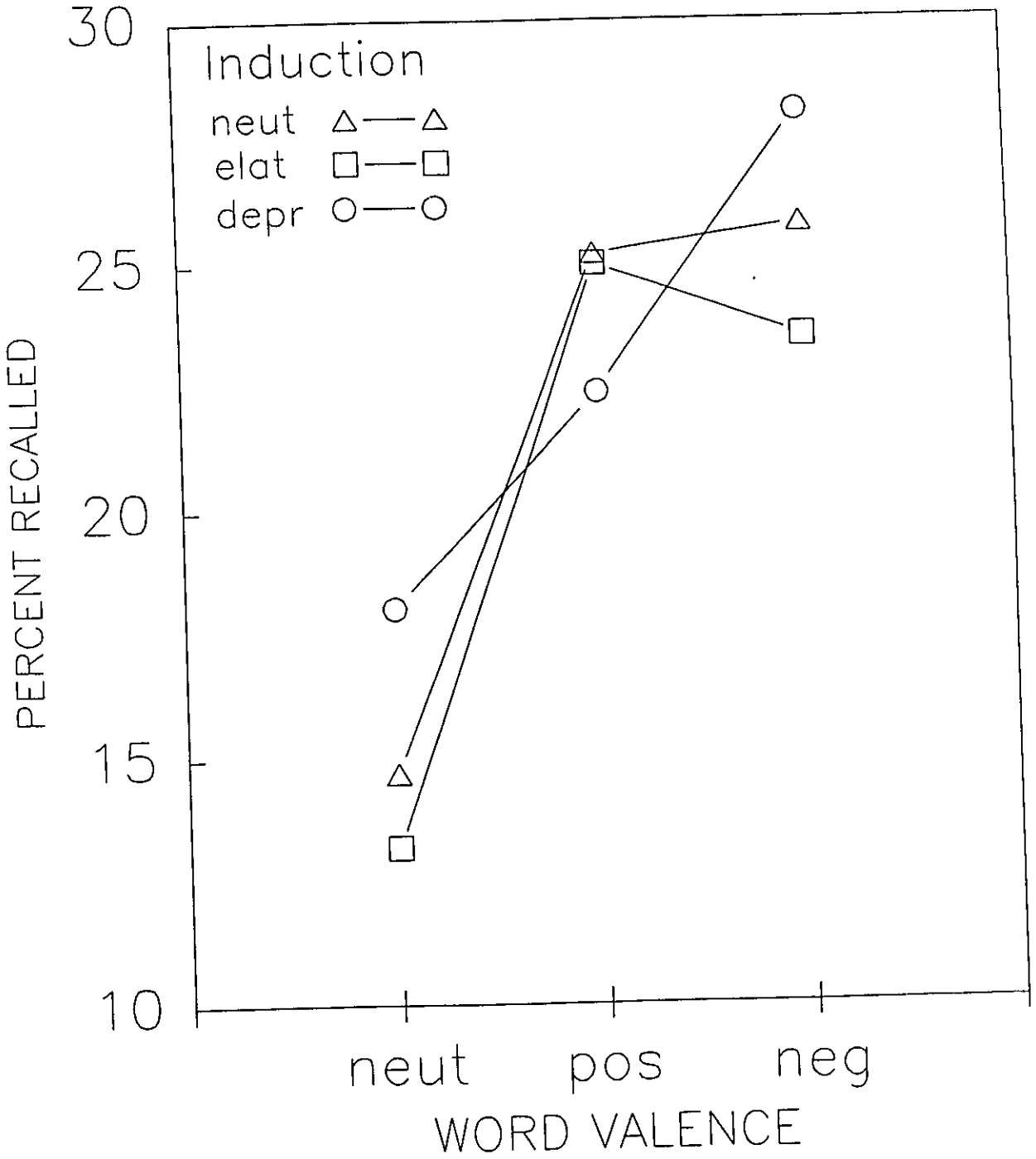


FIGURE 3. Experiment 1 Recall 1: Percentage of Responses Recalled for Mood Groups (generate only)

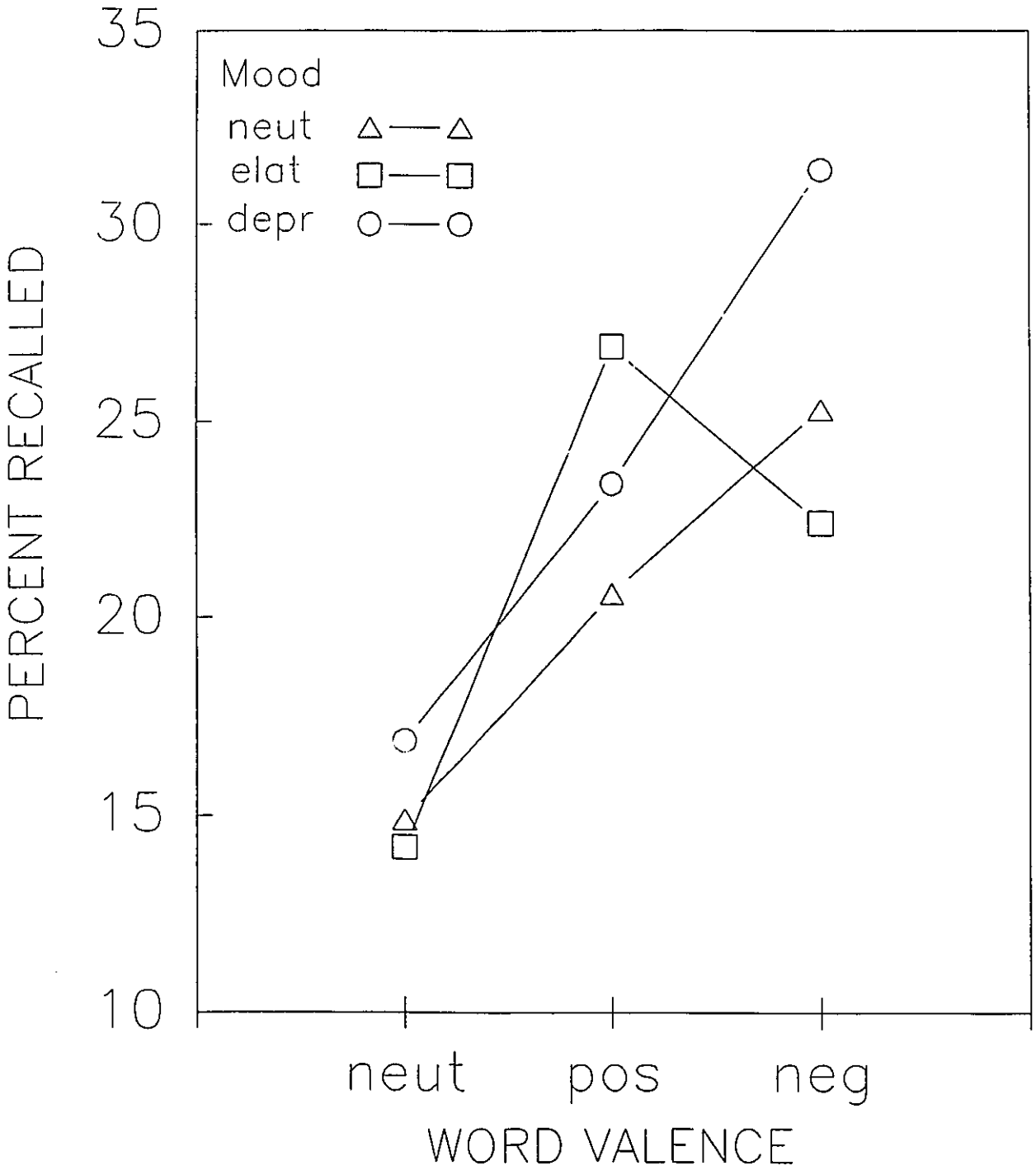


FIGURE 4. Experiment 1 Recall 1: Percentage of Responses Recalled for Mood Groups divided by Sex (generate only)

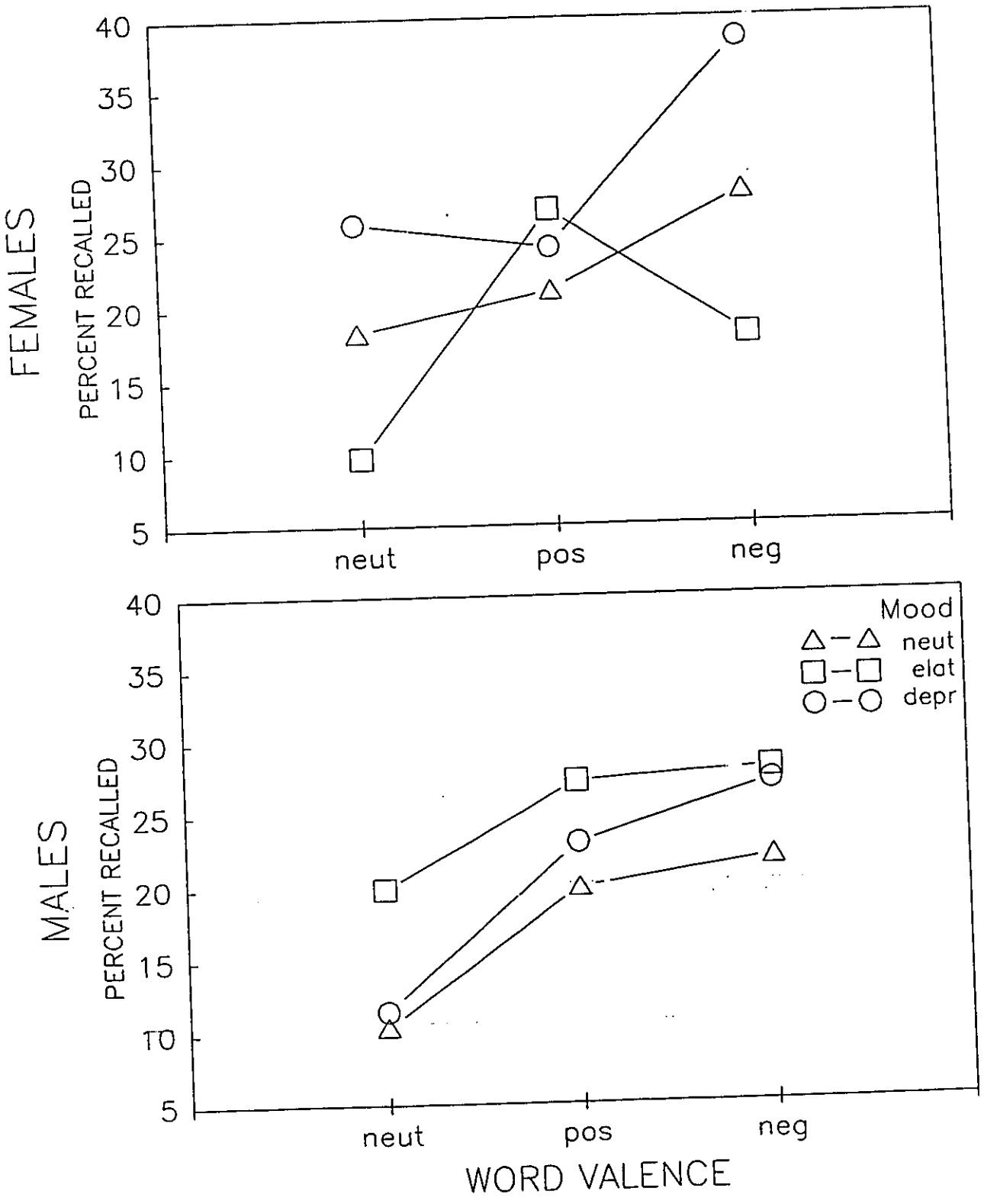


FIGURE 5. Experiment 1 Recall 2: Cue Type by Pair Processing by Word Valence Interaction

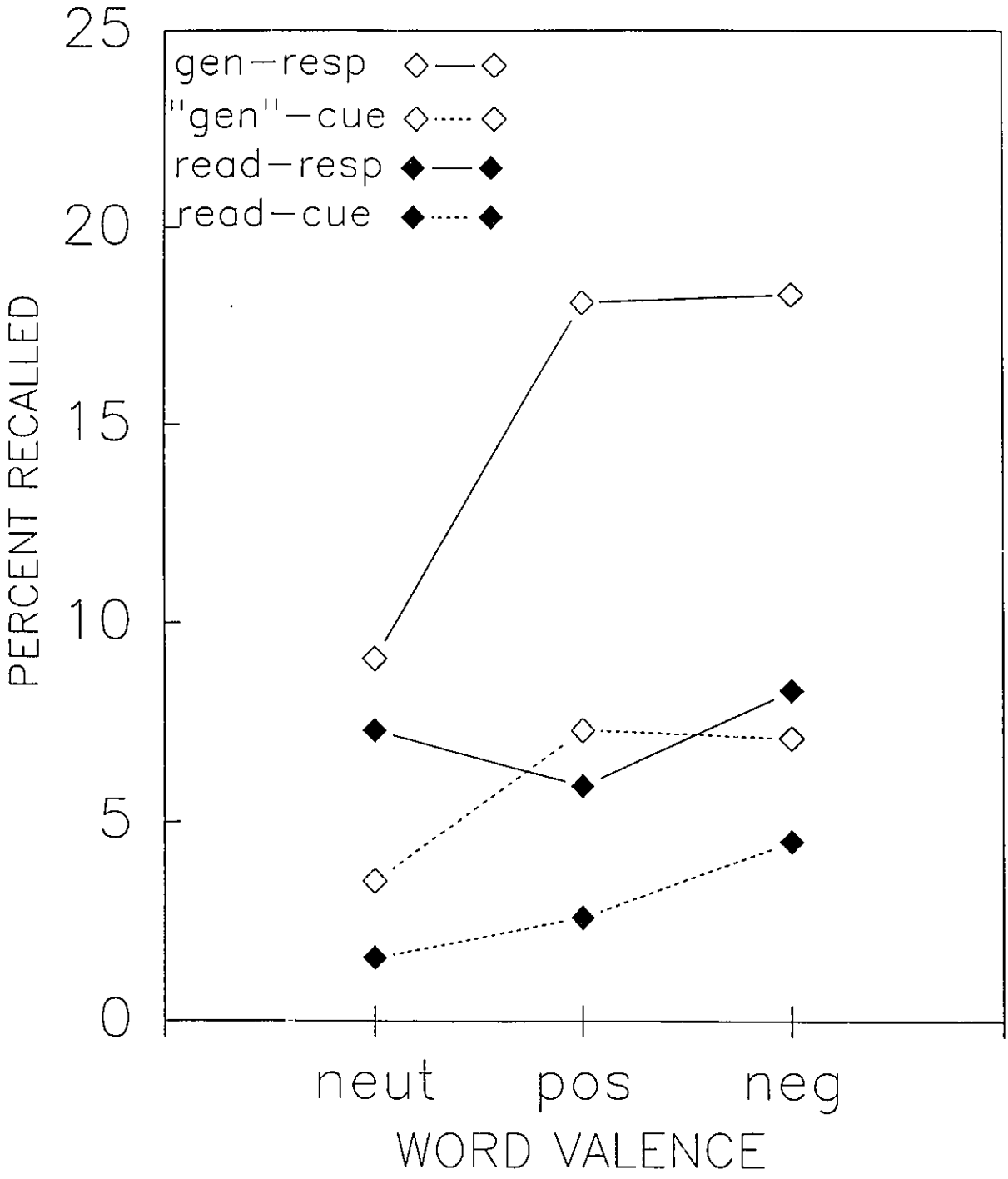


FIGURE 6. Experiment 2: Induction Type by Word Valence Interaction

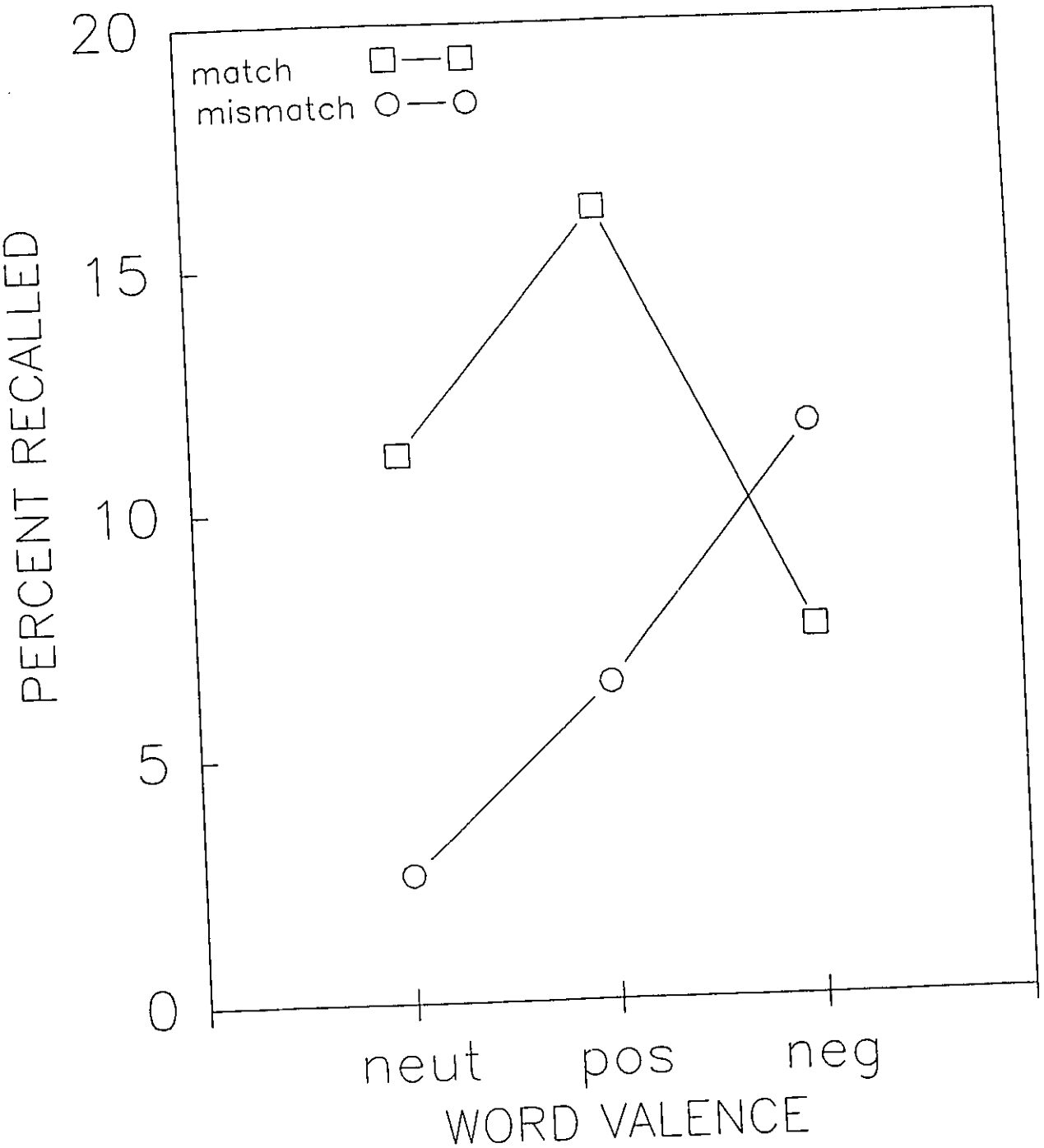
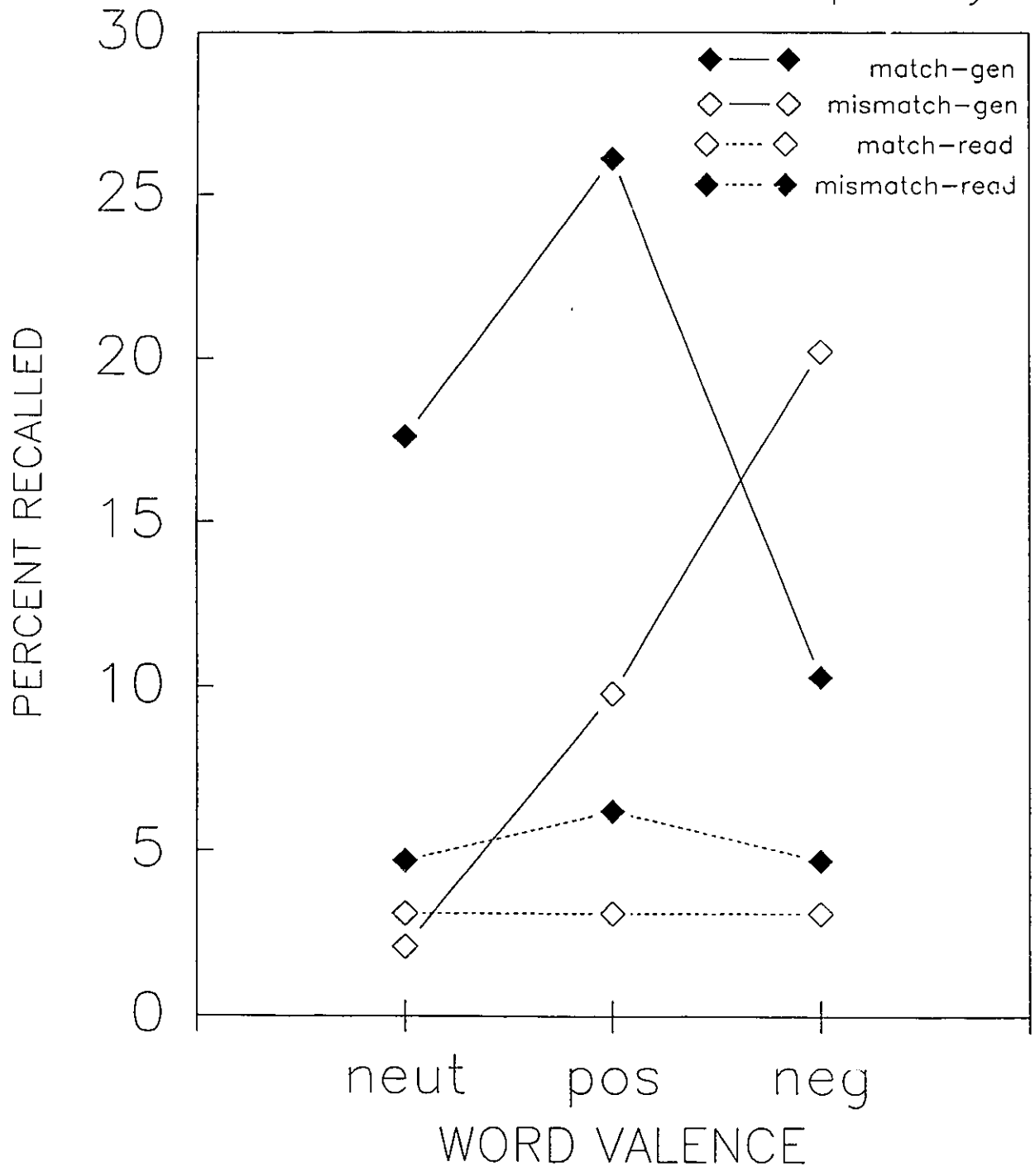


FIGURE 7. Experiment 2: Induction Type by Word Valence Interaction for Generated and Read Words separately



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# APPENDIX 1.

Stimuli: List 1.

hopeful - o _ t _ m _ s t _ _
powerful - s t _ _ n _
calm - s e _ _ n e
contented - s _ t _ _ f _ e d
glad - h a _ _ y
relaxed - p e _ _ _ f _ l
eager - e _ t h _ _ i _ s t _ c
lively - v i _ o r _ _ s
wonderful - t e r r i f i c
adoration - a d m i r a t i o n
thankful - g r a t e f u l
good - f i n e
cheerful - p l e a s a n t
courageous - b r a v e
purposeful - d e t e r m i n e d
compassionate - s y m p a t h e t i c
tired - w e _ _ y
bad - r o _ t _ n
depressed - u n _ _ p _ y
wretched - w o _ _ h l _ s _
worried - n e _ v _ _ s
inferior - i n _ d _ q _ _ t _
useless - s t _ _ i _
horrible - t e _ r _ _ l _
shy - t i m i d
glum - s a d
troubled - u n e a s y
miserable - a w f u l
withdrawn - i n h i b i t e d
isolated - l o n e l y
helpless - v u l n e r a b l e
dull - b o r e d
scientific - m _ t _ o d _ c _ l
passive - r _ s _ _ v _ d
ordinary - n _ _ m _ l
convincing - p _ r s _ _ s _ v _
conforming - c _ n v _ _ t _ o _ a _
humble - m _ d _ _ t
informal - c _ s _ a _
puzzled - p _ r p _ _ x _ _
precise - m e t i c u l o u s
orderly - m a t h e m a t i c a l
prudent - d i s c r i m i n a t i n g
solemn - s e r i o u s
meditative - p h i l o s o p h i c a l
literary - a r t i s t i c
mild - s u b t l e
neat - o r g a n i z e d

Stimuli: List 2.

hopeful - optimistic
powerful - strong
calm - serene
contented - satisfied
glad - happy
relaxed - peaceful
eager - enthusiastic
lively - vigorous
wonderful - te _ r _ f _ c
adoration - ad _ i _ a _ _ on
thankful - gr _ _ ef _ l
good - fi _ _
cheerful - p _ e _ s _ nt
courageous - b _ _ ve
purposeful - de _ _ r _ _ n _ d
compassionate - sy _ _ a th _ _ _ c
tired - weary
bad - rotten
depressed - unhappy
wretched - worthless
worried - nervous
inferior - inadequate
useless - stupid
horrible - terrible
shy - ti _ _ d
glum - s _ _
troubled - un _ a _ y
miserable - aw _ u _
withdrawn - in _ i _ _ t _ d
isolated - l _ _ e _ y
helpless - vu _ n _ _ ab _ e
dull - bo _ e _
scientific - m _ t _ od _ c _ l
passive - r _ s _ _ v _ d
ordinary - n _ _ m _ l
convincing - p _ rs _ _ s _ v _
conforming - c _ nv _ _ t _ o _ a _
humble - m _ d _ _ t
informal - c _ s _ a _
puzzled - p _ rp _ _ x _ _
precise - meticulous
orderly - mathematical
prudent - discriminating
solemn - serious
meditative - philosophical
literary - artistic
mild - subtle
neat - organized

Stimuli: List 3.

optimistic - ho _ _ f _ l
admiration - a _ o r _ _ i _ n
grateful - th _ n _ f _ _
fine - g _ o _
pleasant - c _ e _ r f _ l
peaceful - re _ _ x _ d
determined - p u _ p _ _ e _ u l
sympathetic - co _ p _ s _ i _ n _ t _
terrific - wonderful
strong - powerful
serene - calm
satisfied - contented
happy - glad
brave - courageous
enthusiastic - eager
vigorous - lively
timid - s _ _
rotten - b _ _
unhappy - d _ _ r e _ s _ d
worthless - w r _ t _ h _ d
inhibited - w _ t _ d r _ w _
inadequate - in _ _ r i _ r
stupid - us _ l _ _ _
bored - du _ _
weary - tired
sad - glum
uneasy - troubled
awful - miserable
lonely - isolated
vulnerable - helpless
terrible - horrible
nervous - worried
scientific - m _ t _ o d _ c _ l
passive - r _ s _ _ v _ d
ordinary - n _ _ m _ l
convincing - p _ r s _ _ s _ v _
conforming - c _ n v _ _ t _ o _ a _
humble - m _ d _ _ t
informal - c _ s _ a _
puzzled - p _ r p _ _ x _ _
precise - meticulous
orderly - mathematical
prudent - discriminating
solemn - serious
meditative - philosophical
literary - artistic
mild - subtle
neat - organized

Stimuli: List 4.

optimistic - hopeful
admiration - adoration
grateful - thankful
fine - good
pleasant - cheerful
peaceful - relaxed
determined - purposeful
sympathetic - compassionate
terrific - w _ n _ _ r f _ l
strong - p _ w _ _ f _ l
serene - c _ _ m
satisfied - c o _ t _ n _ _ d
happy - g _ a _
brave - c _ u r _ _ e _ u s
enthusiastic - e a _ e _
vigorous - l i _ e _ _
timid - shy
rotten - bad
unhappy - depressed
worthless - wretched
inhibited - withdrawn
inadequate - inferior
stupid - useless
bored - dull
weary - t i _ e _
sad - g _ _ m
uneasy - t r _ _ b _ e _
awful - m _ s _ r _ b _ e
lonely - i _ o l _ t _ d
vulnerable - he _ p _ e _ s
terrible - h _ _ r _ b _ e
nervous - w _ r _ i _ d
scientific - m _ t _ o d _ c _ l
passive - r _ s _ _ v _ d
ordinary - n _ _ m _ l
convincing - p _ r s _ _ s _ v _
conforming - c _ n v _ _ t _ o _ a _
humble - m _ d _ _ t
informal - c _ s _ a _
puzzled - p _ r p _ _ x _ _
precise - meticulous
orderly - mathematical
prudent - discriminating
solemn - serious
meditative - philosophical
literary - artistic
mild - subtle
neat - organized

# APPENDIX 2.

Musical Appreciation Questionnaire

Please check off the words that describe how the music made you feel:

| | | |
|---|---|---|
| _____ steady | _____ discouraged | _____ suffering |
| _____ understanding | _____ affectionate | _____ free |
| _____ friendly | _____ tormented | _____ destroyed |
| _____ forlorn | _____ rejected | _____ joyful |
| _____ pleased | _____ secure | _____ sad |
| _____ interested | _____ miserable | _____ alone |
| _____ lost | _____ tender | _____ sunk |
| _____ polite | _____ lonely | _____ warm |

Please check off the words that describe how the music seemed to you:

| | | |
|---|---|---|
| _____ strange | _____ still | _____ active |
| _____ passive | _____ unique | _____ vibrant |
| _____ bright | _____ rational | _____ ordered |
| _____ serious | _____ rhythmic | _____ strong |
| _____ ugly | _____ mild | _____ slow |
| _____ humorous | _____ unrhythmic | _____ fast |
| _____ common | _____ unimaginative | _____ dark |
| _____ chaotic | _____ repetitive | _____ emotional |
| _____ beautiful | _____ intense | _____ remote |
| _____ simple | _____ imaginative | _____ weak |
| _____ intimate | _____ familiar | _____ complex |

14. Did you recognize any of the songs? Y / N

15. Can you remember in what context you heard these songs before? If so, please list what you remember.

16. Can you name any of those songs that you recognized? Y / N

If so, please list their names.

17. Please indicate the type or types of musical training you have received.

practical - instrumental or vocal instruction in a school band or chorus

- private instruction on an instrument or in voice

- self-instruction on an instrument or in voice

- group instruction on an instrument

- university music courses involving an instrumental or choral laboratory

theoretical - private lessons in music theory

- self-instruction in music theory

- music courses at the university level

- theoretical instruction as part of practical instruction

18. Please indicate which ONE of the following musical programs you prefer to listen to on the radio and TV.

- jazz music
- folk-song music
- country and western music
- popular music
- classical music
- other (specify) _____

19. Please indicate if you have any records, tapes, CDs etc. in each of the following categories.

____ - jazz music

____ - folk-song music

____ - country and western music

____ - popular music

____ - classical music

____ - other (specify) _____

20. Do you own a far greater number of records in any one category? If yes, name the category.

_____