Memory
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/pmem20

Illusory Recall of Vocal Affect

Kevin N. Ochsner , Daniel L. Schacter & Kari Edwards
Published online: 15 Oct 2010.

MEMORY, 1997, *5* (4), 433–455

Illusory Recall of Vocal Affect

Kevin N. Ochsner and Daniel L. Schacter
Harvard University, USA

Kari Edwards
Brown University, USA

Illusions of memory occur when a person recalls something that did not take place, and may result from processes that systematically bias recall. This paper reports three experiments exploring a novel form of memory bias that can occur when a person is attempting to recall the affective tone of voice in which someone spoke previously. Subjects first studied photographs of faces while listening to sentences spoken in a positive or negative tone of voice. At test, subjects saw brief presentations of faces and were asked to recall the tone of voice in which the pictured person had spoken earlier. Across a variety of study and test conditions a strong recall bias was observed: when faces conveyed either subtle positive or negative affect, subjects tended to recall the pictured person as having spoken with a matching affective tone, regardless of the tone of voice in which the person had actually spoken. It is proposed that this affective recall bias may be the product of a retrieval mechanism that relies on a combination of information from the memory trace and retrieval environment to guide responding.

INTRODUCTION

Introspectively, memory seems to be a simple matter of bringing to mind a record of the past—a record that we take to be an accurate representation of events. For example, what one recalls when thinking about a passing conversation with a friend that took place only minutes ago seems quite accurate. But what is brought to mind may not always be the accurate record that we expect or believe we experience. One might misremember any aspect of the conversation—from the content to the tone of what was said—and what is

Requests for reprints should be sent to Kevin N. Ochsner, Department of Psychology, Harvard University, 33 Kirkland Street, Cambridge, MA 02138, USA. Email: ochsner@wjh.harvard.edu

We wish to thank J. Mark G. Williams and two anonymous reviewers for helpful comments on earlier versions of this manuscript. K.N. Ochsner was supported by a National Science Foundation Graduate Research Fellowship and a Sackler Scholars fellowship. D.L. Schacter was supported by National Institute of Aging grant 8146. Kari Edwards was supported by National Science Foundation grant SBR-9422030.

misremembered might depend on the way in which the information was encoded and stored or the manner and context in which the memory is retrieved.

Typically, research on memory distortions has focused on mechanisms involved in the encoding and storage of information, such as interference, decay, lack of attention, or schematic processing during initial encoding or subsequent recall (Loftus, Feldman, & Dashiell, 1995; for recent review, see Schacter, 1995). But there has also been growing interest in the role of the retrieval environment—a perhaps less well understood though important contributor to memory distortions. Various observations suggest that elements of one's present experience can serve as sources of misinformation about the past, resulting in systematic distortions of recall, memory biases that can cause people to misremember aspects of a target event, or even recall of events that never took place (Jacoby, Kelley, Brown, & Jasechko, 1989a; Jacoby, Kelley, & Dywan, 1989b, Loftus, 1991; Ross, 1989; Schacter, 1996; Tulving, 1983). For instance, misleading elements can be embedded in questions that suggest the presence of objects or persons that were not actually present, leading people to encode and then later ''recall'' the misinformation in place of what actually happened (Ceci, 1995; Ceci & Bruck, 1993; Hyman, Husband, & Billings, 1995; Lindsay, 1990; Loftus, 1979; Loftus & Pickrell, 1995). More commonly, however, these falsely remembered elements take the form of one's present feelings and thoughts, which bias memory through their seamless incorporation into recollections made during the course of everyday experience. These retrospective biases (Dawes, 1988) lead memory for one's past political beliefs, behaviours, or abilities to be ''revised'' in accord with one's present attitudes towards these issues (Collins, Graham, Hansen, & Johnson, 1985; Conway & Ross, 1984; Marcus, 1986).

Memory distortion can also be observed in the domain of emotional or affective memory. Most relevant studies have examined the ways in which attention is drawn to affectively charged stimuli, and associated consequences for memory of central or peripheral details (e.g. Reisberg & Heuer, 1992). Those studies that have examined the influence of the retrieval environment on memory for affective information have considered only how current mood states lead to retrospective biases in autobiographical reports of past mood states. For example, it has been shown that memory for past pain or depression can be biased by the level of pain or depression that a person is currently experiencing: if a person is currently experiencing high levels of pain or depression, he or she tends to recall the level of pain or depression experienced in the past as having been greater than it actually was (Eich, Reeves, Jaeger, & Graff-Radford, 1985; Lewinsohn & Rosenbaum, 1987).

The finding that a person's current mood, which can be considered an aspect of the retrieval environment, biases memory for past mood states (Eich et al., 1985; Thomas & Diener, 1992) follows naturally from the synergistic ecphory model of episodic memory retrieval advanced by Tulving (1983). According to this theory, the content of retrieval is the joint product of trace and cue information. Ecphory is the process of converting a memory trace into a form that can access consciousness and guide responding, but before it does so, the ecphorised trace interacts with information encoded from cues in the retrieval environment. What a person consciously recalls is the output of this synergistic interaction, and recall is therefore always some combination of stored information and information present in the retrieval environment. Thus, in the examples given earlier, it is not so much that mood-congruent memories are retrieved preferentially, but rather that recall of a past state is actually distorted to conform with aspects of the retrieval environment.

The study of retrospective biases in memory for mood states does not, however, provide unambiguous evidence for the influence of the retrieval environment on recall of emotional information. In these studies, past mood states are typically verified using journals or questionnaires, and current moods are compared with these records weeks or months later. It is possible that subjects have recalled, and possibly recoded, memories of past moods during the interval between initial mood recording and the subsequent memory test. Thus the retrieval environment present at test may not be the only retrieval context to have influenced memory of the mood in question. Furthermore, because moods are (by definition) diffuse, objectless, affective states, it is difficult to specify the exact nature of the affective information in either the memory trace or the current retrieval environment that could interact during the retrieval process (cf. Blaney, 1986).

These problems can be circumvented by testing memory for stimuli with known affective quality and strength under controlled presentation and test procedures. We devised a method fitting this description that examines memory for vocal affect, or emotion conveyed through tone of voice. In this paradigm, subjects first viewed photographs of faces while simultaneously listening to the pictured person uttering a semantically neutral sentence in a tone that conveyed positive or negative affect. The pictured faces were chosen to have either subtly positive, subtly negative, or neutral expressions that contained no clear positive or negative affective cues. We chose these stimuli because it is known that nonverbal affective cues like tone of voice and facial expression can have a powerful impact on perception and attitudes (e.g. Rosenthal et al., 1979; Siegman & Feldman, 1987), although little is known about how nonverbal cues are remembered or might be able to bias memory.

After a brief delay, an explicit cued-recall test was given. Subjects saw brief presentations of the faces and were asked to recall the tone of voice in which the pictured person had spoken. If recall of vocal affect can be biased by the affect present in the face at retrieval, then subjects should sometimes mistakenly recall the tone of voice in conformity with the affect present in the tested face. In other words, we sought to determine if seeing faces with subtle positive or negative affect could lead subjects to believe that the pictured person had spoken earlier with a similar affective tone of voice.

In addition, we also designed a task to tap implicit memory (Roediger & McDermott, 1993; Schacter, 1987) for vocal affect. It is possible that biasing effects could be observed on an implicit task that are similar to those observed on the explicit one. In this implicit task, subjects decided how much they liked or disliked the pictured person when they viewed a brief presentation of a face at test. It was hypothesised that prior pairing of neutral faces with positive or negative vocal affect would influence subjects' like/dislike judgements of them, but when faces conveyed affect, this information could influence liking judgements.

Three experiments were conducted to test these hypotheses. All experiments began with an encoding phase in which subjects heard and rated positive and negative sentences while viewing photographs of people who were identified as the speakers. This phase was followed by either implicit and explicit tests (Experiment 1), or just an explicit test (Experiments 2 and 3) of memory for the tone of voice in which the sentences were spoken previously.

EXPERIMENT 1

In this experiment we examined memory for vocal affect on implicit and explicit tests. During the encoding phase, while subjects listened to a sentence spoken in a positive or negative tone of voice, they simultaneously viewed a colour photograph of a person on a computer screen. Because visual cues tend to dominate perception of affect (Rosenthal et al., 1979; Siegman, 1987) when both visual and vocal affective cues are present simultaneously, as during this encoding task, two steps were taken to ensure that vocal affect was accurately and reliably encoded by subjects. First, the photographs that subjects viewed depicted faces whose expressions conveyed neither strong positive nor strong negative affect. Nevertheless, within a restricted range, pretest ratings indicated that the faces could still be classified into three groups: faces that were most positive, most negative, or neutral. Second, subjects used a 7-point scale to rate the degree of positive or negative affect conveyed by the tone of voice in which the sentence was spoken. This helped to ensure that subjects were perceiving the affective information for which memory would be assessed later. Comparison of ratings for positive and negative samples allows empirical verification that affect was perceived clearly.

To maximise perceptible affective and minimise possible semantic influences on memory, the spoken sentences all had affectively neutral semantic content (e.g. ''We saw the cook'') and conveyed affect only through the tone in which they were spoken. Tone of voice is a strong cue to affect regardless of semantic content, and vocal affect may exert a more powerful influence on perception of affect than the semantic content of what is said (e.g. Goldbeck, Tolkmitt, & Scherer, 1988), even when semantic content is absent or unintelligible (Rosenthal et al., 1979).

On the implicit test, subjects viewed brief presentations of faces from the exposure phase, together with some new faces, and rated the extent to which they liked or disliked the person shown in each photograph. Implicit memory for tone of voice would be revealed by subjects' tendency to like persons who had spoken previously in a positive tone of voice, and to dislike persons who had spoken previously in a negative tone of voice. On the explicit task that followed immediately after the implicit task, subjects again saw brief presentations of faces and were asked to recall the tone of voice in which each person had spoken during the exposure phase.

Method

Materials. Photographs of 24 male and 24 female faces were selected from a set of faces normed for degree of emotional expression. None of the faces was characterised by a posed expression (i.e. none were smiling, frowning, etc.). However, on the basis of pretest ratings of emotional expression, these faces could be classified into three groups: one third that were most positive (POS), one third that were more negative (NEG), and one third whose ratings fell between the two extremes and could be considered neutral (NEU).[1]

Recordings of 24 different sentences were then selected also on the basis of pretest ratings of emotional expression.[2] The vocal affective tone of 12 sentences was clearly positive, and the vocal affective tone of 12 sentences was clearly negative. Each recording consisted of a simple first-person subject–verb–object sentence with the subject noun and verb selected to have average affective valence and intensity based on the Brown and Ure norms (1969). This ensured that the sentences had neutral semantic content. Half of the sentences were spoken by a male voice and half were spoken by a female voice.

Design. The 48 photographs were divided into four sets of 12: two sets of male faces and two sets of female faces. Each group was equated for degree of emotional expression. For the encoding task, the 12 male and 12 female voices were paired with each of the two sets of 12 male and 12 female faces, for a total of four face–voice combinations. The voice paired with each face did not always

[1] For these faces, pretest ratings of different stimulus dimensions were highly correlated: valence of facial expression was strongly correlated with subjects' ratings of their own emotional reaction to each face, $r(47) = .95$, $P = .01$, and also with ratings of attractiveness, $r(47) = .94$, $P = .01$; subjects' own reaction was also correlated with attractiveness, $r(47) = .89$, $P = .01$. The dimension of valence (from POS to NEG) was used to select these faces from a larger set for inclusion in the study. More details concerning selection and norming of stimuli are available on request.

[2] Pretest ratings indicated that for male voices, the mean rating for positive items was 5.71 and for negative items 2.54. For female voices, the mean for positive items was 5.6 and for negative items 2.25.

come from the same person, although they were always of the same sex.[3] Within each of these four combinations, pretest ratings of positive/negative affect for the faces and voice samples were uncorrelated—average $r(24) = .0015$, $P > .5$ across all sets. Thus, the affective valence of the face could not serve as a reliable cue for recalling the affective valence of the voice. For each of the four sets, two different random presentation orders (the second the reverse of the first) were created, for a total of eight different possible presentation sets of stimuli. One-half of the subjects saw each face–voice pairing only once. The other half saw each pairing three times; for this group the stimuli were shown three times successively in the same order.

For the implicit test, all 24 faces seen during encoding were presented, and the 24 faces not seen during encoding served as non-studied items. For the explicit test, the same 48 stimuli from the implicit test were presented in a random order. The orders for these stimuli were created in the same fashion as for the implicit test.

Stimulus presentation and data collection was controlled by the program Hypercard running on Macintosh IIci computers.

Subjects. A total of 16 male and 16 female undergraduate students at Brown University received six dollars for their participation. All subjects were right-handed and between 17 and 21 years of age.

Procedure. Subjects were tested in groups ranging from four to eight in experimental sessions lasting approximately 45 minutes. Before completing the tasks in individual testing booths, all subjects received brief instructions explaining the general nature of the experiments simultaneously in a central room. Subjects sat with their eyes approximately 60cm from the computer screen and completed three tasks in succession: encoding followed by implicit and explicit tests of memory. The instructions were presented on the computer screen as part of the task program and allowed subjects to familiarise themselves with each task by repeating a single practice trial as many times as they wished.

During the encoding task, subjects were instructed to wear headphones and were told that they would hear people speaking sentences while viewing photographs of the speakers' faces. Their task was to rate on a 7-point scale the degree of positive/negative expression conveyed by each voice sample. Each face was presented for five seconds, and the sentences began playing as soon as the face appeared on the screen. Sentences lasted an average of three seconds. After the face disappeared, subjects rated the affective tone of the sentence using

[3] This was done because we wanted to use the best exemplars of positive and negative vocal affect, and the most neutral faces, and these samples did not always come from the same person.

the number keys from 1 (labelled *Very Negative*) to 7 (labelled *Very Positive*) at the top of the keyboard. The next trial began one second after subjects indicated their responses.

During the implicit test, subjects were told that the task was about perception of people in photographs and that they would see photographs of faces presented briefly on the screen. Their task was to decide if they liked or disliked the person whose photograph they had just seen, responding as quickly as possible with their first impression. Faces were presented for 50 milliseconds and responses were indicated by pressing keys labelled as *LIKE* or *DISLIKE*. Key placement was counterbalanced across subjects and responses were always made with the right hand. Trials were separated by a one-second interval.

During the explicit task, subjects were instructed that they would view faces that they had seen previously, and that their task was to recall the positive or negative emotional tone of the sentence spoken by each pictured person during the first task. After making the positive/negative recall response, a 7-point scale with the endpoints labelled *Low Confidence* (1) and *High Confidence* (7) appeared on the screen and disappeared when subjects made their response. Subjects used this scale to rate how confident they were that each response was correct. The next trial began one second after completion of the confidence rating. Non-studied items from the implicit test were included so that the design of implicit and explicit tasks would be identical. These items also allowed the additional opportunity to examine how subjects would respond to items that had not appeared during the encoding phase. Presentation conditions and key placement were identical to that for the implicit test, with the exception that response keys were now labelled *Positive* and *Negative*.

After completing the explicit task, subjects filled out debriefing questionnaires that assessed compliance with instructions, use of particular strategies, and thoughts about the purpose of the tasks.

Results

All statistical tests were two-tailed unless otherwise noted.

Explicit Task. To determine whether the recall bias occurred, the percentage of positive responses to studied items were submitted first to a mixed factors ANOVA with exposure frequency (1 vs. 3) as a between-subjects factor and valence of face and valence of voice as within-subject factors. The results of this analysis are depicted in Table 2. Critically, the proportion of positive recall responses increased linearly as a function of the valence of the facial expression, $F(1,60) = 16.0$, $P = .0002$. Thus, the vocal affect that subjects ''recalled'' tended to correspond to the affect in the face presented as a retrieval cue. A significant face × voice interaction, $F(1,60) = 11.16$, $P = .0001$, indicated that this effect was strongest for stimulus persons that had spoken with negative vocal affect.[4]

A marginally significant face × exposure frequency interaction, $F(2,60) = 2.32$, $P = .10$, suggested that the recall bias might differ across exposure frequencies. Therefore, separate analyses were conducted on the data from each exposure group to determine if the recall bias was present after both one and three study exposures. Planned contrasts indicated that the bias was weakly present after a single exposure, $F(1,30) = 3.58$, $P = .068$, but was quite robust after three exposures, $F(1,30) = 12.8$, $P = .001$.

This finding is interesting because, as can be seen in Table 3, recall was more accurate after three exposures than after one exposure, $t(30) = 4.04$, $P = .0003$. In fact, mean recall was at chance after one exposure, $t(15) = 1.75$, $P = .10$, and rose significantly above chance only after three exposures, $t(15) = 3.97$, $P = .001$. Accurate recall was achieved only for NEU, $t(15) = 1.75$, $P = .10$, and NEG, $t(15) = 1.75$, $P = .10$, faces, however. Collapsing across exposure frequency, accuracy was at chance, $t(31) = 1.12$, $P = .22$. Thus the recall bias became larger as recall accuracy increased, which suggests that the bias is not simply a product of guessing when memory is poor.

It is also interesting to examine how subjects attributed memory for vocal affect to non-studied faces that did not appear during the encoding phase. A second ANOVA compared proportion of positive responses for studied and non-studied stimuli, with exposure frequency as a between-subjects factor and valence of face and type of stimulus as within-subject factors. As for studied items, proportion of positive responses to non-studied faces increased linearly as a function of the valence of the facial expression, $F(1,60) = 7.89$, $P = .007$, and this effect did not differ as a function of exposure frequency, $F(1,60) < 1$.

Interestingly, on the debriefing questionnaire none of the subjects noted that they had been asked to recall tone of voice for faces that had appeared the first time as new items on the implicit task, and had not appeared during the encoding task. All subjects reported that they followed instructions and did not adopt a specific response strategy to perform the task.

Confidence Ratings.[5] Examination of confidence ratings for studied items showed that subjects were more confident in correct ($M = 4.63$) than in incorrect ($M = 3.95$) responses, $t(21) = 2.91$, $P = .008$, and were even less confident in

[4]This interaction is of uncertain importance for the memory bias, given that it occurs only in Experiment 1 and not in Experiments 2 and 3, and that the bias is present in all three experiments. It is possible that something about the presence of the implicit task leads to this effect on the explicit task.

[5]Unfortunately, confidence ratings for 10 subjects (4 from the three-exposure group, 6 from the one-exposure group) were lost due to a computer error. All confidence results from Experiment 1 thus have *df* different from the other analyses from this experiment.

responses to non-studied items, $M = 3.49$, $t(21) = 4.64$, $P = .0001$ compared to correct, and $t(21) = 2.29$, $P = .033$, compared to incorrect responses. Data for correct and incorrect responses are shown in Fig. 1. These data indicate that, in general, confidence tracked accuracy of recall. Indeed, confidence was greatest for correct responses to NEU ($M = 5.29$) and NEG ($M = 4.70$) faces studied three times, for which recall accuracy was greatest, and was least for incorrect responses to these same NEU ($M = 4.32$) and NEG ($M = 3.50$) faces. Exposure frequency did not influence confidence ratings, $t(21) < 1$.

Encoding Task. It is possible that one reason why subjects' memories were poor was that they were not able to perceive clearly the affect present in the voice sample at study. To test this hypothesis and to further determine whether subjects' encoding ratings of voice samples were influenced by their pairing with faces, we conducted a $2 \times 2 \times 3$, mixed factors ANOVA with exposure frequency (1 vs. 3) as a between-subjects factor and valence of voice and valence of facial expression as within-subject factors. This analysis indicated that positive voice samples were rated significantly more positively ($M = 5.20$) than were negative ($M = 2.28$) samples, $F(1,30) = 157.3$, $P = .0001$, verifying that subjects were able to differentiate them.

In addition, facial affect had a linear effect on ratings of vocal affect, $F(1,30) = 48.34$, $P = .0001$, with voice samples paired with positive faces being rated most positively ($M = 3.97$), samples paired with neutral faces rated slightly less so ($M = 3.80$), and samples paired with negative faces rated least positively ($M = 3.47$). This effect did not interact with the effect of tone of voice, and no other effects were significant. On the debriefing sheets no subjects noted a relationship between facial affect and vocal affect, and none noted that such relationships bore any relation to the purpose of the experiment.

Implicit Task. Data from the implicit task were subjected to the same analyses as we conducted for the explicit recall task. First, to determine whether liking ratings of studied items were influenced by prior pairing with valenced voice samples, percentage of like responses were submitted to a $2 \times 2 \times 3$, mixed factors ANOVA with exposure frequency (1 vs. 3) as a between-subjects factor and valence of voice and valence of facial expression as within-subject factors. Overall, the affective valence of the voice did not influence like/dislike judgements for faces, $F(2,60) = 3.11$, $P = .080$, suggesting that memory for tone of voice did not implicitly influence like judgements. However, as shown in Table 1, percentage of like/dislike responses did vary significantly as a function of the affective valence of the face, $F(2,60) = 12.45$, $P = .0001$, and the nature of this effect depended on the affective valence of the voice sample, $F(2,60) = 5.63$, $P = .006$. Planned contrasts revealed that vocal affect influenced the proportion of like responses for NEU, $F(1,60) = 8.52$, $P = .005$, but not for POS or NEG

TABLE 1
Proportion of Like Responses on Implicit Task in Experiment 1 as a Function of Facial Affect, Exposure Frequency, and Type of Stimulus

Exps		*POS*	*NEU*	*NEG*	*x*
Studied	1	.65	.56	.48	.56
	3	.56	.43	.38	.46
	x	.61	.50	.43	.51
Non-studied	1	.70	.55	.41	.55
	3	.56	.45	.55	.52
	x	.63	.50	.48	.54

The values represent the percentage of faces given like responses. Exps = exposures; POS = positive faces; NEU = neutral faces; NEG = negative faces.

faces—for both $F(1,60) = 2.78$, $P = .10$. Thus memory for vocal affect influenced like responses only for neutral faces.

In contrast, for POS and NEG faces, like responses tended to be influenced more by the affect present in the face during retrieval than by the affect present in tone of voice during encoding: proportion of like responses increased linearly as a function of the valence of the facial expression—planned $F(1,60) = 18.7$, $P = .0001$, and see Table 1. Thus, when the facial expression was POS, more like responses were made, but when the facial expression was NEG, more dislike responses were made, which is analogous to the memory bias observed on the explicit recall task. In addition, subjects tended to give more like responses after one ($M = 0.56$) than after three ($M = 0.46$) exposures, $F(1,30) = 5.56$, $P = 0.25$.[6]

Subjects rated non-studied items in the same fashion. A second ANOVA comparing the proportion of like responses for both studied and non-studied stimuli indicated that percentage of like responses to non-studied faces followed a linear trend—planned $F(1,60) = 45.4$, $P = .0001$—that did not differ from that found for studied faces—interaction $F(2,60) < 1$. A significant interaction of exposure frequency, type of stimulus, and valence of facial expression, $F(1,60) = 5.46$, $P = .007$, indicated that in the three-exposure group like responses for non-studied items did not conform as strongly to this linear trend.

On the debriefing sheet, only three subjects noted that some faces seen on the implicit task had appeared on the encoding task. None of these subjects reported that this knowledge influenced their responses. All subjects indicated that they had followed instructions to respond with their first impression of the pictured persons.

[6]It is not immediately clear why fewer like responses were given after three exposures than after one exposure; this main effect did not interact with subjects' tendency to give more like responses as a function of increasing positive facial affect, $F(1,30) < 1$, and therefore seems secondary to consideration of the other findings from this task.

Discussion

Two main findings emerged from Experiment 1. First, recall of vocal affect was biased by the affect present in a photograph of a face presented as a retrieval cue. Subjects tended to recall that a pictured person had spoken in a positive tone when provided with a positive face as a retrieval cue, whereas they tended to recall that the stimulus person had spoken in a negative tone when presented with a negative face as a retrieval cue. Second, on the implicit task, memory for tone of voice influenced liking judgements, but only for neutral faces.

Although these results seem to indicate an interesting and possibly important kind of memory illusion, there are two aspects of this experiment that make the recall bias difficult to interpret. First, the recall bias shown on the explicit task mirrored the pattern of like/dislike judgements given to faces on the preceding implicit task. It is possible that the strategy subjects adopted to perform liking ratings (which showed a linear relationship to facial affect) could have carried over to the explicit task. On the implicit task, although subjects were not told that the faces were subtly positive or negative, in performing the task they may have found whatever subtle affective cues were available and used them as a basis for responding. Subtle variations in the expression of faces are known to influence judgements of them, so it is possible that such cues could have been used by subjects (Niedenthal & Cantor, 1986; Ziebrowitz, Olson, & Hoffman, 1993). Thus subjects may have adopted a strategy in which they relied on perceptual rather than memorial cues to guide task performance, and if the implicit task attuned subjects to detect cues to facial affect, this strategy may have carried over to the explicit task, thereby producing the apparent recall bias. In short, it is important to determine if the bias is present when no implicit task is given.

The second aspect of Experiment 1 relevant to interpretation of the recall bias is related to the first. Memory for vocal affect was at or near chance levels for faces with subtle positive and negative expressions, and in the absence of a strong memory, subjects may have used facial affect as a guide for guessing, regardless of whether or not this strategy carried over from the implicit ask. If this interpretation is correct, it could mean that the recall bias is not attributable to a retrieval process or mechanism, but instead may reflect a perceptual judgement or guessing strategy that subjects adopt when memory is poor.

Three factors that could have produced poor memory should be considered. One factor that could influence recall accuracy is whether or not subjects perceived the positive or negative affect conveyed in the sentences presented during encoding: if they did not encode this information, it could not be available for recall later. This possibility seems unlikely, however, because ratings of positive and negative affect differed by more than two standard deviations, which is strong evidence that subjects encoded vocal affect at study.

Second, as noted earlier, the mere presence of the implicit task could have influenced subsequent recall on the explicit task, so it is important to determine if the bias is present when no implicit task is given.

The third factor that could have influenced accuracy and the recall bias is the design of the explicit task. The explicit task was constructed to parallel the implicit test, which necessarily included nonstudied items to provide a performance baseline. The nonstudied items from the implicit test thus appeared subsequently on the explicit test, and subjects were asked to ''recall'' tone of voice in response to these items that had not been presented during the encoding task. In a sense, this feature of the design required subjects to confabulate recall responses for these items. In making these confabulatory responses they could have adopted a response criterion based on affect present in the face, which was the only affective information available. This criterion could have been used for studied faces as well, thereby producing the apparent recall bias.

The fact that the proportion of positive recall responses increased linearly as a function of positive facial affect for both old and new faces suggests that this may have been the case. However, the fact that subjects exhibited lower confidence in responses for these nonstudied items indicates that subjects were aware of some difference in recall responses for old as compared to new items. Moreover, subjects were more confident in their correct than in their incorrect responses, which suggests that they were, in fact, attempting to recall vocal affect. In addition, in their debriefing comments no subjects noted the presence of new items on the explicit test, suggesting that they did not adopt a conscious response strategy for those items. Nevertheless, these data do not rule out a possible explanation of our results in terms of an affect-based, perceptual judgement strategy, rather than in terms of a true retrieval bias. In Experiment 2 we attempt to address this point by eliminating nonstudied items.

EXPERIMENT 2

In order to replicate the results of Experiment 1, and rule out the possibility that either the presence of the implicit task or the generation of recall responses to nonstudied faces influenced responses to studied faces, a second experiment was conducted that was identical to Experiment 1 with two exceptions: (1) after completing the encoding phase, subjects completed the recall task for studied items only, and (2) no implicit test was given. If the recall results in Experiment 1 are attributable to a retrieval strategy induced by producing ''confabulatory'' recall responses for new items, then we should no longer observe the recall bias when only old items are present during recall. However, if the biased recall of Experiment 1 is not attributable to use of this strategy, then the recall bias should remain unchanged.

Method

Materials. The stimuli were identical to those used in Experiment 1.

Subjects. A total of 32 male and 32 female undergraduate students at Brown University participated in return for six dollars. All subjects were right-handed and between 17 and 21 years of age.

Design. The design was identical to that used in Experiment 1 with the exception that only items that appeared in the encoding task appeared on the recall task.

Procedure. The procedure was identical to that used in Experiment 1 with the exception that there was no implicit test.

Results

Explicit Recall. An ANOVA on the percentage of positive recall responses yielded two important results that replicate those of Experiment 1. First, recall of vocal affect was influenced by facial affect, $F(2,122) = 5.53$, $P = .005$. Planned contrasts revealed that the percentage of positive responses increased linearly as a function valence of facial affect, $F(1,122) = 9.96$, $P = .002$, i.e. when the face was POS or NEG subjects tended to recall the voice as having conveyed similar affect (see Table 2). Second, this effect did not vary as a function of exposure frequency, $F(2,122) = 1.93$, $P = .15$.

Eliminating both nonstudied items and the implicit task did enhance overall recall accuracy, as shown in Table 3. Overall, mean accuracy was above chance,

TABLE 2
Proportion of Positive Responses in Explicit Recall Task in Experiments 1, 2, and 3 as a Function of Facial Affect, Exposure Frequency, and Type of Stimulus

	Experiment 1				*Experiment 2*				*Experiment 3*			
Exps	*POS*	*NEU*	*NEG*	*x*	*POS*	*NEU*	*NEG*	*x*	*POS*	*NEU*	*NEG*	*x*
Studied												
1	.50	.48	.40	.46	.56	.45	.40	.47				
3	.71	.51	.50	.57	.59	.52	.46	.52	.55	.48	.41	
x	.61	.50	.45	.52	.58	.48	.43	.50	.55	.48	.41	.48
Non-studied												
1	.60	.52	.46	.53								
3	.61	.56	.53	.57								
x	.61	.54	.50	.55								

The values represent how often a subject recalled a person as having spoken with a positive affective tone. Exps = exposures; POS = positive faces; NEU = neutral faces; NEG = negative faces.

TABLE 3
Recall Accuracy in Experiments 1, 2, and 3 as a Function of Facial Affect and Exposure Frequency

	Experiment 1				*Experiment 2*				*Experiment 3*			
Exps	*POS*	*NEU*	*NEG*	*x*	*POS*	*NEU*	*NEG*	*x*	*POS*	*NEU*	*NEG*	*x*
1	.36	.48	.54	.46	.50	.56	.44	.50				
3	.49	.65	.64	.59	.56	.68	.61	.61	.65	.68	.68	.66
x	.43	.56	.59	.53	.53	.62	.53	.56	.65	.68	.68	.66

The values represent mean percentage of time subjects correctly recalled the affective valence of the voice sample heard during encoding. Exps = exposures; POS = positive faces; NEU = neutral faces; NEG = negative faces.

$t(63) = 3.44$, $P = .001$. But this improvement was attributable almost entirely to NEU, $t(31) = 6.44$, $P = .0001$, and NEG, $t(31) = 2.90$, $P = .007$, faces seen three times at study. For items seen once, recall accuracy exceeded chance only for NEG faces, $t(63) = 2.18$, $P = .04$, although accuracy approached significance for NEU faces seen once, $t(63) = 1.85$, $P = .075$. This explains why, when collapsing across exposure frequency, memory was well above chance for NEU faces, $t(63) = 5.22$, $P = .0001$, but not for POS $t(63) = 1.16$, $P = .25$, or NEG faces $t(63) = 5.22$, $P = .0001$. It also explains why, when collapsing across facial affect, recall accuracy was greater after three than after one exposure, $t(63) = 3.47$, $P = .0009$, and was above chance after three exposures, $t(31) = 4.39$, $P = .0001$ but not after one exposure, $t(31) < 1$. Thus, although recall accuracy was correlated with exposure frequency, the recall bias was not.

Debriefing sheets indicated that subjects complied with task instructions and did not use any particular strategies for recalling vocal affect.

Confidence Ratings. As in Experiment 1, subjects were more confident in correct ($M = 4.49$) than in incorrect ($M = 3.96$) responses, $t(63) = 4.25$, $P = .0001$. In addition, as can be seen in Fig. 1, there was a trend for confidence in correct responses to be greater after three exposures ($M = 4.75$) than after one ($M = 4.22$) exposure, $t(31) = 1.61$, $P = .12$, whereas confidence in incorrect responses did not differ across exposure frequency—three: $M = 3.95$, one: $M = 3.94$, $t(63) < 1$. Thus, in keeping with the results of Experiment 1, confidence tracked accuracy of recall: confidence was greatest for correct responses to NEU ($M = 4.88$) and NEG ($M = 4.78$) faces studied three times, for which recall accuracy was greatest, and was least for incorrect responses to these same NEU ($M = 4.18$) and NEG ($M = 3.43$) faces.

Encoding Task. Subjects' encoding ratings of voice samples were submitted to the same analyses as in Experiment 1. These analyses indicated that positive voice samples were rated significantly more positively ($M = 5.46$)

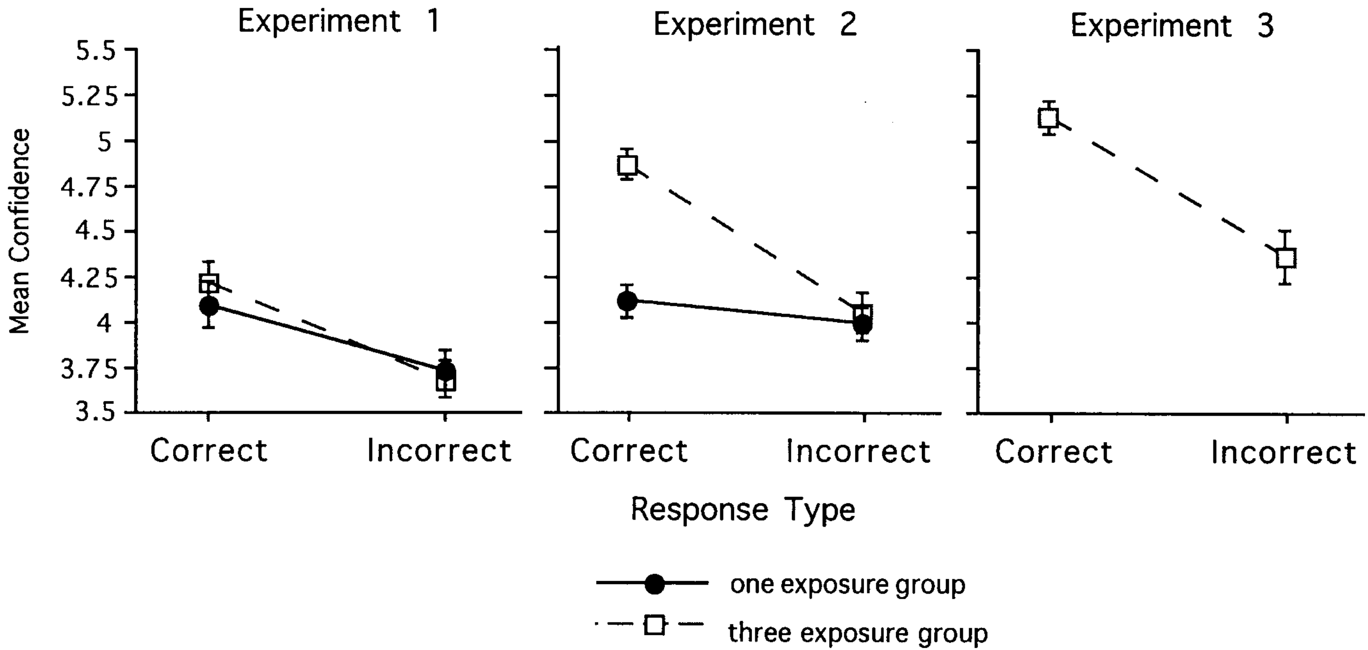

FIG. 1. Mean confidence in Experiments 1, 2, and 3 for correct and incorrect responses. In general, subjects were more confident in correct responses. Note that in Experiment 3 there was no single-exposure group.

than were negative ($M = 2.44$) samples, $F(1,62) = 872.6$, $P = .0001$, again verifying that subjects could differentiate positive and negative vocal affect during encoding.

Also like Experiment 1, facial affect had a linear effect on ratings of vocal affect, $F(1,124) = 40.8$, $P = .0001$. Voice samples paired with positive faces were rated most positively ($M = 4.09$), samples paired with neutral faces were rated barely less so ($M = 4.07$), and samples paired with negative faces were rated least positively ($M = 3.70$). No other effects were significant.

On the debriefing sheets no subjects noted a relationship between facial affect and vocal affect, and none noted that such relationships bore any relation to the purpose of the experiment.

Discussion

The results of Experiment 2 confirmed and extended the finding of Experiment 1 that when a retrieval cue conveys positive or negative affect subjects are likely to falsely recall the tone of voice in which that person spoke as conveying the same positive or negative affect present in the cue. Given that this bias occurred in the absence of a prior implicit task and without attempting to recall items that did not appear during encoding, it is reasonable to suggest that these false recollections represent a memory distortion and are not an artifact attributable to experimental procedure.

However, the fact that recall accuracy still hovered near chance in this experiment poses a problem for the conclusion that we have found a novel form of memory bias. If recall in some conditions is at or near chance levels, it is difficult to be certain that performance reflects the operation of a memory mechanism rather than the use of a judgement strategy driven by perceptual cues. To distinguish between these two competing explanations we conducted a third experiment in which we attempted to boost explicit memory above chance levels in all conditions by reducing the number of studied items by 50%. If this manipulation succeeds in boosting memory performance above chance levels, and if the bias is still observed, then we can conclude that the bias is attributable to operation of a memory mechanism and not a judgement strategy.

EXPERIMENT 3

Experiment 3 was identical to Experiment 2 in all but two respects: (1) the number of items studied was reduced by 50%, and (2) there was no single exposure group—all subjects received three study exposures. If memory is above chance in all conditions of the present experiment, and the recall results in Experiments 1 and 2 are attributable to a retrieval strategy adopted when memory is at or near chance, we should no longer observe that recall accuracy or proportion of positive responses varies as a function of the affect of the facial retrieval cue. However, if the biased recall of Experiments 1 and 2 is not attributable to use of this strategy, then even with recall boosted above chance levels by reducing the size of the study set, the memory bias should remain robust.

Method

Materials. The stimuli were identical to those used in Experiment 1.

Subjects. A total of 20 male and 20 female undergraduate students at Brown University participated in return for six dollars. All subjects were right-handed and between 17 and 21 years of age.

Design. The design was identical to that used in Experiment 2 with the exception that only 12 face–voice sample stimuli appeared during the encoding and test phases. The 24 stimuli used in Experiments 1 and 2 were divided into two subsets of 12 stimuli each. These subsets were balanced for number of male and female faces and were matched for the number of positive, neutral, and negative faces and the degree of expression in each category. Two different combinations of faces and voice samples were created for each subset, and each combination was presented in one of two random orders, for a total of four different presentation orders for each subset, or eight total possible presentation orders.

A corresponding set of eight test lists were created for the explicit test. On the explicit test, each list contained only the 12 studied items that had appeared during encoding.

Procedure. The procedure was identical to that used in Experiment 2.

Results and Discussion

Explicit Recall. Two results are of critical interest: the presence of the recall bias and the level of recall accuracy. First, as shown in Table 2, an ANOVA on the percentage of positive recall responses indicated that recall of vocal affect was influenced by facial affect, $F(2,78) = 3.41$, $P = .04$, and a planned contrast revealed that percentage of positive responses increased linearly as a function of valence of facial affect, $F(1,78) = 6.81$, $P = .01$, replicating the results of Experiments 1 and 2.

Second, as can be seen in Table 3, overall recall accuracy was well above chance, $t(39) = 6.03$, $P = .0001$, and was, in fact, well above chance for POS $t(39) = 3.44$, $P = .001$, NEU $t(39) = 5.85$, $P = .0001$, and NEG faces $t(39) = 4.72$, $P = .04$. In addition, unlike Experiments 1 and 2, level of recall did not differ among face types (all ts < 1).

Debriefing sheets indicated that subjects complied with task instructions and did not use any particular strategies for recalling vocal affect.

Confidence Ratings. Subjects once again were more confident in correct ($M = 5.06$) than in incorrect ($M = 3.45$) responses, $t(39) = 5.52$, $P = .0001$ (see Fig. 1). In addition, subjects tended to be more confident in correct responses to NEU faces ($M = 5.31$) than in responses to POS faces ($M = 5.12$), and were in turn least confident in responses to NEG faces ($M = 4.76$). It is interesting to note that unlike Experiments 1 and 2, confidence did not track accuracy because accuracy did not differ as a function of facial affect.

Encoding Task. Encoding ratings of voice samples were submitted to the same analyses as in Experiments 1 and 2, and results conformed to the results of those experiments. Subjects clearly differentiated positive ($M = 5.50$) and negative ($M = 2.16$) voice samples, $F(1,39) = 1191.5$, $P = .0001$. Facial affect had a linear effect on ratings of vocal affect, $F(1,39) = 12.7$, $P = .0004$, although this effect was of slightly smaller magnitude than in Experiments 1 and 2. Voice samples paired with positive faces were rated most positively ($M = 3.93$), samples paired with neutral faces were given nearly identical ratings ($M = 3.90$), and samples paired with negative faces were rated slightly less positively overall ($M = 3.67$). No other effects were significant.

On the debriefing sheets no subjects noted a relationship between facial affect and vocal affect, and none noted that such relationships bore any relation to the purpose of the experiment.

In summary, the results of Experiment 3 demonstrate that the memory bias in Experiments 1 and 2 is attributable to a retrieval mechanism and not a perceptually based guessing strategy; recall accuracy was above chance in all conditions and the bias was still observed.

GENERAL DISCUSSION

The present experiments demonstrate that explicit recall of vocal affect may be subject to systematic distortions determined by the affective valence of a retrieval cue. In addition, they reveal that under certain conditions memory for vocal affect can influence like/dislike judgements on an implicit memory task. On the explicit task, when cued to recall vocal affect with a photograph of the speaker's face, subjects were likely to report the affective tone present in the face cue itself. If the facial expression was positive, a positive tone of voice was often recalled, and if the facial expression was negative, a negative tone of voice was often recalled. This pattern was observed both when (a) an implicit task preceded recall and subjects were forced to recall tone of voice for items they had not studied, and (b) when recall took place immediately after encoding and only memory for these encoded items was probed. Although chances of detecting the recall bias necessarily decrease as accuracy improves (the size of the bias depends in part on the number and pattern of errors), in Experiments 2 and 3 repeated exposure to differing numbers of face–voice stimuli did not alter the size of the bias, even though it did improve accuracy (see Tables 2 and 3). Critically, the bias was observed in Experiment 3, when recall accuracy was equivalent across conditions, and well above chance for faces of all affective valence. Together, these findings militate against interpretations of the memory bias in terms of either carry-over effects from an implicit task or a guessing strategy employed when memory is poor.

Analysis of confidence ratings provided converging evidence in favour of this conclusion. In all experiments subjects were more confident when they responded correctly than when they made errors, which suggests that subjects were attempting to recall vocal affect as instructed, and were not merely guessing. Nonetheless, it could be argued that the confidence scale used here provides a somewhat indirect and non-specific index of subjective awareness of aspects of subjects' recall. A measure that allows more direct assessment of the nature of subjective knowledge about performance could provide additional information on this issue. One possibility would be to use the remember/know judgement employed extensively by Gardiner and colleagues (e.g. Gardiner & Java, 1991; Tulving, 1985), which could indicate whether or not the memory bias is accompanied by a feeling of experiential memory or just a feeling that subjects know the event took place. This represents an important direction for future studies.

The finding that recall of vocal affect may be driven by the affect present in a valenced retrieval cue is predicted by Tulving's (1983) synergistic ecphory model of episodic memory retrieval. This theory posits that during retrieval, cue and trace information synergistically combine, and that the joint product of this interaction becomes the content of conscious recollection. In the present example, illusory recall takes place when memory for vocal affect interacts with incoming information about the affective valence of the face cue; when facial affect is present it dominates the ecphoric process and drives responding, but when facial affect is absent, memory for vocal affect drives responding. As discussed in the introduction, affective recall biases of this same general form have been reported previously, and they too fit the synergistic ecphory account. A common finding is that a person's current mood, which can be considered an aspect of the retrieval environment, biases memory for past mood states (Eich et al., 1985; Thomas & Diener, 1990). The present experiments extend these findings by demonstrating that specific affective retrieval cues, rather than diffuse moods, can bias memory under conditions in which the encoding and retrieval of affective information is tightly controlled.

The recall bias reported here may be a memory analog of a perceptual phenomenon reported by Rosenthal et al. (1979). These researchers found that when vocal and facial affect are present simultaneously, perception of overall affective tone is dominated by the facial cues; the present experiments show that this phenomenon can occur in memory as well. It seems that even though affect conveyed through tone of voice can reliably communicate many different types of information, including emotional state and individual traits or personality characteristics (e.g. Goldbeck et al., 1988; Montpare & Ziebrowitz-MacArthur, 1987; Rosenthal et al., 1979; Siegman & Feldstein, 1987), affect conveyed through facial expression can be even more powerful and can lead to distortions of perception or memory (Ekman, 1982, 1993; Niedenthal & Cantor, 1986; Ziebrowitz et al., 1993).

One argument against a retrieval, or ecphory, account of the recall bias is that the face presented as a retrieval cue is the same one that appeared during encoding. It is possible that the face is a poor cue to memory for vocal affect, but is a good cue for memory of facial affect. Thus the retrieval information that appears to be biasing recollection may actually be a part of the memory itself, which implies that memory of the face could be the crucial factor that leads one to ascribe positive vocal affect to an affectively positive face. However, this possibility seems very unlikely for two reasons. First, in Experiment 1, the tendency to recall vocal affect as congruent with facial affect was found for both studied and nonstudied faces. This finding indicates that subjects were sensitive to the valence of the facial expression at time of test, and this affect was available to drive responses. Second, in Experiment 2, and to a lesser extent in Experiment 1, the recall bias was not greater after three exposures than after one exposure, which would be expected if memory for the face, rather than perception of it at test, were driving task performance. Nevertheless, it is possible that both memory for facial affect and affective information encoded at retrieval contribute to the recall bias; future experiments that vary the affect present in the face between encoding and test will allow disentanglement of these possibilities.

Another major finding of Experiment 1 was that on an implicit task, like/dislike judgements about a stimulus person were influenced by the tone of voice in which that person spoke previously, but only when that judgement was based on an affectively neutral face. Apparently, when the face conveyed positive or negative affect, subjects made their decisions based on this information. Other researchers have reported that pairing of neutral stimuli with affectively toned stimuli can bias subsequent judgements of the neutral items without conscious deliberation or accessing of beliefs (Edwards, 1990; Krosnick, Betz, Jussim, & Lynn, 1992; Niedenthal, 1990; Zajonc, 1980). In the present experiments, similar biasing of judgements for affectively neutral faces may have occurred, whereas for affectively positive or negative faces, cues present in the faces themselves may have driven responses (Niedenthal & Cantor, 1986). Despite the similarity in results, it is difficult to be certain that subjects in Experiment 1 did not think back to the encoding phase when deciding if they liked a given stimulus person, thereby using explicit memory on a supposedly implicit test. There are some additional reasons, however, to believe that this task was performed implicitly, and thus in a different manner from the explicit task. First, implicit task instructions emphasised that subjects should respond as quickly as possible, and debriefing sheets indicated that subjects did not use recollection as a means of performing the like/dislike task. Second, for positive and negative faces, the relationship between like responses and facial affect was similar for studied and non-studied faces, suggesting that if recall took place it did not strongly influence subjects' responses to studied faces.

The possibility that aspects of the retrieval environment may be incorporated into the content of our recollections has important implications, both for our confidence in the veracity of everyday retrospections and for the accuracy of our judgements of people and events (Jacoby et al., 1989a,b; Loftus, 1979, 1991; Schacter, 1995, 1996). Perhaps most importantly, the present results indicate that when we attempt to recall information about people that we have met, the expression they wear currently may lead us to believe that they conveyed the same affective information to us in the past. Current understanding of the mechanisms underlying affective memory and its distortion is still quite poor, however, and we are only beginning to understand the nature and scope of the problems involved (Christianson, 1992; Roediger, Wheeler, & Rajaram, 1992; Schacter, 1995, 1996). The methods and results of the present experiments provide a starting point for further research into the mechanisms underlying distorted recall of affective information.

Manuscript received 19 August 1994
Manuscript accepted 16 May 1996

REFERENCES

Blaney, P.H. (1986). Affect and memory: A review. *Psychological Bulletin*, *99*, 229–246.

Brown, W.P., & Ure, D.M.J. (1969). Five rated characteristics of 650 word association stimuli. *British Journal of Psychology*, *60*(2), 223–249.

Ceci, S.J. (1995). False beliefs: some developmental and clinical considerations. In D.L. Schacter (Ed.), *Memory distortion*. Cambridge, MA: MIT Press.

Ceci, S.J., & Bruck, M. (1993). The suggestibility of the child witness: A historical review and synthesis. *Psychological Bulletin*, *113*, 403–439.

Christianson, S.-A. (Ed.). (1992). *The handbook of emotion and memory: Research and theory*. Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Collins, L.N., Graham, J.W., Hansen, W.B., & Johnson, C.A. (1985). Agreement between retrospective accounts of substance use and earlier reported substance use. *Applied Psychological Measurement*, *9*, 301–309.

Conway, M., & Ross, M. (1984). Getting what you want by revising what you had. *Journal of Personality and Social Psychology*, *47*, 738–748.

Dawes, R.M. (1988). *Rational choice in an uncertain world*. San Diego: Harcourt, Brace, Jovanovich.

Edwards, K. (1990). The interplay of affect and cognition in attitude formation and change. *Journal of Personality and Social Psychology*, *59*, 202–216.

Eich, E., Reeves, J.L., Jaeger, B., & Graff-Radford, S.B. (1985). Memory for pain: Relation between past and present pain intensity. *Pain*, *23*, 375–379.

Ekman, P. (Ed.). (1982). *Emotion in the human face*. New York: Cambridge University Press.

Ekman, P. (1993). Facial expression and emotion. *American Psychologist*, *48*, 384–392.

Gardiner, J.M., & Java, R.I. (1991). Forgetting in recognition memory with and without recollective experience. *Memory and Cognition*, *19*(6), 617–624.

Goldbeck, T., Tolkmitt, F., & Scherer, K.R. (1988). Experimental studies on vocal affect communication. In K.R. Scherer (Ed.), *Facets of emotion: Recent research* (pp.119–137). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Hyman, I.E., Husband, T.H., & Billings, F.J. (1995). False memories of childhood experiences. *Applied Cognitive Psychology*, *9*, 181–197.

Jacoby, L.L., Kelley, C.M., Brown, J., & Jasechko, J. (1989a). Becoming famous overnight: Limits on the ability to avoid unconscious influences of the past. *Journal of Personality and Social Psychology*, *56*, 326–338.

Jacoby, L.L., Kelley, C.M., & Dywan, J. (1989b). Memory attributions. In H.L. Roediger III & F.I.M. Craik (Eds.), *Varieties of memory and consciousness: Essays in honour of Endel Tulving*. Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Krosnick, J.A., Betz, A.L., Jussim, L.J., & Lynn, A.R. (1992). Subliminal conditioning of attitudes. *Personality and Social Psychology Bulletin*, *18*(2), 152–162.

Lewinsohn, P.M., & Rosenbaum, M. (1987). Recall of parental behavior by acute depressives, remitted depressives, and nondepressives. *Journal of Personality and Social Psychology*, *52*, 203–212.

Lindsay, D.S. (1990). Misleading suggestions can impair eyewitnesses' ability to remember event details. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *16*, 1077–1083.

Loftus, E.F. (1979). *Eyewitness testimony*. Cambridge, MA: Harvard University Press.

Loftus, E.F. (1991). Made in memory: Distortions in recollection after misleading information. In G.H. Bower (Ed.), *The psychology of learning and motivation: Advances in research and theory, Vol. 27*. San Diego, CA: Academic Press.

Loftus, E.F., Feldman, J., & Dashiell, R. (1995). The reality of illusory memories. In D.L. Schacter (Ed.), *Memory distortion*. Cambridge, MA, MIT Press.

Loftus, E.F., & Pickrell, J. (1995). The formation of false memories. *Psychiatric Annals*, *25*, 720–725.

Marcus, G.B. (1986). Stability and change in political attitudes: Observe, recall, and ''explain''. *Political Behavior*, *8*, 21–44.

Montpare, J.M., & Ziebrowitz-MacArthur, L. (1987). Perception of adults with childlike voices in two cultures. *Journal of Experimental Social Psychology*, *23*, 331–349.

Niedenthal, P.A. (1990). Implicit perception of affective information. *Journal of Experimental Social Psychology*, *26*, 505–527.

Neidenthal, P.M., & Cantor, N. (1986). Affective responses as guides to category-based inferences. *Motivation and Emotion*, *10*, 217–232.

Reisberg, D., & Heuer, F. (1992). Remembering the details of emotional events. In E. Winograd & U. Neisser (Eds.), *Affect and accuracy in recall*. Cambridge, MA: Cambridge University Press.

Roediger, H.L. III, Wheeler, M.A., & Rajaram, S. (1992). Remembering, knowing and reconstructing the past. In D.L. Medin (Ed.), *The psychology of learning and motivation: Advances in research and theory*. New York: Academic Press.

Roediger, H.L.I., & McDermott, K.B. (1993). Implicit memory in normal human subjects. In H. Spinnler & F. Boller (Eds.), *Handbook of neuropsychology*. Amsterdam: Elsevier.

Rosenthal, R., Hall, J.A., DiMatteo, M.R., Rogers, P.L., & Archer, D. (1979). *Sensitivity to nonverbal communication: The PONS test*. Baltimore, MD: The Johns Hopkins University Press.

Ross, M. (1989). Relation of implicit theories to the construction of personal histories. *Psychological Review*, *96*, 341–357.

Schacter, D.L. (1987). Implicit memory: History and current status. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *13*, 501–518.

Schacter, D.L. (1995). Memory distortion: History and current status. In D.L. Schacter (Eds.), *Memory distortion*. Cambridge, MA: MIT Press.

Schacter, D.L. (1996). *Searching for memory: The brain, the mind and the past*. New York: Basic Books.

Siegman, A.W. (1987). The telltale voice: Nonverbal messages of verbal communication. In A.W. Siegman & S. Feldstein (Eds.), *Nonverbal behavior and communication* (pp.351–434). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Siegman, A.W., & Feldstein, S. (Eds.). (1987). *Nonverbal behavior and communication* (2nd edn.). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Thomas, D.L., & Diener, E. (1990). Memory accuracy in the recall of emotions. *Journal of Personality and Social Psychology*, *59*(2), 291–297.

Tulving, E. (1983). *Elements of episodic memory.* Cambridge: Cambridge University Press.

Tulving, E. (1985). Memory and consciousness. *Canadian Psychology*, *26*, 1–12.

Zajonc, R.B. (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist*, *35*(2), 151–175.

Ziebrowitz, L.A., Olson, K., & Hoffman, K. (1993). Stability of babyfaceness and attractiveness across the life span. *Journal of Personality and Social Psychology*, *3*, 453–466.