

Research Article

MEMORY DISTORTIONS DEVELOP OVER TIME: Recollections of the O.J. Simpson Trial Verdict After 15 and 32 Months

H. Schmolck,¹ E.A. Buffalo,² and L.R. Squire^{1,2,3}

¹Department of Psychiatry and ²Department of Neurosciences, University of California, San Diego, and

³Veterans Affairs Medical Center, San Diego

Abstract—Fifteen or 32 months after the verdict was announced in the O.J. Simpson murder trial, we asked college students about how they had heard the news, and we compared their responses with what they had told us 3 days after the verdict. Our study is the first to have assessed recollective accuracy at two different intervals more than 1 year after a noted public event. The quality of the recollections after 32 months was strikingly different from the quality of the recollections after 15 months. After 15 months, 50% of the recollections were highly accurate, and only 11% contained major errors or distortions. After 32 months, only 29% of the recollections were highly accurate, and more than 40% contained major distortions. Retention interval appears to be an important factor determining the frequency of memory distortions, and differences in the retention interval across studies may account for some of the contradictions in the flashbulb-memory literature. Metamemory errors and source memory difficulties are a likely basis of poor memory performance after long retention intervals. The results highlight the marked qualitative changes in recollections that can occur between 1 and 3 years after information has been acquired.

Brown and Kulik (1977) introduced the term *flashbulb memory* to describe the almost photographic fashion in which memories of certain surprising and shocking events seem to be preserved across time. Thus, individuals recalling how they had first heard the news of the Kennedy assassination often gave vivid accounts that were full of detail and minute facts. Later studies of memory for surprising and consequential public events were based on the attempted assassination of President Reagan (Pillemer, 1984), the Challenger Space Shuttle disaster (Bohannon, 1988; Bohannon & Schmidt, 1989; Bohannon & Symons, 1992; McCloskey, Wible, & Cohen, 1988; Neisser & Harsch, 1992), the assassination of Swedish Prime Minister Olof Palme (Christianson, 1989), the Loma Prieta earthquake (Neisser et al., 1996), the Hillsborough, England, soccer tragedy (Wright, 1993), the resignation of British Prime Minister Margaret Thatcher (Conway et al., 1994), and the death of King Baudouin of Belgium (Finkenauer et al., 1998).

In some studies, data were collected both shortly after the event (within 2 weeks) and also at some later time (8 to 32 months; Bohannon & Symons, 1992; Conway et al., 1994; McCloskey et al., 1988; Neisser & Harsch, 1992; Neisser et al., 1996). In this way, how participants reacted to the original event could be related to how well they remembered it later. Moreover, the accuracy of the later recollections could be determined by comparing them with the earlier ones.

E.A. Buffalo is now at the Laboratory of Neuropsychology, National Institute of Mental Health, National Institutes of Health.

Address correspondence to Larry R. Squire, VAMC (116A), 3350 La Jolla Village Dr., San Diego, CA 92161.

Two major findings have emerged. First, personal involvement in the events at the time they occurred (measured, e.g., by the reported emotional reaction and stated interest in the subject matter) is a predictor of subsequent recollective success (e.g., Conway et al., 1994; Neisser et al., 1996; Pillemer, 1984). Second, recollections can be remarkably inaccurate. Interestingly, the studies that found the clearest evidence of distorted recollections assessed memory almost 3 years after the event (the Challenger disaster; Bohannon & Symons, 1992; Neisser & Harsch, 1992). Studies that assessed memory only 7 to 12 months after an event found memory to be rather accurate (Christianson, 1989; McCloskey et al., 1988; Pillemer, 1984). For example, 11 months after the Thatcher resignation, participants gave detailed recollections that were highly consistent with the descriptions given 2 weeks after the event (Conway et al., 1994). Yet, all these studies differed from each other in a number of ways. Accordingly, it is unclear that retention interval itself (e.g., 1 year vs. 3 years) is a critical factor determining how vulnerable memory is to inaccuracy and distortion.

We have studied memory for events surrounding the announcement of the verdict in the O.J. Simpson murder trial. To understand how memory changes between 1 year and 3 years after a noted public event, we tested participants 3 days after the verdict was announced and again either 15 months or 32 months later. Initially, participants were asked about how they had first heard the news of the verdict, and we obtained ratings about a number of factors (e.g., emotional reaction and agreement or disagreement with the verdict) that might influence later recollection. At follow-up, participants were asked again about how they had first heard the news, and they also rated how confident they were in their answers.

METHOD

Subjects

Students in an undergraduate psychology class at the University of California, San Diego ($N = 222$) completed a questionnaire on October 6, 1995, which was 3 days after the verdict was announced in the O.J. Simpson murder trial. The students were then divided into two groups of equal size, matched with respect to college level (freshman, sophomore, junior, or senior), the strength of their reported emotional reaction at the time of the verdict, and whether they agreed or disagreed with the verdict. Fifteen months later, in January 1997, a second questionnaire was sent by mail to 52 members of the first group. Twenty-eight individuals returned a completed questionnaire. Beginning 32 months after the verdict was announced (June to August 1998), 53 members of the second group were contacted, either by telephone ($n = 24$) or by mail ($n = 29$), for the purpose of administering the same questionnaire that had earlier been given to the first

Memory Distortions Over Time

group. Twenty-two individuals completed the questionnaire by telephone, and 13 returned a completed questionnaire by mail. There were no differences between the telephone and mail respondents with respect to gender, college level, response accuracy, or confidence ratings. All 35 respondents were therefore treated as a single group.

The first group thus consisted of 28 individuals (14 male, 13 female, 1 unknown), who had been in college a mean of 3.1 years at the time of the first testing. The second group consisted of 35 individuals (16 males, 14 females, and 5 unknown), who had been in college a mean of 2.8 years at the time of first testing. The two groups were similar with respect to their emotional reaction, how much they reportedly talked about the verdict after it was announced, their reported interest in the trial, whether and how strongly they agreed or disagreed with the verdict, and whether or not they first learned of the verdict from the media.

Materials and Procedures

The questionnaire that students completed 3 days after the verdict first asked for a written paragraph ("Please describe how you first heard the news of the verdict in the O.J. Simpson double-murder trial"). Nine specific questions followed:

"What time was it when you first heard the news of the verdict? How did you first hear about it? Where were you? What were you doing? Who told you? Who else was there? How did you feel about it? How did the person who told you feel about it? What did you do immediately after?"

The questionnaire then asked for ratings on a scale from 1 to 5 in response to four questions:

"How strong or intense was your emotional reaction when you heard the news of the verdict?" (emotion)

"How closely did you follow the trial proceedings?" (interest)

"How much have you talked about the verdict since the announcement?" (rehearsal)

"What was your assessment of the verdict?"

For the first three questions, higher ratings indicated greater emotion, greater interest, and more rehearsal, respectively. For the fourth question, a rating of 1 indicated the participant completely disagreed, and a rating of 5 indicated the participant completely agreed. The ratings for this last question were used to determine whether participants agreed or disagreed with the verdict (agreement) and also to determine the strength of agreement or disagreement with the verdict (opinion strength: 3 = low, 2 or 4 = medium, 1 or 5 = strong).

The questionnaires administered 15 and 32 months later were identical to this first one, except that after responding to the nine specific questions, participants were asked to judge how confident they were of each of their answers (on a scale from 1 to 5, 5 = *very confident*). In addition, participants were asked, "Have you ever filled out a questionnaire on this topic before?"

Scoring

Accuracy score

The procedure for determining the accuracy of the recollections at 15 and 32 months was adapted from Neisser and Harsch (1992) and resulted in a score that could range from 0 to 9. Two points were awarded for an accurate answer to each of four questions (How did

you hear? Where were you? What were you doing? Who told you?), and 1 point was awarded for a partly accurate answer. In addition, 1 extra point was added if a score of 4 or above (out of 6) was obtained on the three remaining, less central questions (What time? Who else? What next?). The two questions relating to affect (How did you feel? How did the person who told you feel?) were considered separately (see Flashbulb Memories, later in this section).

Distortion

Accuracy scores do not distinguish between distorted, inaccurate recollections and simple failures to remember. Accordingly, the written paragraph and the answers to the nine specific questions were used to judge the degree of distortion contained in the recollections at 15 and 32 months. Responses were rated as "no distortion," "minor distortion," "major distortion," or "don't remember." Recollections that were the same at the 15-month or 32-month follow-up as they were at the time of the verdict were rated as having no distortion. Recollections that described the same situation but included mistakes concerning some details (e.g., Who else? What next?) were rated as having minor distortions. Recollections that described a completely different situation than was described at the time of the verdict were rated as having major distortions. Individuals who stated (in the written paragraph) that they did not remember the original situation at all, or who answered no more than two of the nine specific questions, received the "don't remember" rating. Examples of recollections are presented in Table 1.

Reliability

Responses were scored for accuracy and distortion by two independent raters. The interrater reliability was .93 for the accuracy scores and .90 for the distortion scores. For data analysis, scores that were discrepant between the two raters were decided by a third independent rater.

Flashbulb memories

The responses to the questionnaires were also judged according to whether or not they constituted what has traditionally been termed a flashbulb memory (Brown & Kulik, 1977). Responses were designated a flashbulb memory if the responses to the nine specific questions contained five or more of the six features listed by Brown and Kulik (1977) as canonical features of a flashbulb memory (i.e., contained information responding to Where? What? Who? One's own feeling? Feelings of another? What next?). These criteria are strict in comparison with those adopted to define flashbulb memories in earlier studies (Pillemer, 1984; Winograd & Killinger, 1983; Wright, 1993) and also in comparison with the definition adopted by Brown and Kulik (1977), who required only that one canonical feature appear in an individual's recollection.

RESULTS

Only 11 (17.5%) of the 63 participants remembered having earlier filled out a questionnaire on the topic of the O.J. Simpson trial (6 of 28 after 15 months and 5 of 35 after 32 months). This low percentage may be due to the participants having filled out the questionnaire in class, so that it was not an event particularly distinct from other classroom exercises. According to responses to the first questionnaire,

Table 1. *Examples of recollections*

No distortion: Subject K.V.

Recollection 1 (3 days):

Leaving a 10:00am psych[ology] class, my roommate and I heard someone commenting on it, so we asked him the verdict.

Recollection 2 (15 months):

I first heard the verdict coming out of a lecture with my roommate. The verdict was to be read in the morning and we had psych[ology] during that time. As we left the lecture hall, I heard someone tell a girl next to me that he was found not guilty. I was stunned and asked him to repeat himself and tell me about the verdict.

Minor distortion: Subject P.H.

Recollection 1 (3 days):

I awoke to screaming outside my apartment window, so I looked at the clock (10:05) and realized the verdict had just been announced. I stayed in bed and reached for the stereo remote and turned the radio to 100.7 and listened to the verdict replayed.

Recollection 2 (15 months):

I knew what time the verdict would be read, so I set my stereo to wake me up so I could hear it. I was sitting in bed and listening to the radio and the screams from the other apartments and outside.

Major distortion: Subject M.G.

Recollection 1 (3 days):

I was in the Commuter Lounge at Revelle [College] and saw it on T.V. As 10:00 approached, more and more people came into the room. We kept having to turn up the volume, but it was kind of cool. Everyone was talking.

Recollection 2 (32 months):

I first heard it while I was watching TV. At home in my living room. My sister and father were with me. Doing nothing in particular, eating and watching how the news station was covering different groups of viewers just waiting to hear the verdict. I think that the focus was mostly on law students and their reactions to the verdict.

15 of the 63 participants (23.8%) agreed with the verdict, 25 (39.7%) disagreed with the verdict, and 23 (36.5%) were neutral.

The main finding was that recollections containing no distortions were the most common kind of recollection in the 15-month group, whereas recollections containing major distortions were the most common after 32 months (Fig. 1), $\chi^2(1, N = 63)$ for the two distributions = 10.7, $p < .05$. That is, from 15 to 32 months, there was a marked increase in the number of recollections that described a completely different situation than was described at the time of the verdict.

Although recollections tended to be more accurate after 15 months ($M = 5.4$) than after 32 months ($M = 4.4$), the difference was not significant, $t(55) = 1.1$, $p > .1$. More than 25% of the individuals in each group obtained an accuracy score of zero. When the zero scores were excluded, the 15-month group was more accurate than the 32-month group (7.6 vs. 5.9), $t(44) = 2.5$, $p < .05$. Neisser and Harsch (1992) used a 7-point scale and obtained a mean accuracy score of 2.95 for recollections 32 to 34 months after the Challenger disaster (44 subjects). When we recalculated our data following their 7-point scale instead of our 9-point scale, our scores were similar to theirs (our scores were 4.1 at 15 months and 3.3 at 32 months; for 3.3 vs. their score of 2.95, $t[69] = 0.6$, $p > .1$).

Figure 2 shows the distribution of accuracy scores in the two groups. There was a trend for more individuals in the 15-month group than in the 32-month group to obtain a high accuracy score of 8 or 9 (50.0% vs. 28.6%), $\chi^2(1, N = 63) = 3.0$, $p = .08$. Additionally, the two groups obtained low accuracy scores (0–3) for different reasons (see Fig. 3). In the 15-month group, the nine recollections receiving low accuracy scores consisted of 6 designated “don’t remember” (21.4%) and 3 designated as major distortions (10.7%). By contrast, after 32 months, of the 16 recollections receiving accuracy scores of 3 or less, only 2 were designated “don’t remember” (5.7%), and 14 were designated major distortions (40%). This difference at 15 and 32

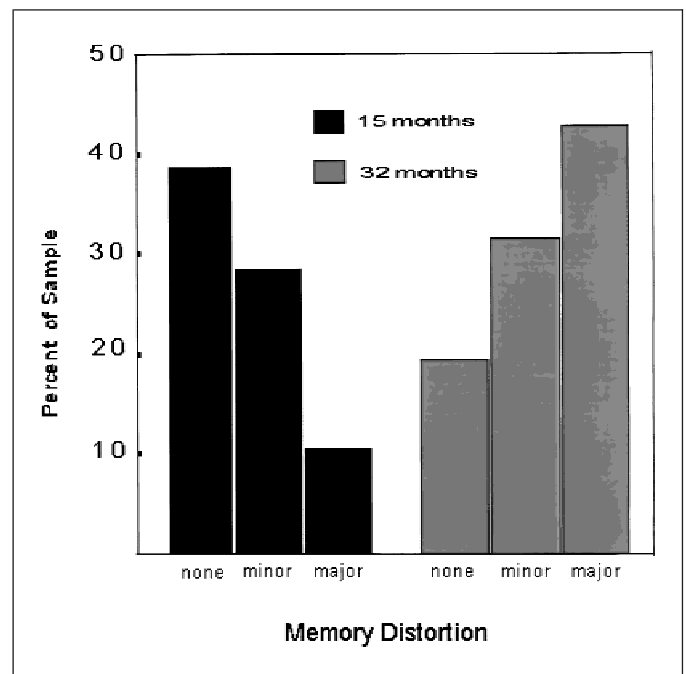


Fig. 1. Percentage of participants whose recollections contained no distortions, minor distortions, or major distortions after 15 or 32 months. The remainder of the recollections were scored as “don’t remember.”

Memory Distortions Over Time

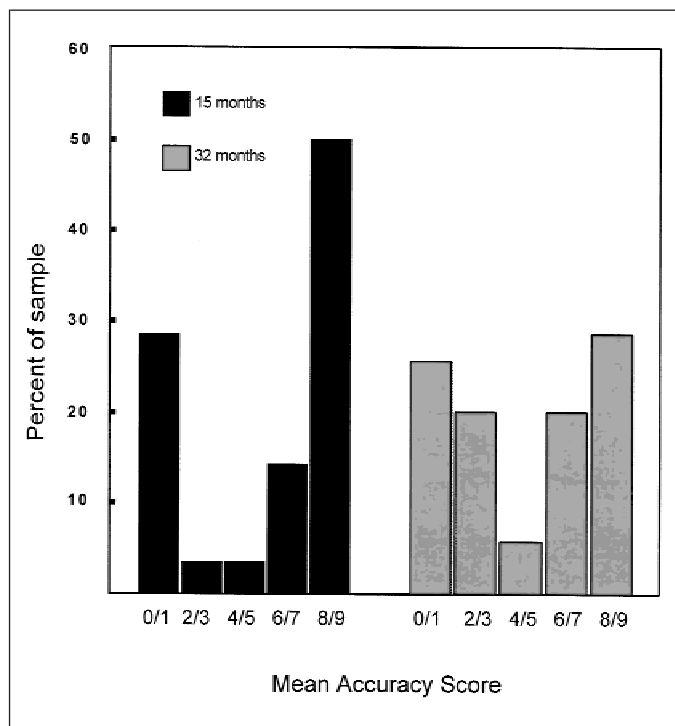


Fig. 2. Distribution of accuracy scores for the 15-month and 32-month groups.

months was significant, $\chi^2(1, N = 25) = 7.8, p < .01$. Interestingly, not only were the participants in the 32-month group more likely to produce a major distortion than to indicate they did not remember, but they also answered more of the nine questions than the 15-month group (8.0 vs. 6.9), $t(61) = 2.0, p < .05$. That is, they tended to provide answers instead of acknowledging that they did not remember.

Figure 4 shows the relationship between the confidence ratings and the quality of recollections for all 63 subjects. Although there was a robust positive correlation between accuracy scores and confidence ratings ($r = .70, p < .01$, after 15 months; $r = .48, p < .01$, after 32 months), it was also the case that many individuals with low accuracy scores had high confidence in their recollections. Specifically, individuals with distorted recollections often expressed high confidence in what they remembered. Of those whose recollections were scored as major distortions, 61% (11 of 18) had confidence ratings of 4 or higher ($M = 4.3$), despite a mean accuracy score of 1.0. Only the 8 individuals (12.7%) whose recollections were scored as “don’t remember” had low confidence in their responses ($M = 1.51$). The pattern of findings was similar for both delay groups.

Table 2 shows the relationship between accuracy scores at 15 and 32 months and each of five ratings obtained at the time of the verdict: emotional reaction to the verdict (emotion), how frequently the verdict was discussed after it was announced (rehearsal), how closely the trial proceedings were followed (interest), whether participants agreed or disagreed with the verdict (agreement), and how strongly participants agreed or disagreed with the verdict (opinion strength). For the group tested after 15 months, rehearsal, interest, and opinion strength all correlated significantly with the accuracy of the recollections. After 32 months, only emotion correlated significantly with accuracy

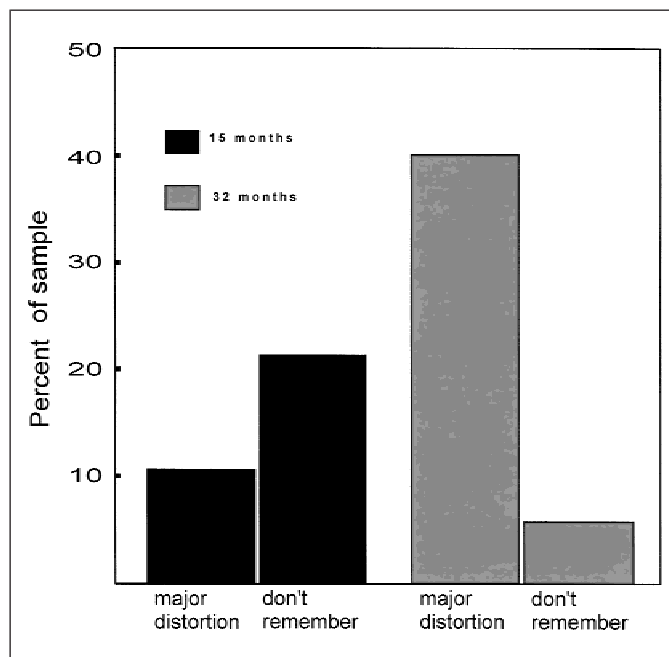


Fig. 3. Percentage of participants with low accuracy scores (≤ 3) whose recollections contained major distortions or were designated “don’t remember” after 15 or 32 months.

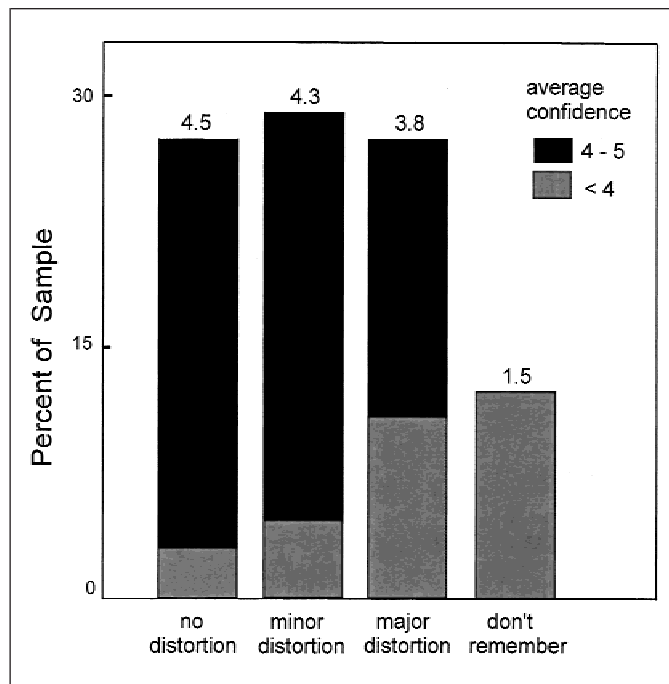


Fig. 4. Relationship between confidence ratings and quality of recollections combined for the two delay groups. The numbers above the bars show mean confidence ratings for each category of recollection. The percentage of individuals expressing high confidence (>4.0) is shown in black.

scores. Table 3 shows that these ratings were not independent factors, but tended to correlate with each other, suggesting that they measured a limited number of key factors that were important predictors of accuracy.

Media

Of the 63 participants, 28 (44%) reported 3 days after the verdict that they had heard the news from another person, and 35 (56%) reported that they had heard the news on radio or television. Later, 18 of the 63 participants remembered the source of their information incorrectly (6 at 15 months and 12 at 32 months). Fourteen claimed that they had heard the news on radio or television, even though they had earlier identified another person as the source; 2 claimed to have heard the news from another person, though they had earlier claimed that television was the source; and 2 had heard the news on the radio but later claimed that they had heard the news on television. Participants who committed these errors about the source of the news described an entirely different situation than the one they had described earlier. Such errors accounted for 77.8% of all the recollections that were scored as major distortions.

Participants who heard the news initially on radio or television were more accurate in their subsequent recollections than those who did not ($M_s = 5.9$ vs. 3.5), $t(54) = 2.7$, $p < .01$, presumably because those who obtained the news from the media were later less likely to make source errors. Interestingly, the correlations between ratings obtained at the time of the verdict and the accuracy scores at 15 and 32 months (Table 2) also applied to those 28 participants who heard the news from another person, and later achieved lower accuracy scores on average.

Flashbulb Memories

When they were questioned 3 days after the verdict, all but 1 participant (98.4%) met the criteria for having a flashbulb memory of the event in which they learned of the verdict. On the basis of their responses to the nine specific questions at follow-up, 22 of the par-

Table 2. Correlations between accuracy scores after 15 or 32 months and five ratings obtained at the time of the verdict

Rating ^a	Accuracy after 15 months		Accuracy after 32 months	
	<i>r</i>	<i>p</i>	<i>r</i>	<i>p</i>
Emotion (2.7, 2.8)	.30	.127	.34*	.046
Rehearsal (2.5, 2.6)	.62**	.000	.28	.101
Interest (2.4, 2.2)	.48*	.010	.15	.407
Agreement (2.7, 2.7)	-.066	.738	-.28	.107
Opinion strength (1.9, 1.9)	.47*	.012	.15	.404

^aRatings for opinion strength were based on a 3-point scale: low (1), medium (2), or strong (3) agreement or disagreement with the verdict. All other ratings were on 5-point scales: Higher scores indicate greater emotion, more rehearsal, greater interest, and stronger agreement, respectively. The numbers in parentheses show the mean ratings by participants in the 15- and 32-month groups, respectively.
* $p < .05$. ** $p < .01$.

Table 3. Correlations between ratings obtained at the time of the verdict for both delay groups

	15-month group		32-month group	
	Emotion	Rehearsal	Emotion	Rehearsal
Rehearsal	.43*	—	.53**	—
Interest	.48**	.62**	.40*	.69**
Opinion strength	.36	.37	.34*	.30
	$(p = .063)$		$(p = .054)$	
	$(p = .083)$			

Note. Correlations not shown did not approach significance ($ps > .10$).
* $p < .05$. ** $p < .01$.

ticipants in the 15-month group (78.6%) and 28 of those in the 32-month group (80%) were judged to have a flashbulb memory. The finding of interest was that many of the participants who were judged to have a flashbulb memory at follow-up had entirely inaccurate memories. Thus, of those 50 participants who were judged to have a flashbulb memory, 38% described a different situation than the one they had described 3 days after the verdict (5 at 15 months, 22.7%; 14 at 32 months, 50%). All of these recollections had been scored as major distortions.

DISCUSSION

Fifteen or 32 months after the verdict was announced in the O.J. Simpson murder trial, college students were asked about how they had heard the news. Their responses were compared with what they had reported 3 days after the verdict. There were four major findings. First, mistaken recollections and distortions of memory were much more common after 32 months than after 15 months (10.7% major distortions at 15 months; 42.9% at 32 months). Additionally, the participants at 32 months tended to report memories rather than simply stating that they did not remember (only 5.7% “don’t remember” responses at 32 months; 21.4% “don’t remember” responses at 15 months). Second, despite their inaccuracy, the recollections were often detailed and associated with high confidence ratings. Thus, even among individuals whose recollections were grossly inaccurate (i.e., recollections that were major distortions), 61% gave confidence ratings of 4 or 5 on a scale from 1 to 5. Third, after both 15 and 32 months, participants commonly misremembered the source of their information about the verdict. Source errors occurred for 29% of all participants, and usually consisted of reporting incorrectly that the media (radio or television) was the source. Finally, the strength of the emotional reaction at the time of first hearing the verdict was the only predictor of recollective accuracy at the longer (32-month) delay.

Our study is the first to have assessed recollective accuracy at two different intervals more than 1 year after a noted public event. The quality of recollections was strikingly different at the two intervals examined. Compared with participants tested after 15 months, participants tested after 32 months answered more questions, were less likely to say they did not remember, and were more likely to produce distorted recollections.

Our observations help resolve a contradiction in the flashbulb-memory literature concerning whether memory is accurate or inaccurate long after public events. We found that distortions in recollections

Memory Distortions Over Time

were relatively uncommon after 15 months. Similarly, in studies that assessed retention within 18 months of the event, the majority of individuals had accurate memories (Christianson, 1989; Conway et al., 1994; McCloskey et al., 1988; Neisser et al., 1996; Pillemer, 1984; Weaver, 1993). In contrast, in studies that assessed retention after more than 32 months (Bohannon & Symons, 1992; Neisser & Harsch, 1992), recollections were frequently inaccurate. Our findings were similar. Specifically, our results 32 months after the trial verdict resemble the findings 32 to 34 months after the Challenger Space Shuttle disaster (Neisser & Harsch, 1992) with respect to the overall accuracy of recollections, the frequency of memory distortion, and the frequency of source memory errors involving the media. We conclude that, despite the considerable differences among the available studies in terms of subject matter and methodology, retention interval is a major factor determining the frequency of memory distortions. Marked changes in recollections occur between 1 and 3 years after information has been acquired.

The fact that individuals were frequently as confident of their inaccurate recollections as they were of their accurate recollections, and failed to say they did not remember, suggests that some of the findings reflect a difficulty in metamemory. Interestingly, many of the errors in recollection occurred because participants made source errors involving radio or television. Neisser and Harsch (1992) suggested that these were often "time slice errors." Individuals may have turned to radio or television after they first heard the news, and these encounters were strongly encoded because the information was delivered in a detailed and dramatic fashion. It has also been shown that memory distortions in the laboratory frequently involve failures in monitoring the source of information (Johnson, 1997).

Forgetting can occur gradually in normal subjects across many years, resulting in progressively weaker memory traces (Squire, 1989). In the present study, weak memory traces may have been another factor contributing to likelihood of source errors. Thus, source memory errors and confabulations have been found to be greater in amnesic patients with frontal lobe pathology (who have weak memory as well as difficulties with metamemory) than in patients who had frontal pathology alone and were not amnesic (e.g., Johnson, O'Connor, & Cantor, 1997). Another possible contribution to source errors is suggested by studies showing that an imagined event that is common or prototypical is more likely to be judged later as a real event than is an unusual imagined event (Durso & Johnson, 1980; Johnson, Raye, Foley, & Foley, 1981). In the present study, the tendency to misreport that the verdict was learned about from the media might also reflect the fact that the media are a common and expected source of important news. Thus, as memory traces grew increasingly weaker, participants in the 32-month group failed to give "don't remember" responses and instead responded according to their expectation as to how they usually learn about important events. Because of inadequate reality monitoring and metamemory, participants then failed to reject their inaccurate memories, and instead provided detailed and confident recollections.

Several earlier studies have identified predictors of recollective accuracy. The importance of personal involvement in the event has been demonstrated in the case of the 1989 Loma Prieta earthquake in California (California residents vs. Georgia residents; Neisser et al., 1996) and in the case of the resignation of Margaret Thatcher (United Kingdom residents vs. non-United Kingdom residents; Conway et al., 1994). Rehearsal, emotional involvement, and a priori knowledge

about the subject matter of the event (or interest in the subject matter) have also been identified as predictors of successful recollection (Bohannon, 1988; Bohannon & Schmidt, 1989; Bohannon & Symons, 1992; Conway et al., 1994; Pillemer, 1984). Our findings confirm and extend these observations. After 15 months, rehearsal, interest, and strength of opinion were all predictive of accuracy. The effect of emotion itself was not significant ($p = .13$), but emotion was correlated with several other predictive factors (Table 3). After 32 months, only emotion was predictive of accuracy.

Several studies with humans and experimental animals have indicated that emotionally arousing material is usually more memorable than neutral material. In human memory, β -adrenergic mechanisms have been implicated in the enhancing effect of emotional arousal (Cahill, Prins, Weber, & McGaugh, 1994). Enhancement of long-term memory for the emotionally arousing parts of a story was blocked by propranolol, a β -adrenergic antagonist. Other findings have suggested additionally that the amygdala mediates the enhancing effect of emotional arousal on declarative memory (Adolphs, Cahill, Schul, & Babinsky, 1997; Cahill et al., 1996). Our finding that emotional involvement is an important predictor of accuracy at long retention intervals likely depends on the influence of the amygdala at the time of learning on medial temporal lobe structures important for the formation of declarative knowledge.

The term flashbulb memory was introduced to describe vivid, episodic autobiographical memories for the moment in which individuals learn about important events. It has been claimed that flashbulb memories are a distinct subset of memories, and that they should be less vulnerable to forgetting than ordinary memories. We found that most participants had detailed memories that could be classified as flashbulb memories using standard criteria. However, nearly 40% of these flashbulb memories were completely inaccurate. Accordingly, claims of distinct memories long after public events need to be interpreted with caution. Considering how frequently flashbulb memories are inaccurate, and the ways in which they behave like other episodic memories (e.g., continuous forgetting across long time periods, enhancement by emotional arousal, increased source memory errors as forgetting occurs), it seems unlikely that so-called flashbulb memories differ from ordinary episodic memory in any fundamental way. Rather, such recollections are better viewed as ordinary autobiographical memories about moments in which individuals learn about important events. Indeed, the announcement of the O.J. Simpson verdict was not as significant, or as tragic, or as unexpected as the explosion of the Challenger Space Shuttle, but memory for these two events exhibited qualitatively similar characteristics over time.

Acknowledgments—This work was supported by the Medical Research Service of the Department of Veterans Affairs, National Institute of Mental Health Grant MH2460, National Institute of Health Grant 2T32AG00216, the McDonnell-Pew Center for Cognitive Neuroscience, and Deutsche Forschungsgemeinschaft Grant Vo 770/1-1 (H.S.). We thank Jennifer Frascino, Joyce Zouzounis, Alisha West, O'Dhaniel Mullette-Gilman, and Stuart Zola for their assistance and T. Rickard for allowing us to recruit volunteers from his undergraduate class.

REFERENCES

- Adolphs, R., Cahill, L., Schul, R., & Babinsky, R. (1997). Impaired declarative memory for emotional material following bilateral amygdala damage in humans. *Learning and Memory*, 4, 291–300.

- Bohannon, J.N. (1988). Flashbulb memories for the Space Shuttle disaster: A tale of two theories. *Cognition*, 29, 179–196.
- Bohannon, J.N., & Schmidt, S. (1989, March). *Another look at flashbulb memories for the Challenger disaster*. Paper presented at the annual meeting of the Southeastern Psychological Association, Atlanta, GA.
- Bohannon, J.N., & Symons, L.V. (1992). Flashbulb memories: Confidence, consistency, and quantity. In E. Winograd & U. Neisser (Eds.), *Affect and accuracy in recall: Studies of "flashbulb" memories* (pp. 65–91). Cambridge, England: Cambridge University Press.
- Brown, R., & Kulik, J. (1977). Flashbulb memories. *Cognition*, 5, 73–79.
- Cahill, L., Haier, R., Fallons, J., Alkire, M.T., Tang, C., Keator, D., Wum, H., & McGaugh, J.L. (1996). Amygdala activity at encoding correlated with long-term, free recall of emotional information. *Proceedings of the National Academy of Sciences, USA*, 93, 8016–8021.
- Cahill, L., Prins, B., Weber, M., & McGaugh, J.L. (1994). Beta-adrenergic activation and memory for emotional events. *Nature*, 371, 702–704.
- Christianson, S.-A. (1989). Flashbulb memories: Special, but not so special. *Memory & Cognition*, 17, 443.
- Conway, M.A., Anderson, S.J., Larsen, S.F., Donnelly, C.M., McDaniel, M.A., McClelland, A.G.R., & Rawles, R.E. (1994). The formation of flashbulb memories. *Memory & Cognition*, 22, 326–343.
- Durso, F.T., & Johnson, M.K. (1980). The effects of orienting tasks on recognition, recall, and modality confusion of pictures and words. *Journal of Verbal Learning and Verbal Behavior*, 19, 416–429.
- Finkenauer, C., Luminet, O., Gisle, L., El-Ahmadi, A., Van der Linden, M., & Philippot, P. (1998). Flashbulb memories and the underlying mechanisms of their formation: Toward an emotional-integrative model. *Memory & Cognition*, 26, 516–531.
- Johnson, M.K. (1997). Source monitoring and memory distortion. *Philosophical Transactions of the Royal Society of London B*, 352, 1733–1745.
- Johnson, M.K., O'Connor, M., & Cantor, J. (1997). Confabulation, memory deficits, and frontal dysfunction. *Brain and Cognition*, 34, 189–206.
- Johnson, M.K., Raye, C.L., Foley, H.J., & Foley, M.A. (1981). Cognitive operations and decision bias in reality monitoring. *American Journal of Psychology*, 94, 37–64.
- McCloskey, M., Wible, C.G., & Cohen, N.J. (1988). Is there a special flashbulb-memory mechanism? *Journal of Experimental Psychology: General*, 117, 171–181.
- Neisser, U., & Harsch, N. (1992). Phantom flashbulbs: False recollections of hearing the news about Challenger. In E. Winograd & U. Neisser (Eds.), *Affect and accuracy in recall: Studies of "flashbulb" memories* (pp. 9–31). Cambridge, England: Cambridge University Press.
- Neisser, U., Winograd, E., Bergman, E.T., Schreiber, C.A., Palmer, S.E., & Weldon, M.S. (1996). Remembering the earthquake: Direct experience vs. hearing the news. *Memory*, 4, 337–357.
- Pillemer, D.B. (1984). Flashbulb memories of the assassination attempt on President Reagan. *Cognition*, 16, 63–80.
- Squire, L.R. (1989). On the course of forgetting in very long-term memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 15, 241–245.
- Weaver, C.A. (1993). Do you need a "flash" to form a flashbulb memory? *Journal of Experimental Psychology: General*, 122, 413–422.
- Winograd, E., & Killinger, W.A., Jr. (1983). Relating age at encoding in early childhood to adult recall: Development of flashbulb memories. *Journal of Experimental Psychology: General*, 112, 413–422.
- Wright, D.B. (1993). Recall of the Hillsborough disaster over time: Systematic biases of "flashbulb" memories. *Applied Cognitive Psychology*, 7, 129–138.

(RECEIVED 1/20/99; REVISION ACCEPTED 7/2/99)