

Research Article

CONFIDENCE, NOT CONSISTENCY, CHARACTERIZES FLASHBULB MEMORIES

Jennifer M. Talarico and David C. Rubin

Duke University

Abstract—On September 12, 2001, 54 Duke students recorded their memory of first hearing about the terrorist attacks of September 11 and of a recent everyday event. They were tested again either 1, 6, or 32 weeks later. Consistency for the flashbulb and everyday memories did not differ, in both cases declining over time. However, ratings of vividness, recollection, and belief in the accuracy of memory declined only for everyday memories. Initial visceral emotion ratings correlated with later belief in accuracy, but not consistency, for flashbulb memories. Initial visceral emotion ratings predicted later posttraumatic stress disorder symptoms. Flashbulb memories are not special in their accuracy, as previously claimed, but only in their perceived accuracy.

Flashbulb memories are extremely vivid, long-lasting memories for unexpected, emotionally laden, and consequential events. Historical events that have led to flashbulb memories include the assassinations of Abraham Lincoln (Colgrove, 1899), John F. Kennedy (Brown & Kulik, 1977), Martin Luther King, Jr. (Brown & Kulik, 1977), and Olof Palme (Christianson, 1989); the resignation of Margaret Thatcher (Conway et al., 1994); the space-shuttle Challenger explosion (Neisser & Harsch, 1992); and the O.J. Simpson murder-trial verdict (Schmolck, Buffalo, & Squire, 2000). The terrorist attacks on the United States on September 11, 2001, the focus of this study, are the latest events to evoke flashbulb memories. The properties of flashbulb memories, what causes their occurrence, the accuracy of the memories, and the influence of emotion on them have all come into question (Winograd & Neisser, 1992).

We chose the following as the most important and tractable questions we could ask about the phenomenon of flashbulb memory. Compared with everyday memories from the same time, are flashbulb memories more consistent? Do participants have a greater sense of recollection and vividness of flashbulb memories, as well as greater belief in their accuracy? What effect does the emotional impact have on the differences observed? In what ways do the properties of flashbulb and everyday memories differ?

One critical issue is the assumption that “people remember these sorts of public negative emotional events better than ordinary events that occurred equally long ago” (Christianson, 1992, p. 194). In a symposium on flashbulb memories organized by Winograd and Neisser (1992), the need to empirically test this assumption was identified by both Rubin (1992) and Brewer (1992), who both noted that many conclusions drawn by previous research were limited by the omission of such a control. Therefore, to obtain a fair representation of nonflashbulb autobiographical memories from the same time period as the flashbulb memories of the September 11 attacks, we asked participants to identify and report an everyday event from the days preceding the attacks to serve as a control memory. A range of days was neces-

sary to ensure that participants could select a sufficiently memorable event; we decided on a maximum difference of 3 days between the everyday event and the flashbulb events, as we considered this difference to be inconsequential compared with the length of the retention intervals. These intervals varied across participants, but each individual was tested immediately after the attacks and once later. It is difficult to assess the objective accuracy of autobiographical memory; however, consistency is measurable and is a necessary (though not sufficient) condition for accuracy. Inconsistencies imply that at least one report is inaccurate.

There are also distinct properties associated with flashbulb memories, such as increased recollection, exceptional vividness, greater belief in their accuracy, and enhanced rehearsal (Rubin & Kozin, 1984). We therefore assessed recollection, vividness, belief in accuracy, and rehearsal for both flashbulb and everyday memories using rating-scale questions. Of particular interest is the role of emotion in flashbulb memories. Christianson (1992), Gold (1992), and Reisberg and Heuer (1992) all argued that emotion’s effect on memory can account for most of the flashbulb memory phenomenon. Therefore, we had participants rate visceral and emotional reactions during both recall sessions and complete a measure of posttraumatic stress disorder (PTSD) symptoms at the second session (Weathers, Litz, Huska, & Keane, 1994).

METHOD

Participants

On September 12, 2001, Duke students were contacted and tested for their memory of hearing about the terrorist attacks on the United States the previous morning. They were then randomly assigned to one of three follow-up sessions scheduled within the limits of the academic calendar to produce roughly equal steps on a logarithmic scale (Rubin & Wenzel, 1996). The first group of 18 participants (4 of whom were male; $M = 18.67$ years) was tested 7 days (1 week) later, the second group of 18 (6 of whom were male; $M = 17.78$ years) was tested 42 days (6 weeks) after the initial event, and the last group of 18 (4 of whom were male; $M = 19.11$ years) was tested 224 days (32 weeks) after the event. Participants were compensated with class credit or \$10.

Open-Ended Questionnaires

At each experimental session, participants were asked a series of open-ended questions. The first set of questions asked specifically about how the participant heard of the terrorist attacks on the United States on Tuesday, September 11, 2001, and the second set asked about an everyday event from the participant’s life in the days prior to the attacks. For the September 11 memories, we asked: “Who or what first told you the information?” “When did you first hear the news?” “Where were you when you first heard the news?” “Were there others

Address correspondence to David C. Rubin, Department of Psychological and Brain Sciences, Duke University, Box 90086, Durham, NC 27708.

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present, and if so, who?" "What were you doing immediately before you first heard the news?" and "Are there any other distinctive details from when you first heard the news?" For everyday memories, we asked: "What was the event?" "When did this event occur?" "Where were you, physically?" "Were there others present, and if so, who?" "What were you, personally, doing?" and "Are there any other distinctive details from the event?" Three blank lines followed each question. For the everyday event, the participant was also asked to provide a two- to three-word description that could serve as a cue for that unique event in the future. The types of events listed for the everyday memory were typical for the life of an average college student (e.g., parties, sporting events, and studying).

Autobiographical Memory Questionnaire

In addition, for each of these events, participants were asked to complete the Autobiographical Memory Questionnaire, a rating-scale measure that was designed to assess various properties of autobiographical memory (Sheen, Kemp, & Rubin, 2001).

Key properties

Recollection of the event and belief that the event occurred as remembered are the definitive properties of autobiographical memory according to Brewer (1986, 1995), Conway (1995), and Rubin (1995), among others. We created a *recollection* measure by collapsing responses to questions about how much "I feel as though I am reliving" the experience (from 1, *not at all*, to 7, *as clearly as if it were happening now*) and "while remembering the event now, I feel that I travel back to the time it happened" (from 1, *not at all*, to 7, *completely*). A composite measure of *belief* was obtained by averaging responses to questions asking whether the participants "believe the event in my memory really occurred in the way I remember it" (from 1, *100% imaginary*, to 7, *100% real*) and whether they could be persuaded that their memory of the event "was wrong" (from 1, *not at all*, to 7, *completely*; reverse scored). Participants rated how much they could "see it in my mind," "hear it in my mind," and "know the setting where it occurred" (from 1, *not at all*, to 7, *as clearly as if it were happening now*). Following the flashbulb memory literature (Brown & Kulik, 1977; Rubin & Kozin, 1984), we averaged these responses into one *vividness* measure. We also asked participants whether they "actually remember it rather than just knowing it happened" (from 1, *not at all*, to 7, *completely*); this was our *remember/know* measure.

Language and narrative

The participants were asked if the memory came "in words or pictures as a coherent *story* or episode and not as an isolated fact, observation, or scene"; "in *pieces* with missing bits"; and "in *words*"; and whether it was "based on details *specific* to my life, not on general knowledge that I would expect most people to have" (all rated from 1, *not at all*, to 7, *completely*).

Emotion

Because emotion is considered by some researchers to be the "special mechanism" that explains the flashbulb memory phenomenon, we looked at various emotional aspects of the participants' memories. One question asked participants to rate the current emotional *intensity*

of the memory (from 1, *not at all*, to 7, *extremely*). We also asked participants if they felt the emotions "as strongly as I did then" (*same intensity*: from 1, *not at all*, to 7, *as clearly as if it were happening now*). Similarly, we asked participants if they felt "the same particular emotions I felt at the time of the event" (*same emotion*: from 1, *completely different*, to 7, *identically the same*). There were also four questions that asked about current visceral responses to the memory: "I feel my heart pound or race," "I feel tense all over," "I feel sweaty or clammy," and "I feel knots, cramps, or butterflies in my stomach" (all rated from 1, *not at all*, to 7, *more than for any other memory*). Responses to these last four questions were averaged to form a global *visceral-response* measure. Finally, current *valence* of the memory was assessed by averaging responses to a scale of positive emotional tone and reverse-scored responses to a scale of negative emotional tone (both originally scored from 1, *not at all*, to 7, *entirely*).

Other features

Finally, we examined ways of remembering. Because participants often poorly judge the objective frequency of occurrence of past behaviors (Fiedler & Armbruster, 1994; Parducci, 1968), we had them use relative rating scales to measure rehearsal rates, rather than estimate the number of past rehearsals. Participants rated how often they "thought about" and "talked about" the event and how often it came to them "out of the blue, without my trying to think about it" (from 1, *not at all*, to 7, *more than for any other memory*). These ratings were then collapsed into a total *rehearsal* measure. *Field versus observer* modes of remembering were assessed with one question asking participants if they saw the event "out of my own eyes rather than those of an outside observer" (from 1, *not at all*, to 7, *completely*).

Second Session

The second session was identical to the first except that the everyday event was cued with the brief description individuals provided at the initial session, whereas the flashbulb event was cued with the same phrase as at the initial session ("how you first heard about the news of the attacks on America on Tuesday, September 11, 2001"). Also, all participants were asked to complete the PTSD Checklist for a Specific Experience (PCL-S), a short survey designed to assess PTSD symptoms (Weathers et al., 1994).

Data Scoring

The recall data were scored by two independent raters who counted the number of details provided. A detail was generally any noun, verb phrase, or unique modifier. Consistency scores for the free-recall portion of the experiment were based on coding guidelines developed from earlier, independent coding attempts. In general, coders marked details as *consistent* if participants used the same or similar words to describe the same real-world entity. For example, if a participant initially said "a friend" was with him and later said "Sue" was with him, these details would have been marked consistent. Those details that were directly contradictory (the majority of the inconsistent cases) or that could not refer to the same real-world entity were marked as *inconsistent*. For example, it would be inconsistent for a participant to say initially that "Mike" was with him and say later that "Sue" was with him. Saying that "Mike" was present initially and "Mike and Sue" were present later would be scored as one consistent

and one inconsistent detail. Disagreements in coding were resolved by discussion. Reliability between the two coders for the number of details recorded was 96% for the flashbulb memories and 97% for the everyday memories, based on a subset of 22 reports.

RESULTS

The measures of recall consistency showed no difference between flashbulb and everyday memories as a function of the passage of time, as shown by the top panel in Figure 1 and the lack of interactions between memory type (flashbulb vs. everyday) and the passage of time (session, group, and their interaction) in Table 1. The two kinds of memory did differ in their phenomenological properties, however, as shown by the middle and bottom panels of Figure 1 and by Figure 2. Furthermore, as shown in Table 1, the interactions between memory type and the passage of time were nearly zero for the recall questions, but were significant for several of the rated properties of the memories. Language-narrative and emotions (with the exception of a floor effect in ratings of visceral emotions for the everyday event) showed only a main effect of memory type, with flashbulb memories higher in narrative coherence, less fragmented, of greater emotional intensity, and of more negative valence.

Consistency

The primary question of interest was whether flashbulb memories are more consistent over time than everyday memories. As shown in the top panel of Figure 1, the mean numbers of consistent and inconsistent details were similar for flashbulb and everyday memories and followed the same pattern over time. A repeated measures analysis of variance (ANOVA) analyzed the effects of three factors on the number of consistent and inconsistent details: memory type (flashbulb vs. everyday), session (first vs. second, collapsing all three delay periods), and group (second session 7 vs. 42 vs. 224 days after the first session). Results are shown in Table 1.

For total number of inconsistent details, the effect of session was omitted because there could not be an inconsistent detail at the first session. Memory decayed over time, as shown by both decreasing number of consistent details and by increasing number of inconsistent details; this was true for both flashbulb memories and memories of everyday events. For both kinds of memories, at most 25% of the consistent details at any time period came from the same individual recall question, so these results were not driven by any one category of response. For each of the seven recall questions, there was a significant effect of session for consistent responses and no interaction with memory type. In contrast, responses to the question asking about “distinctive details” contributed 42% of the inconsistent details across all time periods for both flashbulb and everyday memories. Brown and Kulik (1977) emphasized the persistence of seemingly irrelevant details in flashbulb memories, whereas we more often found that individuals listed different details at different times.

Flashbulb memories are not immune to forgetting, nor are they uncommonly consistent over time. This seems to be strong evidence for the absence of a special mechanism for the consistency of flashbulb memories. Instead, exaggerated belief in memory’s accuracy at long delays, belief that is unrelated to true memory consistency, is what may have led to the conviction, even among some researchers, that flashbulb memories are more accurate than everyday memories.

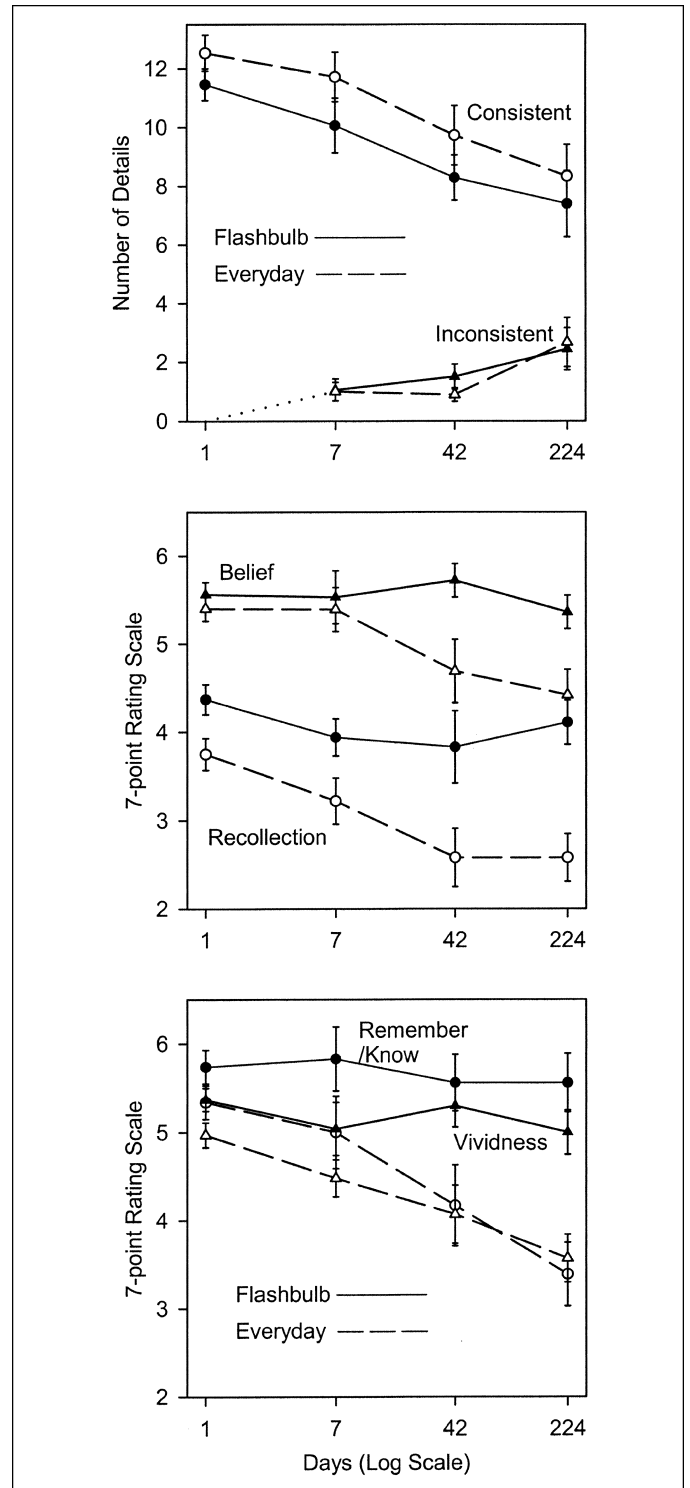


Fig. 1. Consistency and key properties of flashbulb and everyday memories. The top panel shows the mean number of consistent and inconsistent details for the flashbulb and everyday memories from the initial session (1 day after the terrorist attacks) and follow-up sessions (7, 42, and 224 days later). The middle panel shows the mean ratings for the belief and recollection measures. The bottom panel shows mean ratings for remembering (rating of 7) versus knowing (rating of 1) the event took place and for vividness of the memories.

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Table 1. Analysis of variance results

Question	Effect of delay			Effect of flashbulb vs. everyday memory			
	Session	Group	Session × Group	Main effect	Memory × Group	Memory × Session	Memory × Session × Group
Recall							
Details							
Consistent	57.88***	3.12	5.00*	4.26*	0.02	0.45	0.35
Inconsistent	—	4.76*	—	0.04	0.24	—	—
Ratings of memories							
Key properties							
Recollection	30.72***	0.82	0.02	31.30***	1.25	5.13*	0.31
Belief	8.65**	1.47	0.73	5.02*	0.48	8.29**	5.70**
Remember/know	20.94***	2.25	1.46	17.54***	0.75	9.20**	1.41
Vividness	28.72***	1.54	0.66	18.66***	1.50	10.67**	1.21
Language and narrative							
Story	11.06**	2.00	1.48	16.34***	0.83	1.25	0.03
In pieces	20.97***	3.66*	1.37	24.19***	0.23	1.02	2.27
In words	2.21	0.43	0.88	0.78	0.89	3.41	2.21
Specific	0.21	0.37	0.22	2.56	0.00	1.19	1.48
Emotion							
Valence	1.76	0.57	1.20	148.88***	0.28	2.16	1.18
Same intensity	48.56***	1.48	1.28	32.46***	2.96	0.04	0.05
Intensity	43.13***	1.91	0.74	124.03***	0.26	4.24*	0.70
Visceral	65.15***	0.06	0.21	83.64***	0.91	29.24***	0.46
Same emotion	17.18***	0.21	0.06	0.78	2.25	2.39	0.04
Other							
Field/observer	8.53**	0.66	3.31*	0.45	1.18	29.98***	2.06
Rehearsal	35.62***	8.53**	1.61	223.95***	3.16	0.06	0.58

Note. Session refers to the first versus follow-up session. The groups differed in whether the follow-up session was 7, 42, or 224 days after the initial session. Degrees of freedom are 2, 51 for all analyses involving group and 1, 51 for all other analyses. (Because of missing values, the denominator in each case sometimes falls as low as 49.)
 * $p < .05$. ** $p < .01$. *** $p < .001$.

Key Properties

As shown in the bottom two panels of Figure 1, levels of recollection, belief, remember/know, and vividness remained high and constant for flashbulb memories, but decreased over time for everyday memories. Using ANOVAs of the same design as for recall, we examined ratings of various properties of the memories. There were main effects of session and memory type for recollection, belief, remember/know, and vividness; each of these measures also showed a memory-type-by-session interaction, and for belief there was an additional three-way interaction. Thus, participants (erroneously, but reliably) believed that their memories for September 11 were more consistent than everyday memories, a belief that may have been supported by similar patterns of judgments of recollection, remember/know, and vividness.

Language and Narrative

Memory type, session, and group also affected the language and narrative aspects of the memories (see Table 1). Flashbulb memories came as more coherent stories than everyday memories ($M = 4.68$ vs. $M = 3.61$) and were less likely to come in pieces ($M = 3.29$ vs. $M = 4.53$), counter to what would be expected for traumatic memories (Berntsen, Willert, & Rubin, in press).

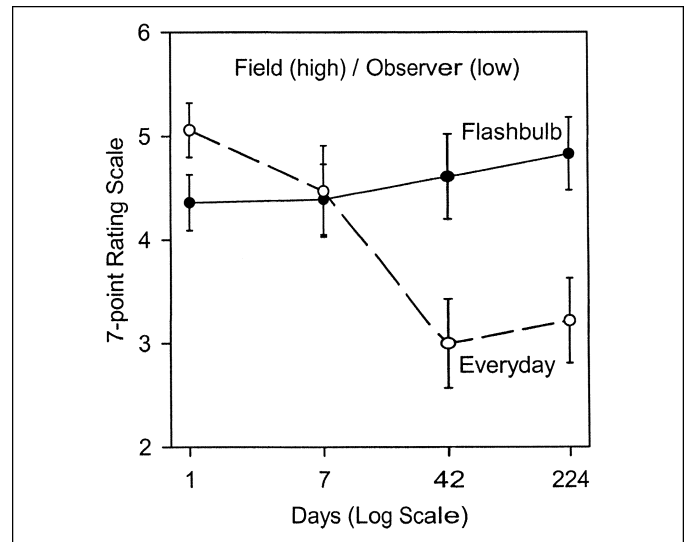


Fig. 2. Mean ratings for whether participants saw the flashbulb and everyday memories through their own eyes (rating of 7) or through the eyes of an outside observer (rating of 1), from the initial session (1 day after the terrorist attacks) and follow-up sessions (7, 42, and 224 days later).

Other Features

Results for rehearsal were consistent with assumptions in the early studies of flashbulb memory (e.g., Brown & Kulik, 1977): Participants rehearsed flashbulb events more than everyday memories ($M = 5.23$ vs. $M = 2.46$), and the ratings of rehearsal for both kinds of memories combined decreased with time, from 4.23 initially to 3.93, 3.58, and 2.85, at the three delays.

There was a memory-type-by-session interaction for mode of remembering (see Fig. 2 and Table 1). As in previous research, the feeling of seeing a memory through the eyes of an outside observer increased over time for everyday memories (Nigro & Neisser, 1983); for flashbulb memories, participants' feeling of seeing a memory through their own eyes remained the same over time. Though the likelihood that participants saw the memory through their own eyes was slightly higher for everyday memories than flashbulb memories initially, over time, participants were much more likely to see the everyday memory through the eyes of an outside observer than to see the flashbulb memory from an observer's perspective.

Emotion

The most salient characteristic of emotion is valence, and, not surprisingly, participants rated the flashbulb memories as more negative in valence ($M = -1.89$) than the everyday memories ($M = 0.61$). There was a main effect of memory type, but no other effects of session or of group, nor any interactions. This difference should not have affected our subsequent analyses on emotional contributions to memory phenomena, however, as Scott and Ponsoda (1996) studied flashbulb memories for negative and positive events and found no differences between them. Therefore, differences in intensity or emotional consistency should be independent from valence differences.

All other emotional variables had main effects of memory type and session, with means lower for everyday memories than for flashbulb memories and lower for delayed memories than for more immediate memories, except that there was no main effect of memory type for whether the same emotions were felt at recall as at the time of the event (see Table 1). There was an interaction between memory type and session for visceral and intensity ratings. Everyday memories ($M = 1.55$ for visceral, $M = 2.64$ for intensity) were initially rated as much lower than flashbulb memories ($M = 3.58$ for visceral, $M = 5.31$ for intensity) and so had less room to drop. But although there were differences between overall emotional investment for flashbulb and everyday memories, the emotional intensity, as measured by both direct intensity ratings and indirect visceral ratings, decreased over time for both.

Correlations Between Sessions

Last, we examined the effects of various characteristics at the time of the September 12 test on the key properties of memories at the second session. Although strong claims of causality cannot be drawn from this initial-measures-predict-delayed-measures analysis, it can provide insight into possible causal mechanisms. We report all significant correlations between the delayed measures of consistency, inconsistency, belief, and PTSD symptoms and the initial measures (other than belief). In order to remove the effects of differential delay on consistency, we made the means for all groups the same by adding 1.78 and 1.93, for flashbulb and everyday memories, respectively, to all participants' consistency measures in the 6-week group; we added 2.67 and 3.15, respectively, to all participants' consistency measures

in the 32-week group. For inconsistency, the effects of delay were removed by adding -0.44 , 0 , -1.38 , and -1.67 , respectively.

For the everyday memories, the results are simple: Belief ratings at the delayed test correlated with whether the memory came in pieces on the initial test ($r = -.30$, $p < .05$). For the flashbulb memories, there were several effects. Number of inconsistencies was correlated with whether the memory came initially as a coherent story and whether the memory came initially in pieces ($r = -.32$, $p < .05$, and $r = .36$, $p < .01$, respectively); these results are consistent with the intuition that with less initial coherence and more initial fragmentation, one finds greater inconsistencies later. Contrary to what the literature suggests should be the case (Christianson, 1992; Pillemer, 1984, 1992; Reisberg, Heuer, McLean, & O'Shaughnessy, 1988), no initial ratings, including measures of emotion, correlated with later consistency. Belief at the delayed test was correlated with initial measures of visceral ratings ($r = -.31$, $p < .05$) and with whether the memory came in pieces ($r = -.35$, $p < .05$), was remembered versus known ($r = .45$, $p < .001$), was specific to the participant's own life ($r = .33$, $p < .05$), and was often rehearsed ($r = .29$, $p < .05$). Initial visceral response to the flashbulb event was significantly correlated with higher ratings on the PCL-S ($r = .48$, $p < .001$), the measure of PTSD symptoms we used. Initial valence rating for flashbulb memories was also significantly correlated with PCL-S scores ($r = -.28$, $p < .05$). Taken together, these results indicate that the more negative the initial reaction, and the more that reaction is felt viscerally, the more PTSD symptoms one will display later.

DISCUSSION

Our design enabled us to draw new conclusions about flashbulb memories because we began testing within 1 day of the flashbulb memory event and then tested each group only once after that, spacing the intervals for the different groups to determine the time course for forgetting. The relative immediacy of the initial report allowed us to see the emergence of inconsistent reports in a way that initial reports obtained well after the event may not (Winningham, Hyman, & Dinnel, 2000). We found a roughly logarithmic decline in consistent details over time for both flashbulb and everyday memories. Our design also eliminated most of the concerns associated with retesting because the 1-week, 6-week, and 32-week groups were independent, so those participants at the longest retention interval did not benefit from forced rehearsal due to repeated testing.

Brown and Kulik (1977) introspected, "What else can one remember from 1963?" (p. 74), and assumed that their participants' memories were accurate. They then focused on explaining this increased accuracy, not on empirically testing whether their assumption was accurate. We were not the first to attempt to verify this assumption. However, earlier studies did not time-match the everyday event with the flashbulb event (Christianson, 1989; Larsen, 1992), did not comparably cue the everyday and flashbulb events (Christianson, 1989), did not obtain an initial report soon after the flashbulb event occurred (Christianson, 1989), did not compare the flashbulb memory with another autobiographical memory (Bohannon, 1988; Bohannon & Symons, 1992), compared the flashbulb memory with memory for an everyday event that participants were instructed to encode especially well (Weaver, 1993), or used only the researcher as a subject (Larsen, 1992). Weaver (1993) compared consistency and confidence in accuracy for a flashbulb memory and memory for a specially encoded everyday event, and reported results similar to ours.

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Another property of flashbulb memories often considered crucial is emotion. In the present study, neither visceral nor emotional ratings related to consistency, as one would have expected from previous literature. However, of all the emotion variables, only visceral ratings correlated with later belief in the accuracy of the flashbulb memories. Presumably, on-line physiological measures would be the best predictors of later belief in the accuracy of flashbulb memories, but even self-ratings of visceral responses were more predictive than were straightforward evaluations of intensity for flashbulb memories. Because this was the first flashbulb memory study we know of to ask about visceral reactions, including other measures of visceral reaction would be a useful addition for future experiments.

We have no evidence that any of our participants suffered PTSD as a result of the events of September 11. Nonetheless, our results may be relevant to the literature on PTSD. First, we found that of the measures taken 1 day after the event, ratings of visceral reactions best predicted PTSD symptoms at the delayed session, suggesting that a fear reaction may be crucial to developing PTSD symptoms. Second, we found that the stressful event was rated as more coherent than the everyday event through all intervals, counter to what most people would expect for a potentially traumatic event (Berntsen et al., in press).

The dissociation between belief in the accuracy of memory and consistency of memory that we found in flashbulb memory reports is not uncommon. McCloskey, Wible, and Cohen (1988); Neisser (1982); Neisser and Harsch (1992); Weaver (1993); Wright (1993); and Schmolck et al. (2000), among others, have all discussed the inconsistencies and errors in flashbulb memory reports. Nor is the association of vividness with belief uncommon. Neisser and Harsch (1992) found that although confidence and accuracy were not related, confidence and imagery were. Johnson and Raye (1981) theorized that individuals rely on the presence of perceptual details to make metamemory judgments accurately. Bell and Loftus (1989) found that including even a small number of seemingly insignificant details will increase the perceived accuracy of a verbal report. Brown and Kulik's (1977) approach provides an example of the frequent confusion of confidently reported stories that include lots of details with objectively accurate memories. The phenomenon they wanted to investigate was the seeming "live quality that is almost perceptual" (p. 74) that is instantly and permanently stored in memory. They assumed accuracy and did not test for consistency.

Our most consistent finding is that a flashbulb event reliably enhances memory characteristics such as vividness and confidence. The true "mystery," then, is not why flashbulb memories are so accurate for so long, as Brown and Kulik (1977) thought, but why people are so confident for so long in the accuracy of their flashbulb memories.

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