

Personal Memories for Remote Historical Events: Accuracy and Clarity of Flashbulb Memories Related to World War II

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One hundred forty-five Danes between 72 and 89 years of age were asked for their memories of their reception of the news of the Danish occupation (April 1940) and liberation (May 1945) and for their most negative and most positive personal memories from World War II. Almost all reported memories for the invasion and liberation. Their answers to factual questions (e.g., the weather) were corroborated against objective records and compared with answers from a younger control group. The older participants were far more accurate than what could be predicted on the basis of results from test–retest studies using short delays. The “permastore” metaphor (Bahrick, 1984) provides a possible interpretation of this discrepancy. Participants with reported ties to the resistance movement had more vivid, detailed, and accurate memories than did participants without such ties. Ratings of surprise and consequentiality were unrelated to the accuracy and clarity of the memories.

Early in the morning of April 9, 1940, numerous squadrons of German planes were flying above Denmark at a low altitude, making horrible noise, and dropping not bombs but leaflets announcing that German troops had crossed the Danish border and that Denmark was “under German protection.” Denmark surrendered with almost no resistance. Five years later, on May 4, 1945, at 8.35 P.M., the Danish speaker at Radio London (BBC broadcasting to Denmark) interrupted his normal reading of the news to cite a telegram from Montgomery’s headquarters stating that the German troops in Holland, Northwest Germany, and Denmark had surrendered. Most people immediately went out to share and to celebrate the news. The dark shades that the Germans had demanded should cover all windows at night were torn down and burned in the streets, and candles were lit in many windows.

How much do Danes who were alive during these two significant news events remember from them? Do they remember their personal context for the reception of the news vividly and with many accurate details even after 60 years, as one might assume on the basis of Brown and Kulik’s (1977) theory of flashbulb memories? To address this question, we compared our older partici-

pants’ responses against historical data and against answers from a younger control group who did not live through these events. Such an archival method with a control group has never been used before in flashbulb memory research.

In addition, we studied the accuracy and clarity of the memories as a function of emotional and social factors. We examined whether participants who reported ties to the Danish resistance movement during World War II had more vivid and accurate memories than did participants who reported no such ties (e.g., Conway, Anderson, Larsen, & Donnelly, 1994). We also studied the possible effects of public commemoration (Frijda, 1997) and emotional valence by comparing memories of the two public events with participants’ self-chosen most positive and most negative personal memories from the time of the occupation. Finally, we examined the prevalence of intrusive memories from the time of the war in relation to characteristics of the previously mentioned four memories and measures of possible effects of the German occupation on participants’ current identity and well-being (e.g., Talarico & Rubin, 2003; Qin et al., 2003). In the following section, we offer a more detailed review of the relevant literature.

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Accuracy of Flashbulb Memories as a Function of Retention Time

Brown and Kulik (1977) defined flashbulb memories as vivid and detailed memories for the personal context for the reception of consequential and surprising news, such as the assassination of President Kennedy in 1963. It is debatable whether their concept of flashbulb memories was intended to imply that the memories were accurate (e.g., N. J. Cohen, McCloskey, & Wible, 1990; Pillemer, 1990; Thomsen & Berntsen, 2003). However, a principal aim of most flashbulb memory studies has nevertheless been to study accuracy, operationalized as consistency between two memory descriptions, one given immediately after the news event and another after a certain delay (Bohannon & Symons, 1992; Christianson, 1989; Christianson & Engelberg, 1999; G. Cohen, Conway, & Maylor, 1994; Conway et al., 1994; Curci, Luminet,

Finkenauer, & Gisle, 2001; Er, 2003; Hornstein, Brown, & Mulligan, 2003; Lee & Brown, 2003; McCloskey, Wible, & Cohen, 1988; Nachson & Zelig, 2003; Neisser & Harsch, 1992; Neisser et al., 1996; Pillemer, 1984; Schmolck, Buffalo, & Squire, 2000; Smith, Bibi, & Sheard, 2003; Talarico & Rubin, 2003; Tekcan, Ece, Gülgöz, & Er, 2003; Weaver, 1993; Winningham, Hyman, & Dinnel, 2000). None of these studies were designed to measure accuracy after a delay of several decades. First, the longest delay used in any of these studies is 3 years (Bohannon & Symons, 1992; Neisser & Harsch, 1992) or close to 3 years (Schmolck et al., 2000). Second, most studies have included only one retest trial. Although some studies have included a second retest trial, the majority of such studies (Hornstein et al., 2003; Neisser & Harsch, 1992; Tekcan et al., 2003; Weaver, 1993) have retested the same participants twice. Thus, performance at the second retest trial may have been inflated by a rehearsal effect deriving from the first retest trial. Third, different test delays and different measures of consistency have been used, complicating generalizations.

Given these concerns, Schmolck et al. (2000) provide the most systematic study of accuracy after relatively long delays, because this study involved two retest trials that were separated from the event and from one another by relatively long time intervals, and each involved a different group of participants (sampled from the same undergraduate population). More specifically, 222 students described their memories of the O. J. Simpson verdict 3 days after the event. Twenty-eight students were retested after 15 months and another 35 participants were retested after 32 months. The two groups were matched with respect to emotional reactions, interest in the trial, rehearsal of the verdict, agreement versus disagreement with the verdict, and whether they had learned the news from the media. Among the participants tested after 15 months, 50% were highly accurate; after 32 months, only 29% were highly accurate. At the same time, the number of clearly inconsistent accounts rose from 11% to 40%.

Schmolck et al.'s (2000) findings show a rapid loss of accuracy over the first 32 months that can be described as an exponential decline. Conceptually, following an exponential function, retention is reduced by 50% each time a certain time interval—called the half-life—has passed. An exponential function is one of the most widely used retention functions. In many studies, retention is simply assumed to follow an exponential decline (Rubin & Wenzel, 1996). Because an exponential decline describes Schmolck et al.'s main findings, and because exponential functions have been found to offer good empirical descriptions of retention in studies measuring recall accuracy (e.g., Rubin, Hinton, & Wenzel, 1999), we use this function here when extrapolating data from the short-term studies in an attempt to project the level of accuracy to be expected at a long-term scale. Two studies have used delays of around 3 years. Neisser and Harsch (1992) found a consistency rate of 42% after 32–34 months, which dropped to 39% when the same participants were tested again 6–7 months later. Bohannon and Symons (1992) reported a consistency score of 45% (averaged across their *upset* and *calm* groups) in their retest after approximately 3 years. Given these results, we conservatively assume a half-life of 3 years for the exponential decline. Conceptually, this means that the level of accuracy existing at any time is cut by a half each time an additional 3 years have passed. Thus, accuracy would be reduced to 50% after 3 years, 25% after 6 years, 12.5% after 9 years, and so forth, yielding an accuracy score of less than

1% after 21 years. Figure 1 illustrates this prediction. The actual scores from Bohannon and Symons (1992), Neisser and Harsch (1992), and Schmolck et al. (2000) plotted in Figure 1 suggest that our prediction is conservative.

Following the prognosis depicted in Figure 1, no accuracy should be detectable after 50–60 years. This agrees with the skepticism that many scholars have expressed concerning the maintenance of flashbulb memories over time (e.g., Neisser & Harsch, 1992; Schmolck et al., 2000; Talarico & Rubin, 2003), and it is also supported by studies showing that the accuracy of flashbulb memories declines at the same rate as the accuracy of memories for a mundane control event when measured within a year of the event and when the control event has distinct cues (Talarico & Rubin, 2003; Weaver, 1993).

However, it is not evident that the retention of flashbulb memories over several decades can be predicted from studies using intervals of 1–3 years, because retention over short- and long-term intervals may have different properties (e.g., Rubin et al., 1999; Rubin & Wenzel, 1996). For example, a study on very long-term memory for semantic information using a cross-sectional design with a maximum delay of 50 years (Baird, 1984) demonstrated exponentially declining retention curves for the first 3 to 6 years, followed by a 30-year period with virtually no decline. Baird (1984) coined the term *permastore* to refer to the relatively stable maintenance of knowledge after the first 3–6 years in memory. With respect to flashbulb memory research, one important implication of Baird (1984) is that the rapid loss of accurate details demonstrated in many studies using delays up to 3 years need not predict performance after several decades.

How can memory accuracy be tested several decades after the events, as is our purpose in the present study? Because no initial memory record was obtained shortly after the events in question, the test–retest method is excluded. An alternative method is to compare memory reports with independent information about the original events, such as that found in field and archival studies of eyewitness testimony. In such studies, eyewitness reports obtained after a crime are compared against independent records stemming from various sources, such as police reports, films or video records, photographs, and/or other witnesses (e.g., van Koppen &

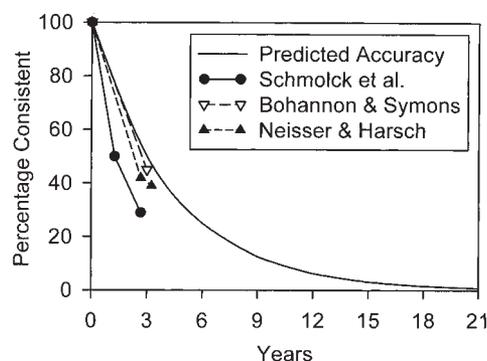


Figure 1. The predicted exponential decline in accuracy over 21 years based on flashbulb memory studies with retest delays around 3 years. Retest scores from Bohannon and Symons (1992), Neisser and Harsch (1992), and Schmolck et al. (2000) are plotted to illustrate the basis of the prediction.

Lochun, 1997; Yuille & Cutshall, 1986). Here, we extend this method to study flashbulb memories for remote historical events in ways we describe in more detail later.

Very few studies have compared the content of very long-term emotional memories against independent records. We have been able to identify two studies in which this was done. Both studies show substantially higher scores for accuracy than what one would expect on the basis of the test–retest studies of flashbulb memories using intervals of a few years. Wagenaar and Groeneweg (1990) reported findings from an archival study of statements (obtained by police and judges) from 78 survivors of the World War II concentration camp Erica in Holland. Some of the statements could be compared against statements given during an investigation 40 years earlier, others only against official documents. The witnesses were not asked the same questions, which made systematic comparisons difficult. The authors reported high degrees of agreement among the survivors as to descriptions of punishment, meals, roll calls, and brutality against Jews. Seventeen of 30 witnesses accurately remembered their date of arrival at the camp, and 16 out of 30 accurately remembered their registration number. Although errors were observed, the authors concluded, “There is no doubt that almost all witnesses remember camp Erica in great detail, even after 40 years” (Wagenaar & Groeneweg, 1990, p. 84).

Schelach and Nachson (2001) asked five survivors from Auschwitz a series of questions about life and death in the camp. Questions were generated from two documentary books about the extermination camp that contained detailed testimonies by camp survivors and liberators and documentation left by fleeing Nazis. The questions addressed both emotional events, such as roll call and death, and more neutral events, such as food, housing, and sanitation. The percentage of accurate answers was calculated for each person and ranged from 53% (for the person who was only 6 years old at the time and had only stayed in the camp for 2 months) to 69% (for a person was 17 years old at arrival and had stayed in the camp for the longest time, i.e., more than 2 years). Accuracy was higher for emotional than for neutral events (71% vs. 52%). As was the case in Wagenaar and Groeneweg’s (1990) study, most of Schelach and Nachson’s (2001) questions referred to knowledge of repeated events rather than unique episodes. However, a few questions addressed a specific episodic memory, namely, “the moment the train arrived at the camp until the inmates received their clothes and numbers were tattooed on their arms” (the absorption procedure; Schelach & Nachson, 2001, p. 123). Accuracy scores for this specific event ranged from 0% to 100%, with a mean of 56% (lowest for the person who was 6 years old at arrival).

One problem with field and archival studies is that it is generally impossible to establish exactly which details witnesses observed and paid attention to during the event. Low accuracy scores on the color of a bank robber’s shoes may reflect lack of attention to this particular feature during the time of the event rather than lack of memory (e.g., van Koppen & Lochun, 1997). Another problem is the absence of a control group. It is thus not clear how much of the information offered by the witnesses could be provided by people who were not present during the event but were simply guessing or making inferences based on general knowledge. Notably, in the studies of the memories for concentration camp experiences, some of the answers given by the survivors might derive from historical

sources rather than from personal memory (Schelach & Nachson, 2001).

To overcome these problems, we examined the accuracy of our participants’ memories for receiving the news about the invasion and liberation by addressing information related to the personal context that could hardly have been overlooked by anybody on the day of the event (e.g., the weather and activities that had to be carried out on the exact day), and we recruited a knowledgeable control group of younger people who were not alive during any of the events or were at most 2 years old during the liberation. Because neither *field* nor *archival* seem to designate this method very well, we will label it *documentary* in the following text. This method is a new strategy in flashbulb memory research, enabling the study of flashbulb memories for remote historical events. A few other flashbulb memory studies have examined the accuracy of factual information but only information related specifically to the news event itself (e.g., Bohannon, 1988; Curci et al., 2001; Finkenauer et al., 1998; Larsen, 1992; Nachson & Zelig, 2003), not information related to the personal context, such as the weather, and not with the inclusion of a control group. Although Bohannon and Symons (1992) asked questions probing information present in the personal context, such as the weather, they did not examine the accuracy of the answers against objective records.

Social and Emotional Factors Related to Flashbulb Memories

In contrast to later studies, Brown and Kulik (1977) did not address possible effects of retention time on flashbulb memories. Once formed, the flashbulb memory would always be available, “unchanging as the slumbering Rhinegold” (p. 86), according to their account. Retention time was of little relevance, because social and emotional factors determined the development of flashbulb memories already at the time of encoding. Crucial factors were critical (but nonspecified) levels of surprise and consequentiality. To support their claims, Brown and Kulik showed markedly higher frequencies of flashbulb memories among African Americans as compared with White Americans for the news of the assassination of four political leaders engaged with questions of civil rights. These differences were matched by generally higher ratings of consequentiality among African Americans for the same four events. Surprise was not measured but it was nevertheless claimed to be decisive: “The registration of surprise and unexpectedness in the central nervous system is the first step and the *sine qua non* of all else” (Brown & Kulik, 1977, p. 84).

Other studies have supported the claim that membership in much affected social groups is associated with better memory performance. For example, in Conway et al.’s (1994) study of Thatcher’s resignation, 86% of the U.K. participants had highly accurate memories 1 year later, versus 29% of the non-U.K. participants (for similar findings, see Curci et al., 2001). Two studies of memories for earthquakes found highly accurate memories 1 year later among participants who had stayed in the earthquake area during the event in contrast to participants who had merely heard about the earthquake through the media (Er, 2003; Neisser et al., 1996). Findings on accuracy are matched by studies showing similar systematic group differences related to the phenomenal qualities of the memories (e.g., Gaskell & Wright, 1997; Kvavilashvili, Mirani, Schlagman, & Kornbrot, 2003). Here,

we address the effect of group membership by comparing memories between participants with and without reported ties to the Danish resistance.

Several studies have found a positive correlation between accuracy and the emotional intensity associated with the event (e.g., Bohannon & Symons, 1992; Conway et al., 1994; Er, 2003; Hornstein et al., 2003; Pillemer, 1984; Schmolck et al., 2000). Some findings from field studies of eyewitness testimony also show a positive relation between accuracy on the one hand and level of personal and emotional involvement in the events concerned on the other (e.g., Christianson & Hubinette, 1993; Yuille & Cutshall, 1986). Possible effects of positive versus negative emotions are less studied. We have been able to identify two studies that systematically compare flashbulb memories for positive and negative news events. Scott and Ponsoda (1996) compared their participants' memories for 10 positive and 10 negative news events chosen from within the same 10-year period and matched pairwise on year. Tekcan (2001) compared students' memories for their reception of the news of the beginning of the Gulf War and the news that they had been accepted to college. In both studies, the positive and negative events were equally likely to form flashbulb memories. However, in the former study, the positive and negative events may not have been sufficiently matched on other variables, such as emotional intensity (Wright & Anderson, 1996), and in the latter study, the distinction between the positive versus the negative event coincided with a distinction between a private versus a public event, respectively.

The invasion of Denmark is described as highly distressing and the liberation as very happy in almost all accounts (Kirchhoff, Lauridsen, & Trommer, 2002). Therefore, the two events together afford an analysis of effects of negative versus positive valence for two thematically related public events. We also compare participants' self-chosen most positive and most negative personal memories from the war period so we may examine whether these memories show a pattern similar to that of the two public events with respect to possible effects of valence, and, further, so we may examine possible differences between memories for public and private events from the same time period. Comparisons of memories for public and private events are rare in the flashbulb memory literature (Rubin & Kozin, 1984), although part of Brown and Kulik's (1977) original work was on this topic. From a culturally oriented perspective emphasizing the role of commemoration (Frijda, 1997; Pennebaker & Banasik, 1997), we should expect a memory advantage of the two public events relative to the two personal events, irrespective of the valence of the events, due to more (public) rehearsal of the former than the latter.

Finally, although the Second World War involved massive bombings and shootings of civilians, little is known about the possible effects of these experiences on the broader population of aging survivors from World War II (Bramsen & van der Ploeg, 1999). Here, we examine intrusive memories of the time of the occupation. Intrusive memories are generally viewed as an important signpost of posttraumatic stress reactions (e.g., Harber & Pennebaker, 1992), but their underlying mechanisms are not well understood (e.g., Berntsen & Hall, 2004). What would predict intrusive memories of World War II events 58 years after the war had ended? According to Horowitz (1975, 1986), intrusive memories reflect an inability to integrate a stressful experience into the overall knowledge base of the person, leading to a fluctuation

between intrusions and attempts at avoiding reminders of the event. Alternatively, Berntsen, Willert, and Rubin (2003) and Berntsen and Rubin (in press) argued that intrusive memories and other posttraumatic stress reactions may reflect a dysfunctional integration of the traumatic memory so that the trauma memory becomes a central component of the person's identity and life story and a reference point for the attribution of meaning to other experiences. In two recent studies, researchers have examined whether intrusive memories of a stressful event are related to the same person's voluntary autobiographical memories of the same stressful event (in both cases, the terrorist attacks on the World Trade Center on September 11, 2001). Qin et al. (2003) found that vividness of the autobiographical memory when recalled voluntarily was positively correlated with both frequency and vividness of intrusive thoughts about the event 1 month after the attack. Talarico and Rubin (2003) found that ratings of visceral responses to the memory of the attack were positively correlated with posttraumatic stress symptoms (including intrusive memories) measured at a delayed test. Here, we examine whether similar relationships exist between intrusive memories and characteristics of autobiographical memories from the time of the occupation.

Method

Participants

The study involved 145 older Danes (mean age 77.3 years, range 72–89 years; 78 women). The majority were recruited with the help of a subject pool of older Danes between 72 and 87 years in age, representative of the general population of older Danes on major sociodemographic variables, from a different research project in health psychology (e.g., Thomsen et al., 2003). A total of 278 questionnaires were sent out. Twelve were returned by the mail service because of delivery failure. Among the remaining 266, 128 (48%) were answered and returned. Five were not included because they were returned too late, not answered, or answered in a form that was not usable. Several of those who did not return the questionnaire called us on the phone and explained that they were unable to fill it in because of problems with reading or writing and not because of a lack of autobiographical memories from the time. An additional set of 50 questionnaires was distributed through an association serving the welfare of older Danes. Of those, 24 (48%) were returned. Data from 2 were not included, because the participants were less than 72 years old. For the purpose of testing baseline accuracy, we included a control group of 65 faculty members, staff, and psychology majors from Aarhus University, Denmark (mean age 34.4 years, range 20–60 years; 46 women).

Design and Questionnaire

The data were collected in 2003. Participants were asked for their memories of four different events from the period of the war (in randomized order): (a) the invasion, (b) the liberation, (c) their most positive personal memory, and (d) their most negative personal memory. Specifically for the invasion and the liberation, they were asked if they remembered where they were and what they were doing when they first learned the news. If yes, they were then asked to describe their personal context for receiving this news and to include as many details as possible. Likewise, they were asked for detailed descriptions of their most positive and most negative memories from the war. To ensure comparability, we told participants that their most positive and most negative memories should refer to specific events—that is, events that had lasted, at most, 1 day. (For ethical reasons, we specified that if participants found their most positive or most negative private memory too hard or too intimate to report, they could

replace it with a milder alternative. Fourteen and 12 participants indicated that they had done so for their most positive and their most negative memories, respectively).

After the descriptions, the participants answered a series of questions on memory characteristics that were identical for all for four classes of memories. These questions are presented in Table 1. Questions 1–11 address the amount and type of reliving and belief associated with the memory—both central characteristics of autobiographical memory (Brewer, 1996). Similar questions have been used in previous studies of autobiographical memory (e.g., Rubin, Schrauf, & Greenberg, 2003). Questions 12–21 address rehearsal and characteristics of the remembered event and are rated retrospectively, a common strategy in research on autobiographical memory. All questions were rated on 5-point scales, with each scale point labeled both verbally and numerically. On the last pages of the questionnaire, participants were asked seven questions related to the time of the German occupation in general and its possible long-term effects on their personal life and present well-being. Data for the following four questions will be reported here:

Avoidance: “There are memories from that time that I try to avoid thinking about.” (1 = *totally disagree*; 5 = *totally agree*)

Scar: “It is fair to say that the time of the German occupation has left a permanent scar on my soul.” (1 = *totally disagree*; 5 = *totally agree*)

Intrusive memories: “Memories from the time of the German occupation tend to spontaneously pop into my head, even though I would rather not think about them.” (1 = *never*; 5 = *very often*)

Dreams: “At night I may still dream about experiences from the time of the occupation.” (1 = *never*; 5 = *very often*)

Three questions, derived from the Centrality of Event Scale (Berntsen & Rubin, in press), addressed the extent to which the time of the occupation was seen as central to the person’s life story and personal identity:

Identity: “I feel that the time of the occupation has become part of my personal identity.” (1 = *totally disagree*; 5 = *totally agree*)

Reference point: “The time of the occupation is a reference point for

Table 1
Questions Answered on 5-Point Scales for All Four Classes of Memories

No. and variable	Question	Anchors
1. Vividness	When I recollect [event in question], I remember it quite vividly.	1 = <i>not at all</i> , 5 = <i>as clearly as if it happened now</i>
2. Travel in time	When I recollect [event in question], it is like I am “traveling back in time.”	1 = <i>not at all</i> , 5 = <i>as clearly as if it happened now</i>
3. Reexperience	When I recollect [event in question], it is like I am reexperiencing it all.	1 = <i>not at all</i> , 5 = <i>as clearly as if it happened now</i>
4. Valence now	The emotions I feel when I recollect [event in question] are . . .	1 = <i>extremely negative</i> , 5 = <i>extremely positive</i>
5. Intensity now	The emotions I feel when I recollect [event in question] are . . .	1 = <i>not at all intense</i> , 5 = <i>very intense</i>
6. Belief	I believe that [event in question] really took place the way I remember it and that I have not unwittingly added anything that did not take place.	1 = <i>totally disagree</i> , 5 = <i>totally agree</i>
7. Visual reliving	When I recollect [event in question], I see with my mind’s eye what took place.	1 = <i>not at all</i> , 5 = <i>as clearly as if it happened now</i>
8. Auditory reliving	When I recollect [event in question], I hear the sounds that are connected with the memory.	1 = <i>not at all</i> , 5 = <i>as clearly as if it happened now</i>
9. Olfactory reliving	When I recollect [event in question], I sense the smell and taste impressions that are connected with the memory.	1 = <i>not at all</i> , 5 = <i>as clearly as if it happened now</i>
10. Bodily reliving	When I recollect [event in question], I feel the bodily sensations that are connected with the memory.	1 = <i>not at all</i> , 5 = <i>as clearly as if it happened now</i>
11. Physical	When I recollect [event in question], I have a physical reaction (e.g., palpitations, feeling restless, tense, sweating, tears, laughter).	1 = <i>not at all</i> , 5 = <i>as clearly as if it happened now</i>
12. Talked about	How often have you talked to others about [event in question]?	1 = <i>never</i> , 5 = <i>very often</i>
13. Thought about	How often have you by yourself thought about [event in question]?	1 = <i>never</i> , 5 = <i>very often</i>
14. Involuntary	How often has the memory [event in question] suddenly popped into your mind without your trying to remember it?	1 = <i>never</i> , 5 = <i>very often</i>
15. Cuing other	Does your memory of [event in question] remind you of other memories from the time of the war?	1 = <i>none</i> , 5 = <i>very many</i>
16. Importance	How important did [event in question] appear to be when it happened?	1 = <i>insignificant</i> , 5 = <i>very important</i>
17. Surprise	How surprising was [event in question] when it took place?	1 = <i>not at all surprising</i> , 5 = <i>very surprising</i>
18. Valence then	How emotionally positive/negative/neutral did [event in question] appear to be when it took place?	1 = <i>extremely negative</i> , 5 = <i>extremely positive</i>
19. Intensity then	How intense were your emotions when it took place?	1 = <i>not at all intense</i> , 5 = <i>very intense</i>
20. Immediate changes	How many immediate changes did [event in question] cause for you and your surroundings when it took place?	1 = <i>none</i> , 5 = <i>very many</i>
21. Long-term consequences	How many long-term consequences did [event in question] have for you and your life?	1 = <i>none</i> , 5 = <i>very many</i>

Note. Participants were encouraged to give brief verbal examples to Questions 15, 20, and 21.

my understanding of myself and the world around me.” (1 = *totally disagree*; 5 = *totally agree*)

Connections: “In my daily life, I may suddenly see connections and similarities between experiences in my current life and experiences from the time of the occupation.” (1 = *totally disagree*; 5 = *totally agree*)

In addition, participants were asked to indicate whether they themselves or somebody close to them had (a) had financial or social ties with the German occupying power, (b) joined the Danish resistance movement, (c) been part of the Jewish community, or (d) volunteered for the German army. (Very few indicated a, c, or d. Our analysis on group effects will therefore concentrate on b.) Also, they were asked to indicate where in the country they lived on the day of the invasion and the day of liberation.

For the two public events, both the older participants and the younger control group were asked a series of questions on factual details that could be corroborated against historical data. (The younger control group was given the exact same questions in a short questionnaire titled “Historical Details From World War II” that was distributed only to them.) Four questions for each of the two events were directly related to the personal context for the reception of the news about the invasion and the liberation. The information needed to answer these questions was present in the personal environment on the day concerned, and there is little chance that anybody alive that day would have been unaware of this information at the time. For both days, participants were asked to describe the weather; they were also asked whether it was a workday or a Sunday and, if a workday, which day of week it was. For the invasion, they were also asked to provide the date for the requirement for dark shades. (This requirement was announced immediately by the occupying power and was effective that same evening; it therefore caused a lot of activity both in private homes and at public places.) For the liberation, they were also asked for the time of the radio announcement of the German capitulation. (Immediately after this announcement, many people went out and the news quickly spread to people who had not themselves heard it on the radio.) Response options were offered only for questions related to the day of the week.

Four questions (two for each event) addressed historical facts. They did not relate directly to the personal context for the reception of the news, and we therefore expected the differences between the older participants and the control group to be smaller on these questions. The information needed to answer the questions may have gone unnoticed at the time of the event and/or relates more to the news itself than to the reception context. This information is mentioned in many historical accounts of the events. Participants were asked who was the Danish prime minister at the time of the invasion (no response options were offered), which two adjectives were used by the Danish king in his description of the expected behavior of the Danish people on the day of the invasion (18 options were provided), when the German capitulation officially came into force (no response options were given), and which other countries the German capitulation on May 4, 1945, had included¹ (no response options were given). Participants were asked to answer the questions without consulting other people or historical sources and simply respond “do not know” if they did not know the answer.

Scoring of the Data

Weather. The weather descriptions provided by the participants for April 9, 1940, and May 4, 1945, were compared against weather data provided by the Danish Meteorological Institute that had been derived from 11 weather stations, which were distributed across the country. Each participant’s description of the weather was evaluated against the weather report from the weather station nearest to this participant’s location at the time. Two independent judges scored the data in the following way. They first assessed how many of six descriptive elements each description contained. The six elements were (a) global evaluation (e.g., “nice weather”), (b) wind, (c) temperature, (d) clouds, (e) precipitation, and (f)

change over time. Second, the accuracy of the descriptions was scored as either incorrect, a mixture of correct and incorrect elements, or correct. Correctness was defined as generally consistent with the independent weather data. Furthermore, in some genres of poetry, internal states often become projected into descriptions of outer circumstances, such as the weather (Jørgensen, 2001). To see if weather descriptions were twisted in either a positive or a negative direction compared with the independent weather data, all of the descriptions were classified as either positively biased (more sun, less clouds, less wind, less rain, warmer than the actual weather, and/or held in an idealistic rosy tone), negatively biased (the reverse of positively biased), or not biased. The two raters agreed on 87.7% of the cases for number of descriptive elements, 88.8% for correctness, and 93.1% for bias. Cases with disagreement were decided either by discussion or by including scores from a third independent rater.

Canonical categories. The memory reports were scored for the presence of the following categories: ongoing activity, information source, location, own affect, other affect, aftermath, and other persons. The first six mentioned categories were identified by Brown and Kulik (1977). We added the category of other persons because this category appeared to be implied by Brown and Kulik’s scoring system by the scoring of other affect. Two independent judges scored the memory reports for the presence of the categories. The categories were scored as present only if they were reported as part of the target event, that is, if they were part of the memory description for the day of the invasion or the liberation, except for aftermath, which could refer to other information. Ongoing activity was scored as present if the participant had reported what he or she was doing when he or she received the news. Information source was scored as present if it was mentioned how the participant found out about the invasion or liberation, such seeing the German planes or hearing the news from a relative. Location was scored as present when there was an explicit mention of a place or if other reported information clearly indicated the location. Other persons were scored as present if they were mentioned specifically by name, title, or role (e.g., “Erik and Grethe,” “my teacher,” or “my husband”) but not if referred to as a relatively anonymous group (e.g., “many people”). Own and other affect were scored as present if there was a clear indication of affect in the report but not if the report merely had a general positive or negative affective tone. Aftermath was scored as present if the participant mentioned what happened after the reception of the news. In addition, we examined whether the reports contained irrelevant details, because Brown and Kulik (1977) pointed out that such information was typical for flashbulb memories. Irrelevant detail was scored as present if the memory report contained details that were deemed to be vivid and peripheral to the central plot, such as descriptions of clothes or quotations of specific utterances. The two judges agreed on 90.5% of the categories. Disagreements were resolved by discussion.

Results

Almost all of the participants (97.2%) reported that they remembered where they were and what they were doing when they first realized that Germany had invaded Denmark on April 9, 1940, and almost all (95.9%) remembered when they first heard about the German capitulation on May 4, 1945. For each of the two events, 138 (95.2%) provided open-ended descriptions of the reception context. Fewer participants reported memories for the two private events: 85.5% reported a most negative memory and 77.1% reported a most positive memory from the period of the occupation. Many of those who did not report a memory for the two personal

¹ The countries were Holland and Northwest Germany. Northwest Germany was a region in Germany defined by the Allied troops at that time. For this question to be scored as correct, participants had to mention Northwest Germany and not just, for example, North Germany.

events indicated that they had no personal memories of specific events from the period of the German occupation.

For each of the two public events, 95% of the memory reports fulfilled the minimum criterion for a flashbulb memory, as defined by Brown and Kulik (1977): The participant confirmed having a memory for the reception context, and his or her open-ended descriptions contained at least one canonical category (most contained several, as we show later). In addition, most of the memory descriptions contained irrelevant details, 68% for the invasion and 71% for the liberation ($p > .5$). The descriptions of the reception contexts were generally informative and detailed for both events, as illustrated by three characteristic examples for each event in the Appendix.

Accuracy

In this section, we present findings on the accuracy of the performance of the older participants (called the *war group* in the following text) on questions about factual details asked for each of the two public events in comparison with the performance of the control group.

Context-related questions. Table 2 shows that more participants in the control group gave no answers² to the weather question, whereas the large majority of the participants in the war group provided a description of the weather ($ps < .00001$). Among participants who gave an answer, the number of correct versus wrong or mixed answers differed significantly between the war group and the control group for both the invasion, $\chi^2(1, N = 134) = 19.94, p < .0001$, and the liberation, $\chi^2(1, N = 134) = 8.69, p < .005$. Of those who answered, the mean number of weather elements mentioned in the war and control groups did not differ for the invasion, $Ms = 1.72 (SD = 0.85)$ versus $1.52 (SD = 0.52)$, respectively, $t(132) < 1.0$, or for the liberation, $Ms = 1.75 (SD = 0.82)$ versus $1.22 (SD = 0.97)$, respectively, $t(132) = 1.85, p = .06, \eta^2 = .03$. Thus, among those who answered, the war group did not provide more comprehensive descriptions than the control group did, just more correct descriptions.

The frequency with which weather descriptions had a positive or negative bias varied systematically with the emotional valence associated with the event. In the war group, the weather descriptions of 31 participants (24.8%) were biased positively for the liberation versus 2 (1.6%) for the invasion. Similarly, the reports of 20 participants (16.4%) were biased negatively for the invasion

versus 0 for the liberation, $\chi^2(1, N = 53) = 45.26, p < .0001$. Participants whose weather descriptions were biased for the liberation also tended to rate their initial emotional reaction as more intense, $t(122) = 1.74, p < .09, \eta^2 = .02$. No similar trend was found for the invasion. In the control group, 3 of the 12 descriptions for the invasion had a bias (all negative), as did 2 of the 9 for the liberation (1 positive, 1 negative).

Table 3 shows the distribution of answers in the war and control groups to questions addressing whether the day of the invasion [liberation] was a workday or a Sunday, which day of the week the day of the invasion [liberation] was, and when the Germans demanded dark shades in all houses to block out light at night. The control group had considerably higher proportions of no answers for all questions compared with the war group (all $ps < .005$). Among the participants who answered the questions, the number of correct versus wrong answers was significantly higher in the war group than in the control group for four of the five questions, and a trend in the same direction was found for the remaining question (see Table 3). The analyses suffer from the fact that very few participants in the control group provided an answer to the questions on days of the week and dark shades. Alternatively, if the percentage of correct answers calculated on the basis of the total are compared, the war group showed clearly better performance on all questions (all $ps < .001$). Furthermore, as illustrated by Table 4, the distribution of erroneous answers to the weekday questions tended to cluster around the correct days in the war group but not in the control group (cf. Thompson, Skowronski, Larsen, & Betz, 1996).

As illustrated by Table 5, several participants in the war group provided the exact time of the announcement of the liberation (8.35 P.M., +/- 5 min), whereas none of the control group did so. Again, substantially fewer participants in the control group provided an answer, $\chi^2(1, N = 210) = 41.50, p < .00001$. Among those who answered, more answers in the war group were within the right hour (8–9 P.M., thus at most 35 min wrong) or at the exact time as compared to the control group, $\chi^2(1, N = 155) = 8.85, p < .01$. The distributions of the two groups as shown in Table 5 differed, $\chi^2(4, N = 210) = 58.83, p < .00001$.

We calculated a sum score for each event by adding all correct answers for the four questions within each person. (With respect to time of the announcement of the capitulation, all answers between 8 and 9 P.M. were classified as correct.) For the invasion, the mean sum was 2.26 ($SD = 1.18$) for the war group and 0.40 ($SD = 0.68$) for the control group, $t(208) = 11.79, p < .0001, \eta^2 = .40$. For the liberation, the mean sum was 2.16 ($SD = 1.12$) for the war group and 0.46 ($SD = 0.77$) for the control group, $t(208) = 11.19, p < .0001, \eta^2 = .38$. In short, for both events, on average, the war group had more than 2 correct answers out of 4 possible and performed roughly 5 times better than the control group.

Questions related to historical facts. As with context-related questions, more participants in the war group than in the control group suggested an answer to the four questions addressing historical facts (all $ps < .00001$). However, in contrast to the context-related questions, among those who answered the history-related questions, the number of correct versus wrong answers did not

Table 2

No, Wrong, Mixed, and Correct Answers About the Weather for the Time of the Invasion and Liberation Among Older Danes Who Lived Through the Occupation (the War Group, $n = 145$) and a Control Group ($n = 65$)

Answer	Invasion				Liberation			
	War		Control		War		Control	
	No.	%	No.	%	No.	%	No.	%
No answer	23	15.9	53	81.5	20	13.8	56	86.2
Wrong	11	7.6	3	4.6	12	8.3	2	3.0
Mixed	11	7.6	6	11.3	16	11.0	4	6.2
Correct	100	69.0	3	4.6	97	66.9	3	4.6

² Responses counted as no answers include "do not know" responses and a few blank responses in this and the following tables.

Table 3

Distribution of Correct, Wrong, and No Answers to Questions Related to the Days of Invasion and Liberation in the War and Control Groups

Questions	War group						Control group						Correct/ wrong χ^2
	Correct		Wrong		No answer		Correct		Wrong		No answer		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Sunday or workday, invasion	125	86.2	1	0.7	19	15.2	17	26.2	5	7.7	43	66.2	23.2****
Sunday or workday, liberation	113	77.9	3	2.1	29	20.0	18	27.7	7	10.8	40	61.5	20.2****
Day of the week, invasion	40	27.6	14	9.7	91	62.8	3	4.6	4	6.2	58	89.2	2.9††
Day of the week, liberation	33	22.8	19	13.1	93	64.1	2	3.0	7	10.8	56	86.2	5.3*
Dark shades demand	62	42.8	35	24.1	48	33.1	3	4.6	7	10.8	55	84.6	4.4*

†† $p < .09$. * $p < .05$. **** $p < .0001$.

differ between the war and control groups, except for one of the four questions: In response to the question addressing the king's words, the mean proportion of correct adjectives was higher in the war group ($M = .72$, $SD = .40$) than in the control group ($M = .48$, $SD = .42$), $t(168) = 3.15$, $p < .001$, $\eta^2 = .06$.

We calculated a sum score for historical facts within each person by adding all correct answers for the two questions related to each event, yielding a maximum score of 3 for each event (in that the questions regarding other countries included in the liberation and the king's words each had a maximum score of 2). For the invasion, the mean sum for the war group was 1.71 ($SD = 0.80$) and for the control group, 0.88 ($SD = 0.99$). For the liberation, the mean sum for the war group was 1.44 ($SD = 0.94$) and for the control group, 0.55 ($SD = 0.76$). The war group performed better on questions about both days, $F(1, 208) = 64.51$, $MSE = 1.03$, $p < .0001$, $\eta^2 = .24$. Both groups performed better on questions about the invasion, $F(1, 208) = 15.68$, $MSE = 0.50$, $p < .001$, $\eta^2 = .07$. No interaction was found ($p > .7$).

Comparing the context-related and history questions, the war group showed equally good performance on both with a hit rate of 0.55 ($SD = 0.24$) for context-related questions and 0.53 ($SD = 0.23$) for the history questions ($p > .2$). The control group did not perform very well on either of the two sets of questions. However, their hit rate for the context-related questions ($M = 0.11$, $SD = 0.15$) was only half their hit rate on the history questions ($M =$

0.24, $SD = 0.25$), $t(64) = 5.14$, $p < .0001$, $\eta^2 = .29$, showing that the latter were easier to answer for people who had not lived through the events.

Canonical Categories, Clarity, and Event Characteristics

Table 6 shows that memory reports for both the invasion and the liberation contained several canonical categories and were generally scored high on measures of vividness and reliving. Thus, both classes of memories appeared to satisfy the live quality criterion for flashbulb memories (Brown & Kulik, 1977, p. 74). At the same time, however, memories of the liberation were rated higher than memories for the invasion on all measures except auditory reliving and surprise, for which the invasion was higher, and vividness, belief, long-term consequences, and immediate changes, for which no differences were found. The higher scores on auditory reliving for the invasion can be explained in terms of the noise from the many German planes that filled the air. The fact that the invasion was scored higher on surprise but lower on almost all other measures of phenomenal qualities, including number of canonical categories, is contrary to Brown and Kulik's (1977) theory and later models on the formation of flashbulb memories (e.g., Finkenauer et al., 1998). Similarly, contrary to Brown and Kulik (1977), consequentiality (in terms of both long-term consequences and immediate changes caused by the event) did not differ between the invasion and the liberation.

One might argue that for participants who were only around 10 years old at the time of the invasion, the subsequent increase in

Table 4

Distribution of Responses to the Day of the Week Question for the Day of the Invasion and Announcement of Liberation in the War and Control Groups

Day of the week	Invasion		Liberation	
	War	Control	War	Control
Monday	6	1	3	0
Tuesday	40 ^a	3 ^a	4	3
Wednesday	6	1	3	1
Thursday	1	1	5	3
Friday	1	1	33 ^a	2 ^a
Saturday	0	0	4	0
Sunday	0	0	0	0

^a Correct answers.

Table 5

Distribution of Responses Regarding the Exact Time of the Capitulation Announcement (8:35 P.M.) in the War and Control Groups

Answer	War		Control	
	No.	%	No.	%
No answer	19	13.1	36	55.4
Outside evening, before 6 P.M.	7	4.8	10	15.4
Evening, outside 8–9 P.M.	50	34.5	12	18.5
Between 8–9 P.M.	46	31.7	7	10.8
8:35 P.M. (+/- 5 min)	23	15.9	0	0.0

cognitive and social maturity might explain why the liberation was remembered with more details and clarity. However, we were unable to find any indications of such developmental effects in the data. The age of the participant did not correlate significantly with any of the variables included in Table 6. Correlation coefficients ranged from $-.11$ to $.14$ (all $ps > .1$) for the invasion and from $-.16$ to $.11$ (all $ps > .1$) for the liberation. To further clarify this issue, we divided participants into an older (current age ≥ 77 years, $n = 73$) versus younger age group (current age 72–76 years, $n = 70$). A series of analyses of variance with age group as a grouping variable and memory scores for each variable in Table 6 as within-subjects measures with two levels (corresponding to scores for invasion and liberation) showed no main effects of or interactions with age group (all $ps > .1$) with only two exceptions: Bodily reliving and intensity then both showed a small interaction with age group in that the younger participants had slightly higher scores for the liberation and slightly lower scores for the invasion compared with the older participants, $F(1, 132) = 5.87, MSE = 0.61, p < .05, \eta^2 = .04$; and $F(1, 128) = 5.05, MSE = 0.73, p < .05, \eta^2 = .04$, respectively. Still, in both cases, a much larger main effect was found for invasion versus liberation, $F(1, 132) = 21.07, MSE = 0.61, p < .0001, \eta^2 = .14$; and $F(1, 128) = 82.09, MSE = 0.73, p < .0001, \eta^2 = .39$, respectively.

To further clarify, we averaged the top 12 variables in Table 6, except canonical categories and valence now, to calculate a composite score for memory clarity for each person. The bottom panel of Figure 2 shows the means of memory clarity for each event as a function of participants' age at the time of the invasion (averaged across every 3 years to reduce noise).³ No increase in memory clarity was found with increase in age ($F < 1$). All age groups

Table 6
Characteristics of Memories for the Two Public Events

Characteristic	Invasion		Liberation		$t(124-137)$	η^2
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Canonical category	4.96	1.49	5.65	1.33	5.10****	.16
Vividness	4.10	0.84	4.24	0.76	1.78	.03
Travel in time	3.68	1.18	3.96	1.05	3.13**	.07
Reexperience	3.69	1.05	3.96	1.01	3.25**	.07
Intensity now	3.22	1.24	3.84	1.14	6.11****	.21
Valence now	2.32	0.94	4.22	0.90	15.01****	.64
Visual reliving	3.96	0.87	4.15	0.92	2.46*	.04
Auditory reliving	3.73	1.22	3.43	1.24	3.31**	.07
Olfactory reliving	2.02	1.27	2.37	1.37	3.69**	.09
Bodily reliving	2.59	1.31	3.01	1.37	4.47****	.13
Physical	2.26	1.36	2.73	1.46	4.85****	.15
Belief	4.46	0.67	4.55	0.65	1.70	.02
Talked about	2.93	0.89	3.12	1.00	3.12**	.07
Thought about	3.05	0.89	3.28	1.03	3.27**	.07
Involuntary	2.71	1.09	2.88	1.04	2.68**	.05
Cuing other	2.94	1.12	3.19	1.16	2.85**	.06
Valence then	1.92	0.85	4.55	0.66	24.07****	.82
Intensity then	3.29	1.27	4.24	1.04	8.90****	.38
Surprise	3.88	1.18	2.49	1.25	10.92****	.47
Importance	3.46	1.42	4.53	0.90	9.15****	.40
Long-term consequences	2.24	1.25	2.28	1.40	1.48	.02
Immediate changes	2.62	1.21	2.76	1.22	1.32	.01

* $p < .05$. ** $p < .01$. **** $p < .0001$.

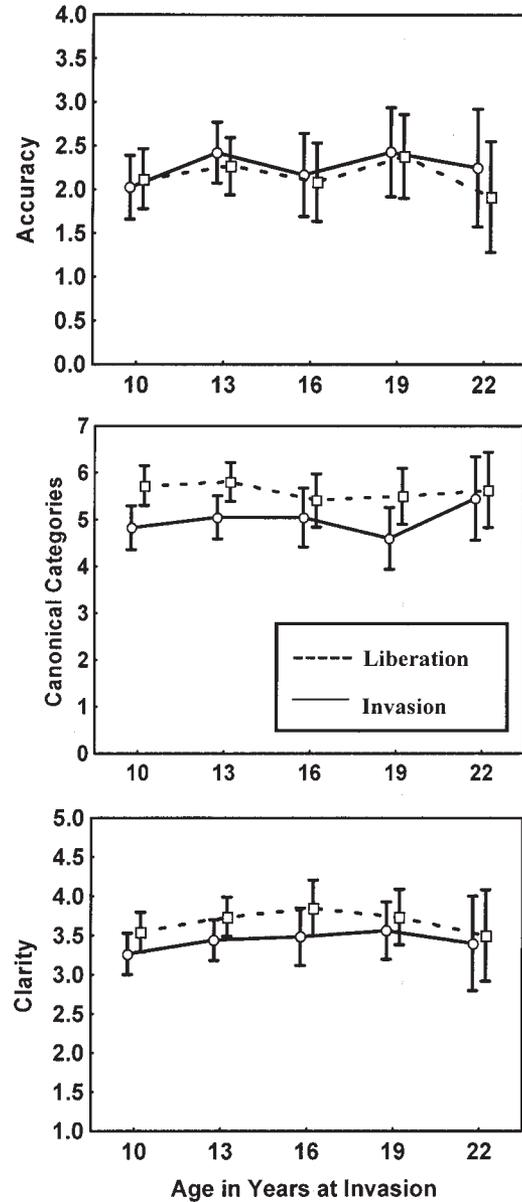


Figure 2. Mean score for memory clarity, number of canonical categories, and context accuracy for invasion and liberation as a function of age at the time of the invasion. (Vertical bars denote 0.95 confidence intervals.)

tended to score higher on the liberation, $F(1, 115) = 12.23, MSE = 0.2, p < .001, \eta^2 = .10$. No interaction was found ($F < 1$). As illustrated by the middle panel in Figure 2, an analysis based on number of canonical categories yielded similar results in terms of a memory advantage for the liberation over the invasion, $F(1, 129) = 16.16, MSE = 1.2, p < .0001, \eta^2 = .11$, no main effect of age groups, and no interaction ($F < 1$). Finally, an analogous analysis on context accuracy showed no significant effects (all

³ The three oldest participants (who were 24, 24, and 25 years old in 1940) were added to age group 22.

$F_s < 1$), as illustrated in the top panel of Figure 2. According to these results, children at age 9 are as capable as older children and young adults of developing long-lasting, vivid, detailed, and relatively accurate memories for the reception of public news. Research with younger participants from the same population is needed to clarify at which age children get this ability (see Winograd & Killinger, 1983; Tekcan & Peynircioglu, 2002).

Social and Emotional Factors Associated With the Memories

In the historical context of the German occupation of Denmark, a relevant measure of social identity was whether participants reported ties with the Danish resistance movement. Among the 136 participants who answered this question, 66 reported ties with the resistance movement (either through their own or a family member's involvement), whereas 70 did not. Table 7 shows that participants who reported ties to the resistance movement had higher scores on context-related accuracy for both events, as well as on history-related accuracy and number of canonical categories for the invasion. Irrelevant details for the invasion showed a marginally significant difference in the same direction. Three comparisons in Table 7 showed that there were only nonsignificant differences between the two groups but that they followed the same pattern as the significant ones. Table 8 shows that participants reporting ties to the resistance movement also had higher means on the composite scores for memory clarity for all four classes of memories. In addition, the resistance movement group had higher means for importance, intensity then, and cuing other on all four classes of memories and higher scores on different measures of rehearsal for the two public events. The results seem to suggest persistent effects of social identity (Tajfel, 1982) on personal memory.

On the basis of the idea of collective memory (e.g., Halbwachs, 1992; Pennebaker & Banasik, 1997) and commemoration (e.g., Frijda, 1997), one would expect the two public events to be remembered with greater clarity than the two private events because of more public rehearsal of the former. On the basis of the idea of a pleasantness bias in autobiographical memory (Walker, Skowronski, & Thompson, 2003), however, we should expect an advantage of the two positive events over the two emotionally negative events. A 2 (public, private) \times 2 (positive, negative) analysis of variance was conducted. Results are presented in Table

9. A series of Tukey's honestly significant difference post hoc analyses showed that for 14 of the variables in Table 9, most of the findings were explained in terms of memory for the liberation being rated higher or (for surprise) lower than the remaining three events ($p_s < .08-.001$). In short, the liberation appeared to have a special status in memory relative to the other three events.

The influences of social and cultural factors are most likely mediated by cognitive and emotional mechanisms at the level of the individual. Several intrapsychic mechanisms are assumed to be positively related to flashbulb memories, notably surprise, consequentiality, emotional intensity, and overt and covert rehearsal (see Brown & Kulik, 1977; Conway, 1995, for a review). To examine this issue, we conducted a series of multiple regression analyses. First, four standard multiple regression analyses were conducted, one for each of the four events, with the composite score for memory clarity as the dependent variable in each analysis. The predictor variables are listed in Table 10. As it appears from Table 10, emotional intensity and/or rehearsal (both in terms of thoughts and involuntary recollections) are the most central predictors for all four events. Overt rehearsal (talked about), which is probably the most frequently used measure of rehearsal in the flashbulb memory literature, was insignificant for all four events. More subtle forms of rehearsal, such as private thoughts and involuntary memories of the event (e.g., Berntsen, 1996), appeared more closely related to maintenance of memory clarity (see Qin et al., 2003; Suengas & Johnson, 1988, for related findings).

Second, two forward stepwise multiple regression analyses, one for the invasion and one for the liberation, were conducted with number of canonical categories as the dependent variable and with the same predictor variables as listed in Table 10. For number of canonical categories for the invasion, only intensity then entered as a significant predictor ($\beta = .26, R^2 = .07, p < .01$). For number of canonical categories for liberation, only valence then entered as a significant predictor ($\beta = .38, R^2 = .14, p < .0001$). Third, four stepwise multiple regression analyses were conducted to examine which of the variables listed in Table 10 were most strongly associated with accuracy measures for the two public events. For context-related accuracy for invasion, only intensity then entered as a significant predictor ($\beta = .27, R^2 = .07, p < .01$). For context-related accuracy for liberation, only importance entered as a significant predictor ($\beta = .27, R^2 = .07, p < .01$). For history-related accuracy for invasion, only importance entered as a signif-

Table 7
Mean Scores for Accuracy, Canonical Categories, and Details for Participants With and Without Reported Ties to the Resistance Movement (RM)

Characteristic	Invasion				Liberation			
	RM	Other	<i>t</i>	η^2	RM	Other	<i>t</i>	η^2
Context accuracy	2.59	1.89	3.68***	.09	2.38	1.99	2.12*	.03
History accuracy	1.94	1.51	3.18**	.07	1.56	1.37	1.06	.01
Canonical categories	5.32	4.58	2.97**	.06	5.74	5.54	0.83	.01
Irrelevant details	0.77	0.61	1.98†	.03	0.78	0.64	1.88	.03

Note. Degrees of freedom for the invasion calculations ranged from 127 to 134; degrees of freedom for the liberation calculations ranged from 128 to 134.

† $p = .05$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 8
Mean Scores for Memory Clarity and Event Characteristics for Participants With and Without Reported Ties to the Resistance Movement (RM) for the Four Classes of Memories

Characteristic	Invasion (df = 121–129)				Liberation (df = 120–130)				Most negative (df = 104–115)				Most positive (df = 88–103)			
	RM	Other	<i>t</i>	η^2	RM	Other	<i>t</i>	η^2	RM	Other	<i>t</i>	η^2	RM	Other	<i>t</i>	η^2
Memory clarity	3.61	3.21	2.78**	.06	3.86	3.44	3.00**	.07	3.56	3.10	2.86**	.07	3.53	2.93	3.31**	.11
Talked about	3.12	2.75	2.35*	.04	3.36	2.86	2.87**	.06	2.67	2.39	1.53	.02	2.60	2.44	0.92	.01
Thought about	3.27	2.91	2.04*	.03	3.50	3.05	2.54*	.05	3.12	2.89	1.29	.01	3.15	2.72	2.34*	.05
Involuntary	2.97	2.45	2.80**	.06	3.17	2.63	3.00**	.07	2.63	2.32	1.72	.03	2.82	2.48	1.87	.03
Cuing other	3.27	2.68	3.04**	.07	3.65	2.85	4.05***	.12	3.18	2.54	3.19***	.08	2.94	2.31	2.62*	.07
Valence then	1.82	2.05	1.54	.02	4.68	4.41	2.42*	.04	1.90	2.27	1.79	.03	3.98	3.35	2.84**	.08
Intensity then	3.53	3.02	2.33*	.04	4.45	3.94	2.84**	.06	4.04	3.43	2.78**	.07	3.90	3.16	3.09*	.09
Surprise	4.17	3.59	2.83**	.06	2.53	2.39	0.63	.00	4.14	3.36	3.05**	.08	3.26	2.61	2.38*	.06
Importance	3.90	3.07	3.42***	.09	4.77	4.31	3.01**	.07	3.95	3.28	2.85**	.07	4.06	3.07	3.86***	.13
Long-term consequences	2.62	1.97	3.00**	.07	2.56	2.16	1.54	.02	1.78	1.58	0.96	.01	2.13	1.76	1.41	.02
Immediate changes	2.98	2.28	3.27**	.08	3.05	2.46	2.73**	.06	2.29	2.00	1.17	.01	2.33	1.93	1.55	.03

* $p < .05$. ** $p < .01$. *** $p < .001$.

icant predictor ($\beta = .35$, $R^2 = .12$, $p < .001$), and for history-related accuracy for invasion, only valence then entered as a significant predictor ($\beta = .31$, $R^2 = .09$, $p < .001$). Thus, ratings of emotion—in terms of intensity or degree of pleasantness or unpleasantness—entered as a significant predictor in most of the analyses. Contrary to Brown and Kulik (1977), surprise and consequentiality (both in terms of immediate changes and long-term consequences) had little predicting value.

Intrusive Memories From the Time of the War

Forty-one (31%) participants reported that they sometimes, often, or very often had intrusive memories that they would rather not think about for events related to the time of the German occupation; 39 participants (29%) either agreed or strongly agreed that this time had “left a scar on their soul”; 39 (30%) agreed or strongly agreed that there were memories from this time that they actively avoided thinking about; and 15 (11%) sometimes, often, or very often had dreams about the occupation.⁴ Three questions addressing how central the time of the occupation was to the person’s current identity and life story (labeled *identity*, *reference point*, and *connections* in the Method section) were added into a composite identity score because all three questions derived from the Centrality of Event Scale (Berntsen & Rubin, in press) and showed an acceptable level of internal consistency (Cronbach’s $\alpha = .77$). Consistent with previous research (Berntsen & Rubin, in press), the identity score correlated positively with the scores from the questions labeled *intrusive memories* ($r = .37$), *dreams* ($r = .35$), and *scar* ($r = .55$). The following analysis concentrates on possible predictors of intrusive memories derived from previous research on this issue (e.g., Berntsen & Rubin, in press; Horowitz, 1986; Qin et al., 2003; Talarico & Rubin, 2003). Questions 5, 10, and 11 in Table 1 addressed the emotional and visceral reactions to the four target memories. They showed a Cronbach’s α of .91 across all four memories and were added (across all four memories) into a composite score for visceral reactions. Answers to the remaining questions on memory clarity and reliving (Questions 1, 2, 3, 6, 7, 8, and 9 in Table 1) also showed high consistency across

all four classes of memories (Cronbach’s $\alpha = .94$) and were added to form a composite score for sensory reliving and belief. These two composite variables as well as the identity score and answers to the question on avoidance were used as predictor variables in a multiple regression analysis with intrusive memories as the dependent variable. Using a forward stepwise regression technique, we found that the following three variables entered as significant predictors in the following order: visceral reactions ($\beta = .48$, $p < .0001$, R^2 change = .39), identity ($\beta = .31$, $p < .01$, R^2 change = .06), and avoidance ($\beta = .23$, $p < .05$, R^2 change = .05). Sensory reliving and belief did not enter as a significant predictor. Thus, participants’ tendency to react bodily or physically and with intense emotion to the four memories from the war that they were asked to recall voluntarily as part of the study was a significant predictor for how often they had intrusive memories from this time period in daily life, whereas sensory reliving and belief in relation to the same four memories was not (cf. Talarico & Rubin, 2003). Also, the tendency to view the time of the German occupation as central to personal identity and life story was a significant predictor for frequency of intrusive memories in daily life, consistent with the findings of Berntsen et al. (2003) and Berntsen and Rubin (in press). The fact that avoidance entered as a significant predictor agrees with the idea of a fluctuation between intrusions and avoidance as described by Horowitz (1975, 1986).

General Discussion

Contrary to the prediction depicted in Figure 1, when the older participants’ answers to questions of factual details were compared against objective data and against answers from controls who were too young to base their answers on personal memory, the older participants remembered context-related details, such as the weather, the day of the week, the time of an announcement, and so forth relatively accurately, whereas the control group generally

⁴ The percentages are calculated on the basis of the number of valid answers (excluding blank responses) for each question.

Table 9
Main Effects and Interactions of Public Versus Private Events and Positive Versus Negative Events, *F* values and η^2

Characteristic	Public vs. private		Positive vs. negative		Interaction	
	<i>F</i>	η^2	<i>F</i>	η^2	<i>F</i>	η^2
Memory reported	28.42****	0.17	9.54**	0.06	5.96*	0.04
Vividness	12.05***	0.11	0.00	0.00	10.23**	0.10
Travel in time	4.28*	0.04	1.07	0.01	8.08**	0.08
Reexperience	19.92****	0.17	1.71	0.02	8.67**	0.08
Intensity now	10.98**	0.10	12.65***	0.12	10.38**	0.10
Valence now	5.05*	0.05	323.05****	0.78	4.24*	0.05
Visual reliving	17.85****	0.16	0.22	0.00	11.04**	0.10
Auditory reliving	22.71****	0.10	19.00****	0.12	1.88	0.10
Olfactory reliving	1.29	0.01	4.45*	0.05	4.91*	0.05
Bodily reliving	0.26	0.00	2.19	0.02	14.01****	0.13
Physical	9.30**	0.09	6.53	0.07	11.70***	0.11
Belief	0.82	0.01	0.91	0.01	4.54*	0.05
Talked about	53.87****	0.35	1.13	0.01	6.18*	0.06
Thought about	10.61**	0.10	1.84	0.02	8.24**	0.08
Involuntary	19.58****	0.16	4.69*	0.05	0.37	0.00
Cuing other	15.92***	0.16	0.19	0.00	9.87***	0.10
Valence then	14.38***	0.14	342.25****	0.80	26.41****	0.23
Intensity then	2.40	0.03	21.07****	0.19	31.56****	0.26
Surprise	0.70	0.01	75.42****	0.45	6.90*	0.07
Importance	18.32****	0.18	21.29****	0.20	24.94****	0.23
Long-term consequences	10.91**	0.12	8.63**	0.10	1.19	0.02
Immediate changes	24.53****	0.23	1.08	0.01	0.46	0.01

Note. The degrees of freedom were 1, 80–141.

* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$.

refrained from answering. When comparing the frequency of correct responses relative to the total number of responses (including “do not know” responses) in the two groups, the older participants, on average, provided accurate answers to 55% of the questions versus 11% in the control group. Because the older participants performed five times better than the control group did, it is highly unlikely that their answers were based simply on general history knowledge, inferences, and guessing. Personal memory appears to have played the major role. When correct versus incorrect responses were compared among those who actually suggested an

answer (even though very few did so in the control group), the older participants performed significantly better on all eight context-related questions except one, which still showed a trend in the same direction. Performance on the history-related questions was less different between the two groups. Again, more older participants suggested answers to the questions. Among those who answered, however, no significant differences were found between the older participants and the control group on three of the four questions. In other studies, researchers have compared memory for personal context (measured in terms of consistency with an earlier report) against memory for the public event itself and found an advantage of the former relative to the latter (e.g., Bohannon, 1988; Smith et al., 2003; Tekcan et al., 2003; but see Nachson & Zelig, 2003). Our findings are consistent with these once a baseline of guessing or answering from general knowledge, as provided by our younger controls, is subtracted.

The finding that very long-term retention of accurate details could not be predicted from flashbulb memory studies using short-term retention intervals can be seen as a case analogous to Bahrick (1984). In a study of long-term retention of Spanish learned in school, he found an exponential decline over the first 3–6 years, after which retention remained stable for at least the following 30 years. Bahrick coined the term *permastore* to refer to the long period of stable retention. Flashbulb memory studies testing memory accuracy at both short and very long test delays are needed to decide whether flashbulb memories show permastore characteristics and whether more than one retention function is needed to account for the shape of the retention curve. Alternatively, the public events in the present study may have been more emotional

Table 10
Beta Weights From Multiple Regression Analyses With Memory Clarity for Each Event as the Dependent Variable

Predictor variable	Invasion	Liberation	Negative	Positive
r^2	.51	.48	.40	.52
Talked about	-.08	.10	.00	-.10
Thought about	.26*	.11	.31*	.33*
Involuntary	.36**	.28**	.09	.18
Valence then	.04	-.16	.05	.01
Intensity then	.38***	.33***	.18	.46***
Surprise	-.01	.12	.20*	.19
Importance	-.18*	.19	-.03	-.23
Long-term consequences	.07	-.09	-.05	-.14
Immediate changes	.07	.14	.23	.13

Note. Missing data were deleted casewise. For the invasion, $n = 108$; for the liberation, $n = 112$; for the negative event, $n = 97$; for the positive event, $n = 78$.

* $p < .05$. ** $p < .01$. *** $p < .001$.

and engaging when they took place than most events in previous flashbulb memory studies were (cf. Neisser et al., 1996), which, in turn, may account for their unexpected level of long-term retention. However, this explanation is post hoc and seems less parsimonious than the permastore analogy, as it implies extraordinarily good memory for a nonspecified class of "highly engaging" public events, whose properties are yet to be defined.

In Bahrick's (1984) study of Spanish, the amount of original training was decisive for performance at later tests. In the present study, the emotional intensity experienced at the time of the event and the amount of rehearsal (in terms of private thoughts and involuntary memories) during the retention period were most strongly related to the clarity of all four memories. Accuracy and number of canonical categories for the two flashbulb memories were predicted by ratings of emotional intensity, valence, and importance. The central role of emotion and rehearsal agrees with several previous studies of flashbulb memories and personal memory (e.g., Bohannon & Symons, 1992; Curci et al., 2001; Hornstein et al., 2003; Mahmood, Manier, & Hirst, 2004; Suengas & Johnson, 1988) as well as neurobiological findings (McGaugh, 2003). Contrary to Brown and Kulik (1977), of all four memories, the one with the highest score for clarity (the liberation) had the very lowest score for surprise (the mean score in Table 6 and examples in the Appendix suggest that this event was generally not seen as surprising). Likewise, consequentiality measured in terms of both long-term consequences and immediate changes caused by the events was unrelated to the accuracy and qualities of the memories (for similar findings, see Curci et al., 2001; Mahmood, Manier, & Hirst, 2004; Weaver, 1993; Winograd & Killinger, 1983; Wright, Gaskell, & O'Muircheartaigh, 1998).

Commemoration and Social Identity

Almost all participants provided a memory for their personal context when hearing the news about the two public events, whereas considerably fewer reported a most positive and most negative personal memory from the war. This advantage of the public events is likely to be partly due to the effects of commemoration (Frijda, 1997; Pennebaker & Banasik, 1997), more specific cuing, and the fact that these events, at the time of encoding, were already endowed with a social and national importance that were widely agreed on and immediately shared. However, with respect to the phenomenal qualities of the memories, no consistent advantage was found for public over private events. Rather, the liberation tended to score higher than the other three events on the majority of the variables. The advantage of the liberation relative to the invasion was not explained as an effect of the former taking place 5 years later in the participants' lives. Irrespective of their ages, participants tended to remember the liberation more clearly and with more details than the invasion. According to historical analyses, however, the liberation has been the most celebrated and publicly commemorated event from the time of the German occupation of Denmark (Kirchhoff et al., 2002), whereas the invasion, in many accounts, is seen as a time when Denmark failed to defend itself and its values (e.g., la Cour, 1945–1947). One may thus argue that memory for the liberation has played and still plays a more central role for the national identity of the participants, has been rehearsed more, and therefore is remembered more clearly and with more details (e.g., Gaskell & Wright, 1997; Neisser, 1982).

A similar cultural perspective may help to explain why the descriptions of the weather, if biased, were biased negatively for the invasion and positively for the liberation. Rather than simply viewing the biases as reflecting emotions at the level of the individual (light and warmth being standard metaphors for positive emotion, darkness and cold for negative emotions), the effects may also reflect the role of the invasion and liberation in the national discourse in which the years of the German occupation are often described as "the 5 dark years" and the liberation has been seen and celebrated as the victory of light over darkness (the dark shades were burned, candles were lit in the windows). The invasion was the beginning of the dark years and thus itself a dark day (although bright and sunny according to the weather data). It is likely that such symbolism explains some of the biases in the reports.

Participants who reported ties with the Danish resistance movement had higher accuracy scores and more canonical categories for the two public events, and they remembered all four events with greater clarity than did participants who did not report such ties. This agrees with previous studies measuring group effects on flashbulb memories (e.g., Conway et al., 1994) and suggests lasting effects of social identity on personal memory. The degree to which participants regarded the time of the German occupation as central to their life story and identity was a significant predictor for how frequently they had unpleasant intrusive memories from that time, which agrees with previous research (Berntsen & Rubin, in press). Prevalence of intrusions was also predicted by the amount of emotional and bodily reaction to the four specific memories but not by measures of the sensory reliving and vividness of these memories. This finding agrees with Talarico and Rubin (2003) and may be related to Brewin's (2001) dual representation view of traumatic memories, although it does not map directly onto his distinction between verbally and situationally accessible memories.

The Documentary Method

No previous studies have examined memory accuracy for the reception of important news by comparing answers about information available in the original reception context against objective records and against a baseline obtained from participants who were too young to base their answers on personal memory. This method enabled us to conduct a retrospective study on flashbulb memories for highly remote events and at the same time attain a measure of their accuracy. This method did not enable us to examine the accuracy of all reported memory details. Nonetheless, by asking questions about those aspects that could be verified, we obtained an estimate that may be generalized to the nonverifiable personal details reported. This estimate is conservative, because it refers to details that the persons did not themselves spontaneously provide in the open-ended memory descriptions, for which reason they are more likely to be inaccurate as compared with the details in the free reports. It is well-established that information provided in free recall is more reliable than information provided in response to memory probes (e.g., Koriat & Goldsmith, 1996). Whereas consistency studies of flashbulb memories depend on the first record being obtained immediately after the public event, the present method allows the accuracy of flashbulb memories to be studied at a very long delay along with measures of memory qualities and personal involvement viewed across a lifetime. In addition, the

documentary method corrects some of the problems associated with the test–retest method (e.g., Brewer, 1992; Lee & Brown, 2003; Winningham et al., 2000). We therefore believe that this method can be a useful supplement to the test–retest method and an important tool in future studies of flashbulb memories for remote historical events.

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Appendix

Examples of Memory Descriptions for Invasion and Liberation (Our Translations)

Memory for the Invasion, Man, 76 Years Old (13 Years Old at the Time of the Event)

I was woken up by a thundering noise, never heard anything like it. Opened the skylight in the attic and looked towards the south. Over the woods nearby, squadrons of big grey planes are coming, three at a time, right above the treetops. One can see the pilots in their cockpits, and the sides of the planes are like wavy sheet metal with big black and white crosses on them. I run downstairs to my family—consisting of my mother and grandmother. My mother is furious. The radio has announced that we are occupied by the Germans. . . .

Memory for the Invasion, Man, 79 Years Old (15 Years Old at the Time of the Event)

I was 15 years old and worked as the fourth farmhand at a farm called Thorupgaard. The 9th of April at 6 A.M., we went into the fields to plow and around 6:15 really many squadrons of planes came over us, and they were flying at such low altitude that the two horses I had to pull the plow were rearing and jumped over the ropes. I was really afraid and had great difficulties. The planes were flying over us for 15 to 20 minutes. I and the three other farmhands eventually got the horses calmed down and we talked a lot about what it all meant. All the planes had swastika on them, so we knew they were German planes. . . .

Memory for the Invasion, Woman, 77 Years Old (14 Years Old at the Time of the Event)

I had my confirmation on March 31. We had planned to have a party on the 9th of April. The woman who was supposed to cook had come at 7:00—that is, before I went to school. Suddenly my father was standing in the kitchen door. He said, “You might just as well stop. The Germans have crossed the border.” I remember the silence that suddenly was. Nobody said anything. I didn’t know if I should go to school or not, and I don’t even remember if I went. A feeling as if everything stopped still.

Memory for the Liberation, Woman, 76 Years Old (18 Years Old at the Time of the Event)

I was at a Red Cross evening school course at Risskov School. It was a first-aid class. I remember clearly that I was lying on the floor receiving artificial respiration when suddenly the door was opened and somebody shouted, “The Germans have capitulated!” We all immediately cheered up and ran out. I went to meet my fiancé. I knew he came from the boat club. We followed the crowd of happy people and ended up in a torchlight procession in the botanical garden. . . .

Memory for the Liberation, Woman, 75 Years Old (17 Years Old at the Time of the Event)

I had been to Tivoli [an amusement park in Copenhagen] with a schoolfellow. Because we expected a capitulation to happen any time, we decided to go home and listen to the radio broadcast from England. But when we reached Monasvej [a street name], a man came out from restaurant Bastholm. He was yelling, and, swinging his arms, he said, “Children, Denmark is free!” I remember this scene as if it were yesterday. We immediately ran to my schoolfellow’s home nearby and heard the news being repeated over the radio. . . .

Memory for the Liberation, Man, 81 Years Old (23 Years Old at the Time of the Event)

I was visiting my girlfriend at her parents’ place. Five to ten minutes after [the announcement on the radio] everything was chaos, cheers, laughter, and happiness, flags out of all windows. German soldiers were dropping their weapons and handed out cigarettes to everyone—everything was joy and happiness. I went home an hour later. My brother and I had got our mothers’ permission to break a big ugly vase the day the war ended. My younger brother did so. He was 21 years old. . . .

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