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# Children's long-term memory for autobiographical events<sup>☆</sup>

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## Abstract

Autobiographical memories not only capture our past, they also help define who we are. In this article, the origins of children's autobiographical memories are first traced, considering both research on infantile amnesia (which shows limited memory for early life events) as well as the perspective emerging from studies of young children's memory skills (which shows surprisingly long-term memory competence by 1- and 2-year-olds). The review then focuses on empirical investigations of children's long-term memory for autobiographical events, dividing studies into those that investigated delays of 1–2 years from those assessing memory after at least 4 years. Although some studies show substantial memory decrements with increased delays, a few studies have documented remarkably robust recall after a number of years. Factors that might contribute to the long-term retention of some events are briefly considered, and implications are drawn for relevant questions that the courts are asking about children's memory abilities. © 2002 Elsevier Science (USA). All rights reserved.

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Autobiographical memories are defined here as memories of particular events that happened to oneself at particular places and times (Pressley & Schneider, 1997). Thus, the memories are of specific events that have the

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properties of being personal and long-lasting. But autobiographical memories are more than this. They also seem to be a cornerstone of one's self-concept (Conway & Pleydell-Pearce, 2000; Fivush, 1994; Neisser, 1988; Nelson, 1993; Welsh-Ross, 1995). To quote Brewer (1986, p. 27), "The self is composed of an experiencing ego, a self-schema, and an associated set of personal memories and autobiographical facts." These personal memories help define who we are. As Conway (1996, p. 295) has stated, "A person without an autobiographical memory would have no self, no identity, no way of responding to the world emotionally." Thus, autobiographical memory is fundamental to the experience of personhood (Conway & Pleydell-Pearce, 2000).

Autobiographical memories become interpreted and integrated into a consistent life story about our self (Brewer, 1986; Bruner, 1987; Neisser, 1988), and these stories also serve social functions (Fivush, 1994; Neisser, 1988; Nelson, 1993). For one thing, they help create interpersonal connections. In fact, sharing personal stories seems to be a universal human activity (Labov & Waletzky, 1997/1967; Miller, 1994) that begins almost as soon as children and parents can converse with one another (Eisenberg, 1985; Hudson, 1991; Miller & Sperry, 1987). Furthermore, the particular stories we tell about ourselves also tell our listeners something about what kind of person we are (Brewer, 1986; Bruner, 1987). That is, our autobiographical stories shape to some extent what other people think about us.

In this paper, I first briefly look at the origin of autobiographical memory, including both a consideration of the concept of infantile amnesia as well as empirical assessments of memory for past events in very young children. Next, I consider children's long-term retention of life events. Then, because the most difficult situations forensically involve remote events, I focus on memories for personal events that took place at least a year in the past. Thus, consideration of memory for events that took place more recently is beyond the scope of this review. Finally, I discuss the implications of this body of knowledge for forensic situations, focusing on questions about children's long-term memory that the courts are asking and the answers that are suggested by the research reviewed here.

## **Origins of autobiographical memory**

### *Infantile amnesia*

A consideration of the origins of autobiographical memory quickly brings one to the concept of infantile amnesia (also called childhood amnesia), which was originally derived from studies of adults' memory for childhood events. Infantile amnesia is typically defined as "an *inability* to recall early life events" (Pressley & Schneider, 1997, p. 8, emphasis added) before a

specific age, generally somewhere between 3 and 5 years (Rubin, 2000). This definition implies an all-or-nothing notion of the accessibility of early life events to memory. But there are a number of reasons why a more flexible definition of infantile amnesia may be required. First, there is increasing agreement that continuity rather than discontinuity is characteristic of development in the memory system of children during the transition from infancy to the preschool years (Bauer, Wenner, Dropik, & Wewerka, 2000; Howe & Courage, 1997; Schneider & Bjorklund, 1998). Children as young as 2 years of age can recall events they experienced a year previously, both nonverbally (e.g., Bauer et al., 2000) as well as verbally (see below).

Second, a common finding of researchers is that a sizeable minority of adults can recall events that occurred prior to their 3rd birthday (a common signpost for the offset of infantile amnesia) and, more important, there are frequent reports of the recollection of events that date from when the respondent was only 1 year old (and, rarely, even reports from younger than 1 year). On a personal note, my 17-year-old son's first memory was of an event that occurred when he was 22 months of age, an event which can be dated precisely even though there are no photos or other physical reminders. He recalls that when we visited the house that we subsequently purchased and have lived in ever since, the woman who owned it took him to the family room and fed him an unending stream of chocolate chip cookies while her husband toured us around the house and grounds. He also recalls the furniture in the room as well as its layout, even though he never saw her or that furniture again (and the renovations to the room subsequent to our purchase of the house completely altered that room's shape and appearance). A number of researchers have collected "first memories" from adults that date to when they were under 2 years of age (Eacott & Crawley, 1999; Howes, Siegel, & Brown, 1993; MacDonald, Uesiliana, & Hayne, 2000; Rubin & Schulkind, 1997; Usher & Neisser, 1993; Weigle & Bauer, 2000), and in half of these studies participants' parents confirmed the accuracy of most of the memories. Such early recollections have even been documented in deaf adults (Weigle & Bauer, 2000). A recent survey of over 11,000 autobiographical memories of adults drawn from published studies (Rubin, 2000) not only documented the expected accelerating curve of recall during the period of 3–5 years, but also found that the time period between 1 and 2 years of age showed an increasing incidence of memories. So it appears that memories become less accessible with earlier age rather than entirely cut off at a specific age.

A third reason why a flexible definition of infantile amnesia is perhaps more appropriate is that individual differences in the age of earliest memory are related to factors that are independent of fundamental memory abilities. For example, there seem to be differences in the age of earliest memory depending on the respondent's gender [with girls earlier (Davis, 1999; Mullen, 1994)—but see MacDonald et al., 2000] or culture. Both Mullen (1994) and

MacDonald et al. (2000) found that adults' first memories dated from an earlier age for Caucasians than for Asians, and MacDonald et al. (2000) further found that, on average, New Zealand Maoris' first memories were 10 months earlier than were those of Caucasians, with an average first-memory age of only 2 years 8 months for Maoris at the time of event occurrence. As well, family constellation may play a role: Mullen (1994) found that first-born children had earlier first memories than did later-born children. Furthermore, the content of the experience seems to play a role. Usher and Neisser (1993) asked respondents to recall four events that were externally verifiable, namely the birth of a sibling, a family move, a family death, and a hospitalization. Event content played an important role in whether an event was recalled: deaths and family moves were seldom recalled unless they occurred after the respondent turned 3, but hospitalizations and sibling births that occurred at age 2 were typically recalled (and even sometimes sibling births occurring at age 1—there were no parallel data on hospitalizations dating from age 1). In an extension of this research, Eacott and Crawley (1998) found that although only about half of their respondents recalled information about a sibling birth that occurred when they were between 2 years 0 months (hereafter 2;0) and 2;3, 90% of respondents recalled a sibling birth that occurred when they were over 2;3. The specific details that they recalled were later confirmed by their parents. In another extension, Eacott and Crawley (1999) found that a number of respondents who were under 2 years of age (usually 1;8–1;11) also recalled some relevant information about a sibling's birth. There are also suggestions that traumatic experiences may be recalled from very early ages (e.g., Green et al., 1994; Terr, 1988).

There is one other finding that supports the need for a flexible concept of infantile amnesia. Kihlstrom and Harackiewicz (1982) asked high school students twice for their first memory, separated by a 3-month interval, and over 40% of their respondents produced a different first memory. That is, the specific earliest memories that people call to mind may differ from time to time, suggesting that perhaps accessibility to specific early memories is variable.

In summary, continuity rather than discontinuity in fundamental memory skills characterizes development among very young children; some individuals can recall events that date from before their 2nd birthday; factors such as culture, family constellation, and event content seem to play a role in how early in their lives people can recall events; and finally, which particular first memory is recalled by respondents may vary across time or situation. Nevertheless, it is undeniable that the early years up to about age 7 are characterized by a smaller-than-expected number of accessible memories (Pillemer & White, 1989; Rubin, 2000; Wetzler & Sweeney, 1986). Getting back to the definition of infantile amnesia, the one I prefer is more in keeping with that given by West and Bauer (1999), namely a relative paucity

among adults of autobiographical memories for events that occurred before their 4th birthday. In keeping with this definition, Fivush (in press) argues that infantile amnesia should more appropriately be seen not as a barrier but as a process. This is not to say that these very earliest memories are as detailed or as elaborate as later memories; instead, they tend to be not only sparse in number but also shorter and more fragmentary.

A number of explanations have been proposed to explain the phenomenon of infantile amnesia, although it is beyond the scope of this paper to review them comprehensively. The original explanation by Freud (1905/1953) based on repression of sexually toned recollections has not maintained credibility over time but there are a host of other explanations, including those based on neurological maturation (Nelson, 1995; Nadel & Zola-Morgan, 1984), the processing involved in the encoding and storing of memories (Pillemer & White, 1989), developing language abilities (Nelson, 1993; Peterson & Rideout, 1998), a shift in the nature of what children attend to (Fivush & Hamond, 1990; Harley & Reese, 1999), changing knowledge structures or understanding of events (Usher & Neisser, 1993; Pillemer, Picariello, & Pruet, 1994), and the lack of a narrativized or story like structure for early memories (Fivush, 1994; Nelson, 1993; Snow, 1990).

Another explanation that has recently been proposed by several investigators focuses on social interaction (Fivush, 1994; Hudson, 1990; Nelson, 1993; Tessler & Nelson, 1994). These theorists suggest that social interaction plays a key role in learning memory skills. Talking about past events sustains social bonds and facilitates social connectedness (Nelson, 1993), and, as a consequence, personal memories become valued for their own sake. A range of laboratories have found that the sorts of memory–talk interactions that mothers engage in with their children affects how much children recall their past. For example, Ratner (1980) found that the number of memory questions mothers asked their children predicted the children's recall to independent interviewers 1 year later. Similarly, both Fivush and her colleagues as well as McCabe and Peterson have found that mothers who were more elaborative (Fivush et al.'s term) or topic-extending (McCabe and Peterson's term) had children who recalled more, not only when talking with their own parents but also when conversing with relative strangers. Specifically, these investigators documented longitudinal relationships between mothers' earlier conversational style and children's subsequent memory skills 1–2 years later (Fivush, 1994; Haden, Haine, & Fivush, 1997; McCabe & Peterson, 1991; Peterson & McCabe, 1992, 1994, 1996; Reese, Haden, & Fivush, 1993).

Another recent hypothesis for infantile amnesia focuses on children's development of a self-concept (Harley & Reese, 1999; Howe, 2000; Howe & Courage, 1993, 1997; Welsh-Ross, 1995). This approach suggests that it is the attainment of a personal frame of reference or a sense of self which provides the framework to which personal memories can be attached. Howe

and Courage (1993, 1997) argue that self-recognition, or the ability to visually recognize oneself, is sufficient for this to occur, whereas Welsh-Ross argues that a more complex psychological sense of self is necessary. That is, she believes that a child's self-concept must be psychological rather than physical in nature and such a psychological sense of self develops later (at around 3 years) than self-recognition (which occurs at around  $1\frac{1}{2}$  years of age).

Yet another recent proposal focuses on metacognitive skills. Nelson (1992, 1993) argues that autobiographical memory is dependent on the mastery of language as a representational system. That is, language must become not only a way of telling other people what you know and remember, but also a way of representing what others know and remember. Thus, the metacognitive ability of being able to compare differing representations of the same event is crucial for autobiographical memory. Perner (1991), Perner and Ruffman (1995) and Welsh-Ross (1995, 1997) also emphasize metacognitive skills, in particular children's developing theory of mind. For example, Welsh-Ross (1995) proposes that two metacognitive skills are essential: understanding that knowing about an event depends on having had personal experience with that event and understanding the mental state of remembering.

Undoubtedly, the phenomenon of infantile amnesia is not dependent development in just one domain. Rather, a multiplicity of factors probably play a role, and a thorough account of infantile amnesia will probably require an understanding of how various factors interact with each other. A beginning has been made by some investigators in exploring how multiple factors may interact. For example, Welsh-Ross's (1995) model posits the joint interaction of social interactive, self-concept, and metacognitive skills, and Harley and Reese (1999) recently compared predictions derived from self-concept and social-interaction perspectives and found that both independently contributed to young children's memory skills. Such multifactor approaches will provide fruitful new directions for research.

The concept of infantile amnesia was derived from studies of *adults'* memory for childhood events. We turn now to assessments of young *children's* memory for earlier childhood events.

### *Memory for past events by very young children*

One of the early explanations for infantile amnesia posited substantial memory limitations for young children, i.e., that young children were unable to form long-term memories of events (e.g., Piaget, 1952). Considerable evidence now exists showing nonverbal memory in infants and toddlers (see Bauer, 1997, for a review) and of more relevance here is the evidence for verbal memory in very young children. A host of investigators have shown that young 2-year-olds, and even 1-year-olds, demonstrate long-term verbal

memory for past events. In fact, children start referring verbally to past events from nearly the beginning of language acquisition (Sachs, 1983).

Toddlers (between 24 and 30 months of age) readily participate in conversations about past events when their conversational partner deliberately tries to elicit memory conversations, both when their conversational partner is a parent (Eisenberg, 1985; Harley & Reese, 1999; Hudson, 1990, 1991, 1993; McCabe & Peterson, 1991; Miller & Sperry, 1987; Peterson & McCabe, 1992, 1994, 1996) and when the partner is a relative stranger, namely a researcher (Fivush, Gray, & Fromhoff, 1987; Harley & Reese, 1999; McCabe & Peterson, 1991; Peterson & McCabe, 1992, 1994, 1996; Peterson & Rideout, 1998). These latter memory conversations are particularly notable because the researchers, being unfamiliar with the events being talked about, were unable to provide appropriate scaffolds to help the child's recollection or to provide relevant cues in their questions. Nevertheless, children this young have a lot to say about past events. Diary studies have shown that children this young even initiate some of these memory conversations with their mothers (Hudson, 1990, 1991; Nelson & Ross, 1980; Reese, 1999). Two of these diary studies recorded memory conversations about past events for a child starting from as young as 14 months (Reese, 1999) and 20 months of age (Hudson, 1991). Furthermore, Nelson (1988), in her analysis of a 21- to 36-month-old's monologs from the crib, found that Emily talked about past events even when she was alone, with no adult conversational partner.

In some of the above studies the parents were able to situate in time the events being talked about, and some of the verbal memories of the children were for events that had occurred remarkably long ago. Table 1 summarizes studies that present evidence of long-term verbal memory in 1- and 2-year-olds. When children are asked to recall salient life events during conversations (i.e., there is no environmental support such as props to help cue memory), it is well-documented that some 2-year-olds can recall events that occurred between half a year and a year in the past, although Hudson (1993) reported that 24- to 30-month-olds had a great deal of difficulty reporting to their mothers memories of events that had occurred more than 6 months ago. In all but one study, the events being recalled varied widely (as did children's memory of them) and there was no documentation of the event at the time of occurrence. The exception is Peterson and Rideout (1998), who documented children's medical emergencies right after they occurred and then returned to ask about these targeted events 6 and 12 months later. The most extreme example of long-term recall was an anecdotal report by Bernstein and Blacher (1967), who described a child who seemed to recall a very painful medical event that took place when she was only 3 months of age. Such long-term memory of events occurring this early in life has not been found by others, however. In contrast to the above studies that have documented 2-year-olds' ability to recall events without the presence of environmental support, other studies such as those by Bauer and her col-

Table 1  
Studies presenting evidence of long-term verbal memory in 1 and 2 year olds

Study	Age in months	Recall delay in months	Findings
<i>Recalling salient life events during conversation</i>			
Bernstein and Blacher (1967)	28	25	Anecdotal report of 1 child recalling painful medical event
Nelson and Ross (1980)	21–30	6–12	Diary reports of event recall; 8% of events occurred 6–12 months ago
Todd and Perlmutter (1980)	24	9	Anecdotal report of 1 child recalling family event
Fivush et al. (1987)	29–35	6–10	Children asked to recall events suggested by mom; all recalled at least one from 6 months ago
Hudson (1993)	24–30	6–10	Children asked to recall events suggested by mom; 10 months ago recalled by at least 1 child
Peterson and Rideout (1998)	24–31	6 and 12	Medical emergency documented at occurrence; 5 (of 23) had good and 10 spotty recall
Harley and Reese (1999)	25 and 32	Up to 12	Children asked to recall events suggested by mom; at least 1 child recalled 1 year ago
<i>Recalling nonverbal experimental events (e.g., toy manipulations)</i>			
Myers, Clifton, and Clarkson (1987)	32	23	One child verbally recalled stimulus
Bauer, Hertsgaard, and Dow (1994)	21–22	8	Children verbally recalled toy manipulation events
Bauer and Wewerka (1995)	19–32	6, 9, and 12	Children verbally recalled toy manipulation events
Bauer, Kroupina, Schwade, Dropik, and Wewerka (1998)	22–32	6 and 12	Children verbally recalled toy manipulation events

leagues find that even 1-year-olds can verbally recall aspects of laboratory events (such as toy manipulations) when the child is back in that laboratory environment.

In summary, it is clear that young 2-year-olds and even older 1-year-olds have long-term verbal memory for some events that occurred several months in the past, and occasionally there are reports of memory for events that occurred as remotely as a year ago. Thus, although lots of events that occurred in the past are not recalled by very young children, some clearly are. However, as shown in the research on infantile amnesia, virtually all of these events will undoubtedly not be remembered when these children are considerably older. Nevertheless, a verbal long-term memory system is demonstrably present in 2-year-olds, and to a lesser extent, even in 1-year-olds.



In most of the above studies, the remoteness of the recalled events varied widely and unsystematically. Next, we will look at more systematic investigations of time delays, that is, studies in which the passage of time was a major variable being investigated.

### **Long-term autobiographical memory**

We turn now to a review of studies investigating children's long-term memory for autobiographical events. This review is limited to delays measured in years, not days, weeks, or months. Studies exploring long-term memory in children will be divided into those focusing on memory after 1–2 years, and those focusing on very long delays, specifically children's recollection of target events after at least 4 years.

Three types of research paradigms have been used. (a) In one, children are questioned about a range of naturally occurring past events by parents or investigators, and then the researchers return a year or more later to re-question children about some of the same events. These events are often highly idiosyncratic across children and depend on the sorts of experiences that have occurred in the children's lives, such as vacations, visits to relatives, parties, and so on. (b) In a second paradigm, some target event occurs (either naturally, which is capitalized on by researchers, or else staged deliberately) and children are later questioned about that event. The researchers have extensive information about the details of the target event because of photographs, videotapes, or detailed checklists, which are collected at the time of event occurrence; moreover, the events are highly similar or even identical across children. Thus, it is possible to be highly specific during questioning, since "the facts" are known and they are almost identical across children. These studies have included staged laboratory events, well-child check-ups, and medical procedures such as voiding cystourethrogram fluoroscopy (VCUGs) where procedures are standardized across children and the researcher is aware of all the elements of the child's experience. (c) In the third paradigm, naturally occurring events that are salient and may be personally significant to children (such as accidents or medical emergencies) are selected for study. In broad terms the events share a similar overall structure, but details can differ substantially between children (e.g., breaking a leg skiing vs falling and needing sutures to close a laceration on the forehead vs being attacked by a dog). Because the target event was not recorded at the time of occurrence, assessments of recall accuracy depend on reconstructions by adult witnesses to the event. Furthermore, detailed checklists of procedures cannot guide questioning and thus interviews focus on overall structure of the target event and on the important components that comprised it. Although there is less knowledge about the details of event occurrence in this third paradigm than in the second one,

it has the advantage of being able to capitalize on events that are inaccessible to memory investigations any other way. Often these events are chosen for study because they are seen as the sort of highly salient and memorable events that may remain significant to the child and become part of his or her self-story (and become one of those events recalled years later by researchers investigating early memories and infantile amnesia).

### *Recall 1–2 years later*

Looking first at children's open-ended recall about a range of events which differed between children, Fivush and her colleagues investigated preschoolers' recall when they were reinterviewed about the same parentally selected events a year later. In one study, mothers talked with their  $2\frac{1}{2}$ -year-old children about a number of events that the children had experienced and which they thought their children might remember, such as holiday trips and parties (Fivush & Hamond, 1990). Unfortunately, no information was presented on how far in the past these events had occurred, so it is unclear how long-term the children's recall was at the first interview. Both 6 weeks and 14 months later, the children were reinterviewed about some of the same events by a researcher. After a delay of 14 months (when the children were just under 4 years of age), although some events were not recalled at all, children recalled as much (or even more) information about those events that they did remember than they recalled at the first interview. But only a quarter of the information recalled in the later interview had been mentioned in an earlier interview. Nevertheless, parents assessed 90% of this new information as accurate. Thus, children recalled new and different (but nevertheless correct) details about the same events after a delay of 14 months.

In an extension to the above study, parents suggested possible target events to researchers who then interviewed children at 3;4, 3;10, 4;10, and 5;10 in a longitudinal investigation (Fivush, Haden, & Adam, 1995; Fivush & Shukat, 1995). The results of particular relevance to the present concern children's recall of events at 3;10 and 4;10, and a different set of events at 4;10 and 5;10. The events had occurred usually months before the first interview (the delay between event occurrence and the first interview averaged 2–5 months). Parallel to the earlier study by Fivush and Hamond (1990), children recalled just as much information a year later as they had earlier about those events that they remembered, although, again, the information was different. Overall, less than 10% of the information that was recalled by the children was consistent across any two recall occasions. As well, both earlier and later interviews were highly embellished with descriptives, suggesting that recall did not become impoverished over a year-long delay. Furthermore, narrative structure and cohesiveness were similar across interviews. Again parallel to the earlier study, parents identified the vast majority of children's new information as accurate.

In summary, studies using the first paradigm described above suggest that preschool-age children have good memory for events that occurred over a year ago. In these studies, children are questioned about the same idiosyncratic events a year apart but the questions they are asked vary not only between children but also across interviews for the same children.

We turn now to studies using the second research paradigm described above, namely those which investigated children's memory for a target event for which event structure and details were recorded at the time of event occurrence. Thus, the interviews were typically not the open-ended discussions about past events found in the above research by Fivush and her colleagues but rather highly focused questionnaires that queried children's recall of specific components of the target experience.

The youngest participants for whom this paradigm is relevant have been studied by Bauer and her colleagues. Children as young as 25 months of age spontaneously talked about some of the elicited imitation tasks that they had seen a year earlier when they were shown the toys that had been used initially (Bauer et al., 1998). However, such elicited imitation tasks are not the stuff of long-term autobiographical memory.

In an early study with older children, Fivush, Hudson, and Nelson (1984) assessed kindergarten children's memory for a class visit to an archeological museum. Photographs of the various visit components were later used as memory cues. The children's memory for the visit was assessed immediately, 6 weeks, and 1 year after the visit. After a year's delay, children required more (and more specific) prompts to remember the museum event and they recalled fewer details in free recall. However, when given photographs, they could accurately describe what was happening in each, and they could chronologically order the photographs to match the order of their experiences during the class visit.

Memory for medical events has been the focus of a number of studies of children's long-term memory. To explore the effect of a year's delay on recall, Goodman, Hirschman, Hepps, and Rudy (1991) investigated children's memory for inoculations they had received a year earlier (study 4) as part of their school health preparation (and about which they had been interviewed at the time—study 2). The children were 5–8 years old at follow-up, with no age effects found. The amount of information provided in free recall decreased over the year interval, but for probed recall using specific questions, there was no change in accuracy for questions about persons, the room, or peripheral information, nor for the accuracy of all questions overall. However, the proportion that was answered correctly decreased for questions about actions (from 87 to 73%) and about central details (from 82 to 70%). Thus, some decreases in memory were noted, although the children's recall was still similar across the two interviews despite the year interval.

In a second study involving a real medical event, this time a medical emergency involving facial laceration that had to be sutured by a plastic sur-

geon, Burgwyn-Bailes, Baker-Ward, Gordon and Ornstein (2001) interviewed 3- to 7-year-olds after a few days, 6 weeks, and 1 year about treatment details that were provided on a checklist by the surgeon. Children recalled three quarters of the features of their medical treatment at all interviews and there was no effect of time delay. In other words, the children, overall, did not recall less a year later than they had initially; rather, recall was stable over this delay period. However, there were differences between children, and much of the variance accounting for these differences was attributable to various identifiable factors, according to regression analyses. Most important of these factors, of course, was age: The older the child, the more she or he recalled. As well, better language skills in younger (but not older) children were associated with better total recall, although not better open-ended recall. More interesting is the role of variations in parenting: parents who were more traditional, emphasizing child obedience to parental authority, had children who recalled less a year later than did children of less traditional parents, both in terms of total recall and open-ended recall. The authors speculated that children who are taught to conform to adult authority may be less likely to trust their own interpretations and memories of events.

Salmon and Pipe (1997) varied the target event by using a play event which was quasi-medical. Children who were 3 and 5 years old examined a “sick” teddy bear with a researcher. Both 3 days and 1 year later, children were interviewed in one of three ways: with real props that had been in the original event, with toy props representing the real objects that had been used, and with just verbal prompts. The questions were all open-ended. Unlike the two previous studies about real medical events, forgetting was considerable after a year, especially in the older children, i.e., the ones who had recalled more in the first place. But it is important to note that even after only 3 days, less than half of the items of information that could potentially be recalled were actually mentioned (or physically enacted) by the older children, and less than a third by the younger. Although children recalled more if they had the aid of physical props (either toy or real), forgetting was equivalent in all groups. However, toy props engendered the most errors. In terms of the effect of a year’s delay on the frequency and proportion of errors, only the younger children showed increasing inaccuracy with time. The older ones maintained a high accuracy rate for what they did recall (85% accuracy after a year), whereas the 4-year-olds slipped to only 69% accuracy after a year from 87% initially.

Pipe and her colleagues (Pipe, Gee, Wilson, & Egerton, 1999) staged a nonmedical event which they thought would be memorable, namely a visit to a “magician.” One year after the event (Study 2), 7- and 10-year-olds showed no decrease in how much they recalled relative to recall 10 days later when prompted about the event, although they recalled more if props from the earlier event were present. Furthermore, accuracy rates were quite high

although they decreased with time, especially for younger children and those cued by props. Pipe and her colleagues also looked at the memory of this same event (visiting a magician) by 8-year-olds after 2 years had passed (Study 1). However, prompts were more general and children were not specifically asked to tell about what happened with various magic show objects, as they had been in the other magician study. In this study, the number of items recalled by the children decreased substantially over the 2-year delay although the number of errors stayed the same. Stated differently, the proportion of recall that was accurate decreased (from 88 to 75%). Thus, the two studies about visiting a magician demonstrate different results: after 1 year, little change in memory is noted, but after 2 years, substantial memory decrements are found. However, the method of interviewing children differed substantially between the studies so it is not clear whether the decrement after 2 years is due to an increasing time delay or changes in the method of questioning.

The above studies are either staged or else have extensive data collected at the time of the event, and as well, the details of the events are almost identical across children. However, other studies have used events that have similarity in structure across children although the specific details may vary considerably (i.e., the third paradigm listed above). Such studies rely on (mostly) parental report to provide information about the details of what happened, and such witness reports then provide the gold standard against which the child's recollection is matched. The possibility of witness error is acknowledged although it is seen as of minimal importance to the overall findings of this research. The strength of this approach is that naturally occurring events of high salience to children can be selected for study. Although some of the studies illustrating the use of the second paradigm involve salient events (such as facial lacerations), others do not. Even if highly salient, the range of event components asked about in the second paradigm is quite limited in that questions exclusively involve what happens within the confines of a laboratory, doctor's office, or hospital room, and as discussed below, such events do not seem to be the most memorable ones to children.

As one example of the third type of research, Sheingold and Tenney (1982) interviewed 4-year-olds (and their mothers) as part of a larger study on children's memory about the birth of a sibling. The children had extensive recall of the details surrounding the birth, which had taken place up to a year earlier, and in fact they recalled as much as did older children. However, the older children also had an increasing delay between event occurrence and the interview, since all sibling births occurred when children were 3–4 years of age.

In another study of a highly salient naturally occurring event, Hamond and Fivush (1991) questioned children who had visited Disneyworld when they were between the ages of 2;9 and 4;6. The children were divided into

a younger versus older group, and half of the children in each group were questioned after 6 months and half after 18 months since the visit. All of the children recalled a lot about their visits, regardless of age. Furthermore, the delay between event occurrence and recall had no effect: Children recalled as much 18 months later as did those who were interviewed after only 6 months. The only difference in recall is that older children were more likely to elaborate on the information they provided, and they also provided more information spontaneously.

Peterson and her colleagues (Peterson, 1996, 1999; Peterson & Bell, 1996; Peterson, Moores, & White, 2001; Peterson, Parsons, & Dean, in press) assessed 2- to 13-year-old children's recall of a medical emergency in which the child was injured seriously enough to require hospital emergency room treatment. Most injuries involved broken bones or lacerations requiring suturing, although there were also dog bites, crushed fingers requiring drainage, and burns. Adult witnesses (mostly parents) of both the injury and subsequent hospital treatment were interviewed to determine what had happened and to provide a standard against which the children's recall could be assessed. Children were interviewed within a few days of the target events as well as after 6 months (Peterson & Bell, 1996) and again 1 year and 2 years later (Peterson, 1999; Peterson et al., 2001; Peterson et al., in press). Children accurately recalled 75% of the components of their injury experience initially, and 2 years later they recalled just as much accurate information. However, they also added some inaccurate details in later recall such that their accuracy proportions decreased from 93% initially to 84% at 2 years. Interestingly, children at no point recalled as much about the components of their hospital treatment, and furthermore, this part of the event was the part they were most likely to forget. Initially they recalled only 57% of the components of their hospital treatment and this decreased to a recall of 51% of the components 2 years later. Although children were slightly less accurate in their recall of hospital features, declines in accuracy were equivalent for both injury and hospital experiences.

One other study is noteworthy because of the young age of the children involved. The same methodology was used as above: Peterson and Rideout (1998) recruited children from a hospital emergency room where children had been taken for treatment of a trauma injury, but most of the children were too young to be able to talk about their injury with a researcher (and according to parent report, they did not talk to their parents either, except minimally when prompted for a specific item of information). Children were classified as younger 1-year-olds (between 13 and 18 months of age), older toddlers (between 20 and 25 months of age; none of these children responded to verbal prompts to tell about their injury to a researcher), and 2-year-olds (26–33 months of age; all of these children could talk about their injury). The children were visited again 6 months, 1 year, and 1½ to 2 years after their injury, when even the youngest children had achieved sufficient

language competence to narrate their past experiences. The children who had been 26 months of age or older when injured were all able to provide accurate information about a third of the scorable components of their injury and hospital treatment both initially and a year later, and they accurately recalled even more after 2 years. But they not only recalled accurate components, they also provided a lot of erroneous information. A quarter of the content information (i.e., responses to *wh*- questions) they provided was in error, but, interestingly, this error rate remained the same over time. (Responses to *yes/no* questions were more error-prone, and in fact had an accuracy rate no different than chance.) Thus, as these former 2-year-olds got older, they began adding both more correct components as well as errors to their memory accounts, and the percentage of the information they recalled that was incorrect remained stable across time.

The story was different, however, for those children who were unable to talk about the target events initially: Recall was substantially poorer and more error-prone in children who were under 26 months of age at the time of injury. In fact, 18 months after the hospital visit, none of the children who had been between 12 and 18 months of age at the time of injury could provide more than minimal fragments about the event and half could not recall it at all. For toddlers, i.e., those between 20 and 25 months of age, three of the eight children could recall the most important components of their injury (what was injured and how it happened) while two other children could recall nothing. The remaining three children had only fragmentary recall of bits of the event, but errors were rife. The authors concluded that having the language skills that allowed talking about the event when it occurred, i.e., having the ability to participate in narrative conversations about their injury and hospital experience immediately afterward, was a crucial factor contributing to children's ability to remember the events  $1\frac{1}{2}$  to 2 years later.

In summary, much of the research investigating children's recall over a 1- to 2-year delay shows excellent recall of earlier events by children. In free-wheeling, open-ended interviews about a range of past events, children provide just as much information a year later as initially about those events they remember, although the content of their recall changes. In focused interviews about specific target events, children in some studies demonstrated only minimal or else no memory decrement over this long a delay [Burgwyn-Bailes et al., 2001; Hamond and Fivush, 1991; Goodman et al., 1991; Peterson, 1999; Peterson et al., 2001; Peterson, et al., in press; Pipe et al. (study 2), 1999]. In other studies, considerable forgetting was noted [Fivush et al., 1984; Pipe et al. (study 1), 1999; Salmon and Pipe, 1997]. In most of the research, older children recalled more than younger children, and Peterson and Rideout (1998) further presented evidence suggesting substantial differences in recall of events that had occurred when children were only 1 versus 2 years of age. Specifically, the majority of former 1-year-olds exhibited fragmentary or no recall about a salient personal injury, whereas all former 2-year-olds

recalled a substantial amount of information about it. In contrast, Bauer and her colleagues (Bauer et al., 1998; Bauer & Wewerka, 1997) found that if children were cued by seeing the toys that had been used previously, and in the same laboratory context, many former 1-year-olds demonstrated verbal memory for elicited imitation tasks. One explanation for these different results proposed by Bauer et al. (1998) is that the context-specific cues helped children recode nonverbal memories into verbal form. Next, we turn to studies investigating children's recall after very long delays.

*After very long delays of 4 or more years*

A pervasive belief is that the passage of long periods of time results in strong memory decrements, especially for young children, although there are certainly reports of accurate recall of some events after many years have passed. Events that were highly traumatic for individuals are one class of event that have been reported to be recalled accurately and in detail for years (e.g., Terr, 1988; Tyano et al., 1996). But even quite mundane events may be recalled for long periods of time. For example, Myers, Perris, and Speaker (1994) reported that two 5-year-old children showed some verbal recall of a laboratory task (involving nonverbal toy manipulation) that they had participated in when they were only 10–14 months of age. In this section we will review studies that specifically investigated the effect of very long time delays on children's memory.

Some studies have indeed found substantial memory decrements for children after the passage of several years. Gold and Neisser (1980) found that after the passage of 5, 8, or 11 years, memories for kindergarten activities were sparse, although what was recalled about some types of activities, especially art projects, tended to be accurate according to teacher records. Hudson and Fivush (1991) also investigated children's memory for a kindergarten activity. They returned after 6 years to reinterview children about a kindergarten field trip to an archeological museum, and they found substantial forgetting over time. However, if enough cues were provided (including photographs taken at the time), more information could be recalled by the children. Furthermore, the specific activities they *did* recall were recalled in as much detail 6 years later as initially, although the authors also reported that the children's recall after 6 years tended to be more reconstructive and inferential.

Likewise, Pillemer et al. (1994) found substantial forgetting when they investigated children's recall of an emergency evacuation of their preschool in response to a fire alarm after 7 years. Only four of the 25 children produced intact narrative memories after 7 years and an additional 6 had fragmentary memories, while 60% of the children recalled nothing at all. The authors noted that all children with intact memories and most of the ones with fragmentary recall had been in the older preschool program (mean age 4½) rather



than the younger program (mean age  $3\frac{1}{2}$ ) at the time of event occurrence, and furthermore, it had been the older children who had shown more understanding of the causal and temporal connections within the event when interviewed shortly after the event occurred. Thus, they proposed that children's understanding of events, and particularly causal and temporal connections, plays an important role in event long-term memory.

Quas et al. (1999) looked at children's long-term recall of a VCUG procedure. Children were between 3 and 13 years of age when interviewed about the procedure which had occurred when they had been between 2 and 6 years old. Those children who had been 2 years old at the time of their VCUG had no memory of the procedure and only half of those who had been 3 remembered it. By 4 (at the time of the VCUG), two-thirds recalled it years later, and by 5–6 years of age, almost all children had definite recall. Thus, parallel to the findings of Pillemer et al. (1994), age had a clear effect on whether children recalled the event. When Quas et al. examined data for only those children who remembered the event, age at VCUG was not a robust predictor of amount remembered. Furthermore, the length of the delay between VCUG and interview (longer versus shorter than 3 years) was not associated with recall of accurate or inaccurate details. In other words, children continued to recall the procedure just as accurately after several years as after shorter delays, as long as they recalled it at all.

This pattern of children showing excellent long-term recall for those events that they did remember was also found by Fivush and Schwarzmuel-ler (1998). They asked 8-year-olds to recall events that they had been previously interviewed about during a series of interviews that initially took place when the children were between 3;4 and 5;10 (see Fivush et al., 1995; Fivush & Shukat, 1995). Thus, recall was for events that took place between 2 and 5 years in the past. These events had been selected by parents at the time of the initial interview because parents thought they had been memorable to their children, events such as special outings, trips, and family occasions like weddings. Most of the events were still recalled by the 8-year-olds, but of most interest is the fact that children recalled virtually the same number of propositions about the same target events during earlier and later interviews, regardless of their age at initial interview, although both earlier and later interviews about events that took place when children were older were longer than those about events taking place when children were younger. Furthermore, 80% of the information that children recalled, on average, was different from that which was recalled during the earlier interview, although this new and different information was overwhelmingly identified as accurate by mothers when they were given the children's transcripts to assess. This impressive recall was in response to open-ended prompts to tell about "that time they did X." Thus, the authors suggest that if children are asked to recall memorable events, recall can be excellent even though several years have passed.

In the above study, parents had identified events that they thought were memorable to their preschoolers, and these events therefore varied considerably from child to child. Other researchers have instead chosen specific events that were relatively similar across children but that studies on infantile amnesia suggested were particularly memorable. One of these is the birth of a sibling (e.g., see Eacott & Crawley, 1998, 1999; Usher & Neisser, 1993). Sheingold and Tenney (1982) asked children and young adults about their memories for events surrounding the birth of a sibling, which had taken place when they had been approximately 4 years of age. They found that children or young adults who were 8, 12, and 20 years of age at the time of the interview all recalled the same amount of information about their sibling's birth; furthermore, they recalled as much as did 4-year-olds, who were interviewed after an average delay of only 7 months about the birth. Mothers were asked to verify the accuracy of the recalls, and accuracy rates were similar across ages for the children. Thus, the length of the delay (between 7 months and 16 years) was unrelated to children's recall of a highly salient event.

One of the limitations of this research is that the details of the target events were not known at the time of event occurrence; rather, parents were asked to assess the accuracy of their children's recall after several years had passed. Clearly, parental memory is also vulnerable to change over time, and parents may have identified some of their children's information as accurate because they may not themselves have had clear recall and their children's recall seemed reasonable. Thus, research on long-term memory needs to include studies where the information is either known because of contemporaneously collected records or is constructed through adult witness report immediately after the event. When this was done by Quas et al. (1999), a number of children, particularly younger preschoolers at the time of event occurrence, did not recall the event. Other investigators have chosen events for which children seem to have robust recall: Parker and Fivush and their colleagues investigated children's recall of Hurricane Andrew, and Peterson and her colleagues have assessed children's recall of an injury that was serious enough to require a trip to the hospital emergency room (ER) for treatment.

Initial investigations of 3- to 4-year-olds' recall of Hurricane Andrew's devastating visit to the Florida coast in 1992 took place after a few months (Bahrick, Parker, Fivush, & Levitt, 1998; Parker, Bahrick, Lundy, Fivush, & Levitt, 1998). Fivush (in press), and Sales, Goldberg, and Parker (2001) report some preliminary data from reinterviews conducted with the same children 6 years later, when the children were 9–10 years of age. In the later interview, the children provided twice as many propositions about the hurricane event as they had in the previous interview. Fivush concluded that children have "enduring clear and vivid memories" of some events that they have experienced. However, since these were only preliminary reports, no in-

formation was reported on the accuracy of the children's recall, nor on the consistency of their recall of particular components of the event. To our knowledge, the only long-term investigation of a highly memorable event for which later recall accuracy could be assessed on the basis of information about the event collected at the time of event occurrence is that by Peterson and her colleagues.

Peterson and her colleagues have been following a group of children who were recruited from a hospital ER where they had been taken because of a minor trauma injury, typically lacerations requiring suturing or broken bones requiring setting and casting (Peterson, 1996, 1999; Peterson & Bell, 1996; Peterson et al., 2001; Peterson et al., in press). Recently, as many of these children as could be found 5 years after their injury were reinterviewed about what they recalled (Peterson & Whalen, 2001). At the time of their injury and ER treatment, extensive interviews had been conducted with adult witnesses in order to reconstruct the details of the children's experiences (Peterson & Bell, 1996). These served as the standard against which the children's recall was compared. Because experiences varied from child to child but still shared a lot of commonalities, a prototype for the injury event and for the hospital event were developed, with some variation in how many of the prototype's components applied to each particular child. (See appendices in Peterson, 1999, and Peterson & Bell, 1996, for a complete description of the prototypes as well as examples.) The completeness of each child's recall could then be assessed by determining how many of the prototype components that had been identified as relevant to that particular child (by witness report) were in fact recalled by the child. Likewise, accuracy could be assessed by comparing children's reports against adult witness reports.

That this injury was a highly memorable event is clear from the fact that every child who had been 2 years of age or more at the time of occurrence recalled this event clearly 5 years later (Peterson & Whalen, 2001). However, it is less clear that some of the children who had been only 2 years of age when injured recalled what happened in the hospital ER during treatment, although they could mostly identify the major treatment event (e.g., "got stitches," and "got a cast"). Older children, however, seemed to have definite memory for both events, the injury and the ER treatment, although they recalled more about the details surrounding their injury than their ER treatment. Fig. 1 shows the percentage of prototype components that children recalled correctly for both events across a 5-year period.

A number of observations are apparent from Fig. 1 (for details, see Peterson & Whalen, 2001). First, children had considerably better recall of the injury event than of the hospital event. Furthermore, there was no statistically significant decrement from the initial to the 5 year interview in the percentage of prototype components that were correctly recalled for the injury event, whereas the children (except 2-year-olds) recalled less about the hospital event 5-years later. This is an important observation: children maintained

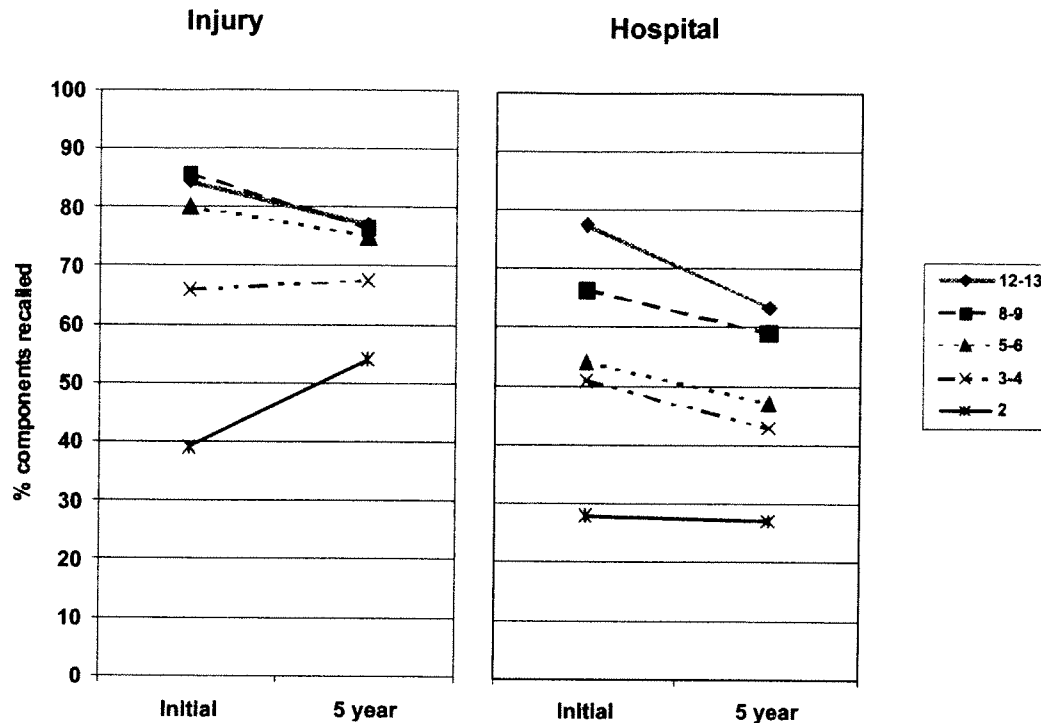


Fig. 1. Percentage of relevant prototype components recalled by children initially and 5 years later about their injury and hospital treatment.

good recall of the details surrounding their injury, whereas they showed the expected memory decrements for the hospital event, at least in terms of how many components of their experiences they correctly remembered.

The similar percentage of hospital components recalled across time for the 2-year-olds can be contrasted with their substantially better recall across 5 years for the injury components. The increase in information about the injury event by the former 2-year-olds in their later interview can be readily accounted for. First, this is an event that they definitely recalled. Most importantly, as anyone who has attempted to do an extensive interview with a 2-year-old can attest, children this young are not very cooperative interviewees. They are far more interested in playing than in answering lots of questions, and many questions by interviewers had to be posed “on the fly” as these busy children moved about their environment playing, bouncing on beds or sofas, and so on. In contrast, they were 7 years of age at the time of their last interview and had become highly cooperative interview subjects. That is, their performance on memory tasks has improved, but probably not their memory *per se*. This performance factor probably plays a role for other preschoolers who are older than 2, but it is notable how much more cooperative 3-year-olds are in an interview task than are 2-year-olds, and 4-year-olds are even more cooperative. (School-age children, by comparison, are generally quite cooperative in interviews.) Thus, as other researchers have attested, the verbal recall of very young children is not a very good reflection

of what they actually remember (Fivush & Schwarzmüller, 1998), but is instead highly affected by performance factors such as cooperation. So it is not surprising that 2-year-olds in this study provided more information in their later interview than in their first about their injury; more surprising is that they did not do so for the hospital event.

For simplicity, Fig. 1 does not show the difference between children's recall of central versus peripheral components, although there was a substantial difference between them for all age groups except the 2-year-olds. Children (except 2-year-olds) recalled central details better than peripheral details in both the early and later interviews. Thus, if one just looked at recall of central details, children's recall scores in Fig. 1 would be 5–10% higher for central details and a parallel amount lower for peripheral ones. In fact, 5 years after the injury, all age groups (except 2-year-olds) recalled over 80% of the central components of the injury event, whereas on average they recalled only 65% of peripheral components. There was no interaction.

The above data reflects only the completeness of the children's recall, i.e., what proportion of the prototype elements that were relevant to their particular experience that they actually correctly recalled. A different perspective is the accuracy of what children do recall, regardless of whether they recall a lot or a little. The percentage of children's information that was assessed as accurate is shown in Fig. 2. The children are quite accurate (except for the 2-year-olds) at the initial interview and become significantly less accurate with the passage of time. However, the event makes a difference for accuracy too. Although children recall fewer details of their hospital event than the injury event, the details that they do recall are just as accurate during the initial interview, regardless of which event is being remembered (94% versus 93% accuracy for the injury versus hospital event, respectively). In contrast, children's information about the injury event is significantly more accurate at the 5-year interview than their information about the hospital event (83% versus 73%), although both show decrements. There was also an interaction between the type of detail being recalled (central vs peripheral) and time: Children were equivalently accurate when recalling both types of details in their initial interview, but were more accurate recalling central than peripheral details 5 years later.

Overall, children are able to provide as much correct information about the components of the injury event 5 years later as initially, although they also add some additional incorrect information in the later interview. Nevertheless, over 75% of their information about the injury event (and for children who are at least 5 years of age, over 85% of their information) is accurate after 5 years—an impressive degree of recall. Their recall of what happened in the ER is less complete at both interviews. Although what they do recall is just as accurate as their recall of injury details during the initial interview, by the 5-year interview they are less accurate as well as less complete in their recall of the hospital event as compared to the injury event.

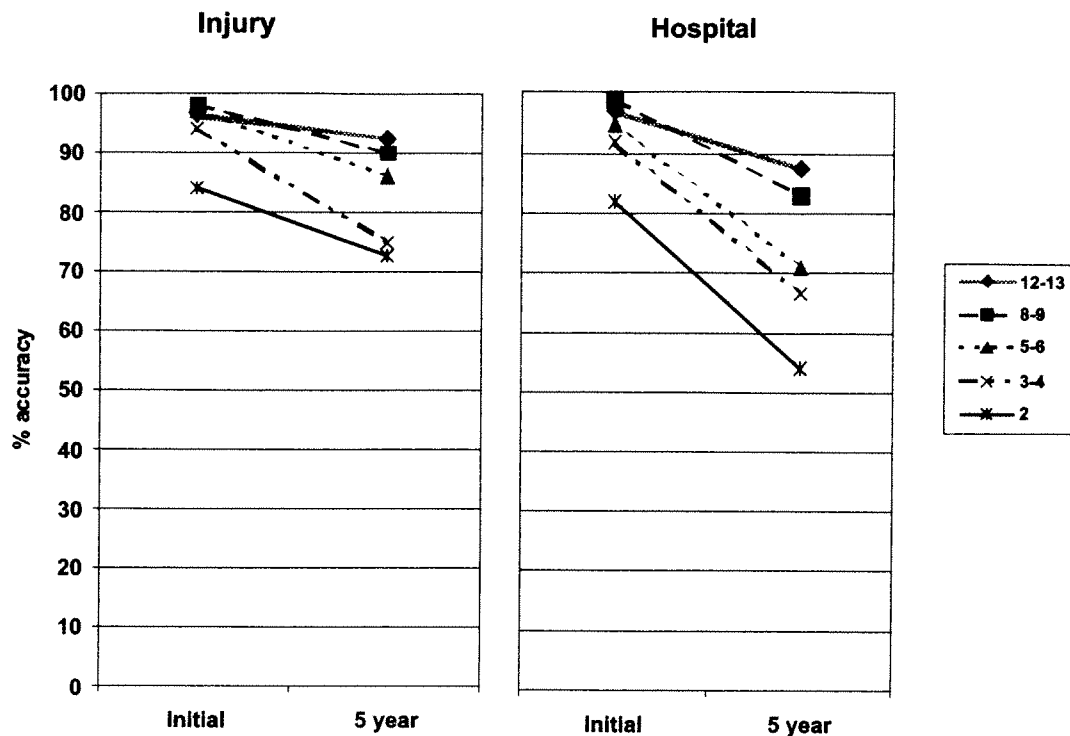


Fig. 2. Percentage of children's recall about their injury and hospital treatment that is accurate, both initially and 5 years later.

There is an important caveat to this body of research, however: These children were interviewed multiple times about the events. Although there was a gap of 3 years between the last interview and the prior one, the children had been interviewed between two and four times within the first 2 years of event occurrence. Clearly, more research needs to be done on children's long-term recall of memorable events when they are not reinterviewed about them on multiple occasions, since such reinterviews can function as reinstatements of the original events (Fivush & Schwarzmueler, 1995; Peterson, 1999; Poole & White, 1995). In addition, no responses to yes/no questions were included in analyses, since concerns have been raised about the validity of this question format with preschool-age children (Peterson & Biggs, 1997; Peterson, Dowden, & Tobin, 1999; Peterson & Grant, 2001). Thus, both recall completeness and, in particular, accuracy assessments could be different if yes/no questions were included in analyses.

Peterson and her colleagues have also traced 20 of the children whose earlier interviews are described in Peterson and Rideout (1998) 5 years after their injury. All were under 26 months of age at the time of injury. Preliminary analyses indicate that a third of the children seem to have some recall of the major components of the injury episode 5 years later, another third have only fragmentary recall, and the remaining third have no recall at all. For those children who seem to recall the event, it is their injury, not

their hospital treatment, that they remember. The groups did not differ in terms of whether the children were older or younger 1-year-olds at the time of injury, and the youngest child who seemed to have definite recall was only 13 months of age when he was injured. Thus, some 1-year-olds demonstrate very long-term recall over delays of at least 5 years. Since adults also occasionally recall events from this young, this is not an entirely unexpected finding. Nevertheless, the majority of the former 1-year-olds did not.

In summary, the studies that have investigated children's recall after 4 or more years have shown that some events are very well recalled by children, whereas some are not. Thus, the topic of recall is a critical variable. Even when the same children are remembering two different parts of what was really one integrated event (namely an injury and a subsequent ER treatment of that injury), both of which happened at the same time, recall differs depending upon event. Thus, any conclusions about how well children can remember something long-term critically depends the question "what sort of event are they remembering?"

### **Factors influencing long-term recall**

It is beyond the scope of this review to evaluate the sorts of factors that seem to enhance children's long-term recall. However, a few factors that have been mentioned above should be highlighted. As noted above, the nature of the event is an important factor. A number of event properties that contribute to some events being more memorable than others have been suggested by investigators, such as the emotional impact of the event (see review by Quas et al., 1997), the integration of the event into one's life story or the importance of the event in defining one's sense of self (Brewer, 1986; Bruner, 1987; Neisser, 1988), and the distinctiveness of the event (Bauer et al., 1998; Howe, 1997).

One important factor is age of occurrence, with events happening at older ages remembered better than events occurring at younger ages. However, there are a number of exceptions reported in the literature, where older and younger children display equivalent recall of salient events (e.g., Quas et al., 1999, for those children who remember the VCUG event; Sheingold & Tenney, 1982, for a sibling's birth). Furthermore, there seems to be a particular difficulty for children as young as 2 years of age (when an event happened) recalling the occurrence of some events which older children readily recall (e.g., having a VCUG—Quas et al., 1999, but see Peterson & Rideout, 1998, and Peterson & Whalen, 2001, who show that former 2 year olds have reasonably good memory for injuries although not subsequent ER treatment). But long-term recall of events occurring when a child is only 1 year old, in the absence of contextual support, is relatively rare (e.g., Peterson & Rideout, 1998).

Some investigators have highlighted the poorer language skills of younger children as a contributor to their poorer memory skills (Bauer & Werker, 1995; Burgwyn-Bailes et al., 2001) or children's limited ability to participate in conversations about events at the time they occur because of linguistic limitations (Peterson & Rideout, 1998). As well, children's ability to organize their event-tellings in narratively coherent ways may also contribute to the quality of event memory. That is, children who have better mastery of language narrative skills may have enhanced long-term recall of events (Fivush, 1994; Nelson, 1993; Snow, 1990).

A number of investigators have pointed out the importance of the child's comprehension of an event at the time it occurs. Pillemer et al. (1994) account for the difference in older versus younger preschoolers' recall of an emergency evacuation of their preschool by looking at the children's understanding of the causal and temporal relations between events that comprised the evacuation episode. Likewise, Goodman, Quas, Batterman-Faunce, Riddlesberger, and Kuhn (1994) found that children who had greater understanding of a VCUG procedure had better memory for it. Even infants show better long-term recall of toy manipulation sequences that have temporal and enabling connections between actions rather than random ones (Bauer et al., 2000).

Reminding children of target events also seems to enhance long-term recall. For example, having intervening interviews between event occurrence and final memory assessment, which serve to remind children of the target event, seems to help children remember (see reviews in Fivush & Schwarzmüller, 1995, and Poole & White, 1995). But again, the content of the event may play a role. For example, Peterson (1999) found that when children's recall of medical emergencies was assessed 2 years after their injuries, having an additional interview at 1 year postinjury had little effect on children's recall of the details surrounding the highly memorable injury episode at 2 years. In contrast, having that extra interview helped children recall the details of hospital treatment—the episode that they seem to have more difficulty remembering.

And finally, there are a number of parental variables that seem to play a role. For example, parents who spend time discussing salient events with their children seem to help them remember those events, whether the events are fun trips to Disney World (Hamond & Fivush, 1991) or uncomfortable medical procedures (Goodman et al., 1994). And if, during those event discussions, parents use a more topic-extending or elaborative style, their children seem to recall more after delays of a year or more (Fivush, 1994; Haden et al., 1997; McCabe & Peterson, 1991; Peterson & McCabe, 1992, 1994, 1996; Reese et al., 1993). As well, parents who have an avoidant attachment style (Quas et al., 1999) or who are more traditional in their parenting practices (Burgwyn-Bailes et al., 2001) have children who seem to have poorer long-term recall. (See Quas, Qin, Schaaf, & Goodman, 1997, for an excellent



review of individual differences and memory.) The role of child and family individual difference variables in predicting children's long-term memory is becoming a very active area of research, and undoubtedly children's recall will be found to be influenced by a number of individual and family variables.

### **Conclusions: Do young children have long-term autobiographical memory?**

Although very few if any memories for events which occurred when children were 1 or 2 years of age continue to exist into adulthood, it is nevertheless clear that a verbal long-term memory system is present in 2-year-olds and even in 1-year-olds. Two-year-olds readily engage in conversations about events that occurred several months previously. Virtually all of these events will not be recalled many years later but, surprisingly, some are. Although only particularly salient events seem to have this memory longevity, both research with adults and with children have found that at least some types of events seem to be recalled for many years.

The record is much richer for children who are at least 3 years of age. Whether the events are serious personal traumas (Terr, 1988), natural catastrophes (Fivush, in press; Sales et al., 2001), injuries (Peterson & Whalen, 2001), medical procedures (Quas et al., 1999), trips to Disney World (Hammond & Fivush, 1991), or random events selected by parents as salient occurrences (Fivush & SchwarzmueLLer, 1998), children can display impressive long-term memory for events that occurred when they were this young. When given open-ended prompts, they are able to provide as much information as they had when interviewed soon after event occurrence (Fivush & SchwarzmueLLer, 1998) and, surprisingly, much of this information is new and different from what they provided before. When given more focused probing, children display impressive recall for many details, although such focused questions have shown that children show some forgetting and that they show some decreases in recall accuracy. However, such decreases need to be seen in perspective: children are recalling events that occurred when they were very young, namely when they were preschoolers, and the delay between event occurrence and later recall can be considerably greater than between when the child was born and when the event originally happened. The fact that children are sometimes so accurate after the passage of so many years is remarkable.

As we have seen, there have been only a few investigations of children's memory over long time spans, and those that do exist are all subject to limitations. For example, children are often interviewed multiple times before the final memory assessment, and the entire event may be reinstated in detail by such reinterviews. Furthermore, the events that tend to be recalled long-term are the types of events that also may become incorporated into

family stories or have external reminders such as photographs or videos, and it is not clear how much of a role such familial reminders may play, although parents claim that such events are only talked about in the days immediately afterward (Peterson, 1999), and Usher and Neisser (1993) found that the presence of photographs was associated with poorer recall. Furthermore, Fivush and Hamond (1990) found that when young children talked with a parent about an event considerably prior to talking with a researcher, they incorporated relatively little parent-provided information into their accounts. Thus, there is no reason to assume that children merely recall what parents have said about prior events rather than recall the events themselves, although very little good data exist to resolve this issue. Thus, more research in this area is desperately needed. However, it seems that for some events at least, children *can* have excellent recall of autobiographical events that endures over many years. A summary given above bears repeating: any conclusions about how well children can remember something long-term critically depends on the question “What sort of event are they remembering?”

### **What are the courts asking memory experts about children’s long-term memory?**

Although a main focus in the legal arena is suggestibility, basic questions about autobiographical memory emerge in a surprising number of cases involving child witnesses, and these cases span criminal, family, and civil cases. In this section, some questions asked by the courts will be posed, and answers that are suggested by the literature reviewed here are given.

#### *Can a preschooler (and especially, can a 2-year-old) be a reliable witness?*

In a recent case, a 2-year-old was the only witness to an accident that left her mother permanently disabled, and the question that arose was whether a 2-year-old could be a reliable witness (D. Poole, personal communication, May 2001). In fact, courts are filled with cases that involve preschool-age children, and often they are the sole witnesses to critical events. The evidence reviewed here is unequivocal: children this young can give reliable testimony. More specifically, if events are highly salient and distinctive, they can be highly memorable over remarkably long periods of time, even for children as young as 2 years of age. It is undeniable that children this young are vulnerable to misleading questions, to suggestions, and to a range of poor interviewing practices (for a review see Bruck, Ceci, & Hembrooke, 2002), but, when interviewed appropriately, preschoolers can exhibit reliable long-term recall.

*How important are competency requirements such as understanding the concept of truth and lies?*

Courts not only have been suspicious of children's memory skills but they often impose competency requirements that are unrelated to memory skills, for example, whether or not children understand the concept of truth or lies. However, cognitive development in areas unrelated to memory may not a good predictor of the reliability of an individual child's memory reports. The 2- and 3-year-olds whose long-term memory was assessed in various studies reviewed above may have little ability to define these concepts appropriately for the court, but they undeniably have the ability to recall events over long periods of time.

*What can we make of the fact that children do not always describe events in the same way from time to time?*

According to Steward et al. (1996, pp. 6–7), "the consistency of a child's report was rated in a recent national survey as one of the top three criteria that professionals use to assess the accuracy of allegations of child abuse." A recent analysis of the data from children who were recruited in a hospital ER by Peterson and her colleagues is particularly relevant to the issue of consistency (Peterson et al., 2001). Peterson et al. assessed the consistency of the children's reports across four interviews spanning 2 years, and even preschoolers (when questioned similarly) were highly consistent across interviews when recalling their injury, with an average of 80% of the information recounted in later interviews being present in the earlier ones—at least for the highly memorable injury event. (As discussed above, the details of what happened in the ER are less memorable than the details of the injury.) And the information that was consistently reported from interview to interview was almost always accurate. In particular, the major components of what happened were consistently and accurately reported in interview after interview.

Errors occurred, of course, and attorneys often ask what we can make of the fact that events are sometimes described differently. Some types of information are more error-prone than others; for example, any question querying information about time seems to be particularly problematic because preschoolers have a poor grasp of time concepts. Thus, they did poorly when questioned about when something happened, what time of day it occurred, and even the sequence of some events (Peterson, 1996). As another example, bystanders, onlookers, or people who played minor secondary roles were not recalled well. Some children even asserted (when interviewed 2 or 5 years after an injury) that a yet-unborn sibling was among the onlookers. In contrast, the major participants and the central actions and events were not confused.

A further finding of Peterson et al. (2001) was that information provided for the first time a year or two after the injury occurred (but not present in the earlier interviews) was not reliable. (See Pipe et al., 1999; Salmon & Pipe, 1997, and Steward et al., 1996, for similar findings.) Remember, however, that the interviews by Peterson and her colleagues were highly similar across time; in contrast, Fivush and her colleagues (Fivush et al., 1995; Fivush & Hamond, 1990; Fivush & Shukat, 1995) found that information appearing for the first time in later interviews was likely to be accurate, but interviews differed substantially across time and often new information appeared for the first time in a later interview simply because it was not asked about in an earlier interview.

Returning to the question of what we can make of inconsistencies in young children's reports to the court, the answer depends on what children are inconsistent about. If they are inconsistent about tangential information, people who played minor roles or who were just onlookers, or issues involving time, then such inconsistencies cannot be seen as compromising the reliability of the child's report. On the other hand, inconsistencies in terms of participants playing major roles or the central components of events are a different story. For example, in a murder case described by Poole and White (1995), a 5-year-old identified in different interviews more than a dozen perpetrators and four different murder weapons. Such inconsistency about the major components of a highly salient event was simply not found by Peterson and her colleagues.

In summary, an understanding of children's long-term memory skills can help courts assess the testimony of child witnesses. Such an understanding is an important foundation for forensic applications, even though other factors (such as poor interviewing techniques) may compromise that testimony. However, if one understands that young children *can* demonstrate good long-term recall, one is in a better position to evaluate the assertions of particular children under particular interviewing circumstances.

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