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Young Children's References to Temporal Attributes of Allegedly Experienced Events in the Course of Forensic Interviews

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Developmental differences in references to temporal attributes of allegedly experienced events were examined in 250 forensic interviews of 4- to 10-year-old alleged victims of sexual abuse. Children's ages, the specific temporal attributes referenced, and the types of memory tapped by the interviewers' questions significantly affected the quantity and quality of temporal references produced. The findings documented age-related increases in 4- to 10-year-olds' references to temporal attributes, using the appropriate relational terminology, both spontaneously and in response to temporal requests. More references to temporal attributes were elicited from recall than from recognition memory, highlighting spontaneous reporting capabilities. Implications for theories concerning the developing understanding of temporal concepts and for the design of effective, age-appropriate, forensic interview techniques are discussed.

Time is both an integral part of episodic memories (Tulving, 1972, 2002) and a type of source knowledge that uniquely defines autobiographical episodes, yet there has been little systematic research on developmental changes in the amount and type of temporal information provided by children when verbally recounting experienced events. In his work on the developing conceptualization of time, Piaget (1927/1971) emphasized that time is a fundamental epistemological concept that children come to understand later in development (9 or 10 years of age) relative to their understanding of objects and actions, in part because time concepts depend not on direct perceptual information (Gibson, 1969) but rather on the ability to logically infer the consequences of actions, understand causal relationships, and explain later events in terms of earlier events. Only when children can relate to time operationally, he argued, are they able to understand and reconstruct time sequences in reverse. Younger children cannot engage in such reversible operations "whereas 8-year-olds can make use of that power and thus reconstruct the true and irreversible order of events" (Piaget, 1927/1971, p. 6).

The most influential recent research on the development of temporal understanding in young children has been conducted by Friedman (e.g., Friedman, 1990, 1992, 1993, 2000; Friedman & Lyon, 2005). Friedman differentiated among and examined the temporal processes involved in reconstructing the time of past events, the conditions under which different processes are useful, and the effects of temporal category, task characteristics, context familiarity, and children's age on the accuracy of their temporal judgments. In addition to this line of research, the present study draws on studies examining children's abilities to reference the temporal attributes of past events; understand and use relational words, such as first, next, before, after (Fivush & Mandler, 1985; Nelson, 1993); and construct narratives (Fivush & Mandler, 1985; French, 1989; French & Nelson, 1981; Hudson & Shapiro, 1991; Lamb, Orbach, Sternberg, Esplin, & Hershkowitz, 2002), as well as their general knowledge of time patterns (Friedman, 1977, 1986, 1991, 1992).

The present study focuses on age-related differences in 4- to 10-year-old children's references to temporal attributes (i.e., sequencing, dating, number of occurrences, duration, and frequency) when describing allegedly experienced incidents of abuse

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both spontaneously and in response to temporal requests made during forensic interviews. All the interviews were conducted using the National Institute of Child Health and Human Development (NICHD) structured Investigative Interview Protocol (Orbach et al., 2000).

The ability to report temporal attributes of past events (e.g., the temporal sequences of within-event components, chronological order, and the time of occurrence) depends on the capacity to mentally reconstruct time (Piaget, 1927/1971; Tulving, 1972) by relating information associated with memory traces of a target event to general knowledge of time patterns (e.g., cyclic periods of time nested within progressively higher order temporal scales, such as days of the week or months of the year; Friedman, 1977, 1986, 1991, 1992). In addition, temporally related linguistic markers (i.e., relational words such as before, after, first, next) need to be recognized and produced to report the temporal relations among past events and within-event components (Fivush & Mandler, 1985; French & Nelson, 1981; Harner, 1980; Nelson, 1993; Weist, 2002; Winskel, 2003). As they develop, children provide increasingly complex temporal reports (Carni & French, 1984; Fivush & Mandler, 1985; Friedman, 1986, 1991; Weist, 2002) and more often produce lengthy contextualized narratives (Hudson & Shapiro, 1991; Lamb et al., 2002; Orbach et al., 2000) as well as increasingly accurate estimates of temporal attributes (Brown, 1975; Droit, 1995; Ellis, Palmer, & Reeves, 1988; Fivush & Haden, 1997; Friedman, 1986; Levin, 1979). The ability to report temporal information about experienced events is also affected by event-specific factors, such as the content of the event (e.g., Friedman, 1986, 1990, 1991; Hudson & Shapiro, 1991; Levin, 1992), the number of events to be reported (Powell & Thomson, 1996), or the delay between the event and the interview (Hudson & Shapiro, 1991; Lamb, Sternberg, & Esplin, 2000; Oates & Shrimpton, 1991). Additional factors involve retrieval conditions, including the availability of temporal requests and the type of memory tapped by the eliciting prompts (Lamb et al., 2002; Sternberg et al., 1996).

Researchers have demonstrated that the ability to make accurate temporal judgments steadily improves with age (e.g., Carni & French, 1984; Fivush & Mandler, 1985; Friedman, 1977, 1986, 2000). Although subsequent research has found that Piaget underestimated children's incipient abilities to make judgments about succession and duration and showed that children can make these judgments in some contexts at a much younger age than Piaget believed (e.g., Brown, 1975; Droit-Volet, Clement, & Wearden, 2001; Friedman, 1990), researchers have found substantial changes in other aspects of children's temporal understanding at 8 to 10 years of age (e.g., Friedman, 1992; Montangero, 1992; Tartas, 2001). These discrepant findings are attributable mainly to the interaction among the specific temporal category (e.g., sequencing, dating), context familiarity (e.g., knowledge of conventional time scales such as days of the week or months of the year), and task complexity, with respect to both the types of prompts (e.g., open ended or forced choice) and their content (e.g., forward vs. backward sequencing), which influence the age at which particular temporal tasks can be performed (Carni & French, 1984; Fivush & Mandler, 1985; French, 1988, 1989; Friedman, 1977, 1990, 1991; Hudson & Shapiro, 1991; Levin, 1992). For example, children can recognize and reconstruct temporal sequences earlier than they can verbally recall them (Brown, 1975; Gibson, 1975; Klausmeier, Ghatala, & Frayer, 1974). In addition, children can display mastery of certain tasks in some contexts earlier than in other contexts, thus successfully completing specific temporal tasks at younger ages when they are placed in more familiar contexts. For example, they can specify backward sequences of familiar daily activities ("Before we went to sleep, we watched TV") earlier than they can specify backward sequences of the months of the year ("November is the month before December"; Friedman, 1986, 1990).

Whereas Piaget (1927/1971) argued that duration judgments rely on succession, speed, and distance cues, and are thus understood late in development, other researchers have shown that preschoolers can perceive duration noninferentially in the context of familiar events (Droit, 1995; Droit-Volet et al., 2001) or familiar daily activities (Friedman, 1990). Context effects were also evident in studies conducted on the estimation of temporal attributes when attribute values that were easily differentiated facilitated the estimation tasks (Archer, 1962; Gibson, 1975; McCormack & Russell, 1997). Evidence that context affects children's performance on temporal tasks challenges theories explaining age differences in terms of broad qualitative shifts in children's thinking.

The present study was designed to examine children's references to temporal attributes while recounting allegedly experienced events during forensic investigations. In forensic settings, information about temporal attributes such as the date of occurrence, the number of alleged incidents, and the sequence of event components can uniquely define specific incidents (Tulving, 1972, 2002) and help structure narrative accounts of experiences. The present study is the first to explore temporal references in children's narratives about allegedly experienced and personally meaningful events. In the legal context, it is often critically important to specify the time at which an alleged criminal offence occurred. In cases of child sexual abuse, it is especially important to obtain such information from alleged victims because corroborative evidence is scarce and in most cases the victim is the sole witness to the crime other than the suspect. Even when alibi defenses are unlikely because the alleged perpetrator is part of the victim's immediate family and has continuous access to the child (as in 91 of the 250 cases in the present study) and when multiple incidents of abuse by the same perpetrator are alleged (as in 142 of the cases), the value of the children's testimony is enhanced when the temporal context of the alleged abuse is specified. Such references to time of day (e.g., day, night), contiguity with another activity (e.g., "every time when my mother works the night shift"), or estimations of when the abuse was initiated (e.g., "it started when I was in first grade") contribute important forensic information. Moreover, temporal references enhance the retrieval of event-specific narratives and eliminate the non-contextualized lists of actions that are typical of script descriptions. It is much easier to evaluate children's credibility in such narrative accounts, contained in interviews of high quality, in which most information is retrieved from recall rather than from recognition memory (Hershkowitz, 2001; Raskin & Esplin, 1991; Undeutsch, 1982).

Sequencing

In addition to helping place events and within-event components in chronological order, the sequencing of within-event components facilitates both the reconstruction of to-be-remembered events and the production and structuring of narrative responses, thereby rendering forensic accounts more comprehensible. Piaget (1927/1971) argued that children younger than 6 or 7 years have difficulty reconstructing sequential relationships because they lack the prerequisite abilities to infer causal and logical connections between actions and to understand the reversible nature of these associations. Children seem able to represent temporal sequences mentally much earlier than suggested by Piaget, however (Brown, 1975; Brown & French, 1976; Carni & French, 1984; Fivush & Mandler, 1985; Strube & Weber, 1988). Preschoolers can provide narrative accounts of experienced events, report event components in a temporally coherent order, and use relational vocabulary to contextualize their narratives and to sequence familiar and unfamiliar events using pictorial representations (Fivush & Mandler, 1985; French, 1989; French & Nelson, 1981; Friedman, 1990). The ability to accurately reconstruct within-event sequences of familiar activities (i.e., having lunch, eating at a restaurant) presented pictorially and to judge their relative timing (i.e., earlier, later) steadily increases between 4 and 10 years of age (Fivush & Mandler, 1985; Friedman, 1977, 1990; Thompson, Gomez, & Schvaneveldt, 2000). In a study examining young children's responses to open-ended prompts, sequencing was often referenced by 4- to 8-year-old children during forensic interviews, with children as young as 4 years structuring narrative accounts of allegedly experienced events and using the appropriate relational vocabulary (e.g., next, before, after; Lamb et al., 2003). Although considerable controversy persists about the ability to move bidirectionally within mental representations of the order of events or the sequence of contiguous event components, many researchers have demonstrated that children under 7 years have difficulty with sequence reversibility and that, like other temporal abilities, the ability to project backward depends on familiarity with the specific content and the ability to represent it mentally (Carni & French, 1984; Fivush & Mandler, 1985; French, 1989; French & Nelson, 1981; Friedman, 1986, 1990, 1991).

Dating

Both adults and children have difficulty dating most autobiographical events (Friedman, 1987; Wright, Gaskell, & O'Muircheartaigh, 1997). Friedman has argued that dating—making inferences about when an event could have taken place—is enabled by knowledge about conventional time patterns, acquired over many years (Friedman, 1991, 1993). Dating of experienced events involves a number of processes, including temporal distancing, that is, assessing how much time has elapsed between the occurrence of a past event and the present time (e.g., "a long time ago") and temporal localization, that is, linking the time when an event occurred to a conventional time scale, an anchoring landmark event, or an extended lifetime period (e.g., "on November 23," "the day before Thanksgiving," or "when I was in high school," respectively; Friedman, 1991; Shum, 2000). Friedman has further demonstrated that the two skills—distancing and locating—are developmentally independent, that the awareness of temporal distance develops earlier than the ability to locate events in time (Friedman, 1991, 1992), and that the ability to link events to a location on a long time scale increases with age (Friedman, 1977, 1991). Friedman

(1991) also showed that 6- to 8-year-olds were able to use cues about distance to judge the relative recency of two events, whereas location responses were used when events could be linked to representations (Friedman, 1991). The ability to temporally locate events is affected by context, however, such that children as young as 4 years can locate past events on the time-of-day scale but cannot locate past events on a scale longer than a day (Friedman, 1991). Accurate referencing of conventional temporal locations in the past and use of long-scale patterns such as seasons and months are generally not grasped until after 6 years of age (Friedman, 1991; Strube & Weber, 1988; Tartas, 2001). Moreover, preschoolers seem incapable of using landmark (anchor) events to improve temporal reconstruction (Friedman, 1991; Strube & Weber, 1988), and children younger than 13 years perform poorly when asked to determine the proximity of Halloween to an unrelated target event (Friedman & Lyon, 2005). In a field study (Lamb et al., 2003), young children between the ages of 4 and 8 years could indicate the timing of at least one of the incidents they alleged by reference to the calendar (e.g., ''last Tuesday'') or to a discrete event (''the last time I slept over there''). Preschoolers (4- to 6-year-olds) were considerably less informative than 7- and 8-year-olds, however.

Number of Occurrences

Witnesses' realization that the abuse allegedly occurred at more than one time may be crucial in legal contexts. In courts of law, child witnesses are expected to recount specific episodic events, each occurring at a particular place and a specific time. When repeated abuse is reported (i.e., when the child describes multiple episodes of abuse by the same perpetrator), interviewers are urged to solicit event-specific details rather than generic accounts of what usually happens, but their success may be impeded by the children's inability to report the number and timing of the allegedly experienced incidents. The development of the ability to estimate the number of similar recurring events is poorly understood, in fact. Several researchers (Connolly, Hockley, & Pratt, 1996; Ellis et al., 1988; Hasher & Zacks, 1979) have suggested that this ability matures early and remains invariant between 5 and 20 years of age, whereas others have shown gradual developmental improvements (Ghatala & Levin, 1973; McCormack & Russell, 1997; Sanders, Zembar, Liddle, Gonzalez, & Wise, 1989). Most researchers have studied such estimation using simple visual stimuli, such as word lists, pictures, or lights (Brown, 1997; Ellis et al., 1988; Hasher & Zacks, 1979) rather than experienced events.

Duration

There is wide agreement among researchers that duration is poorly understood by children and is inaccurately estimated before 8 to 10 years of age (Droit, 1995; Droit-Volet et al., 2001; McCormack, Gordon, Brown, Smith, & Brock, 2004). Most researchers have confirmed Piaget's (1927/1971) prediction that children can infer event duration from nontemporal, perceptually based cues (succession, speed, and distance) only after 10 years of age, when they no longer confuse duration with distance or speed and understand the interrelationship among these three concepts (Acredolo, 1989; Levin, 1977; Levin, Israeli, & Darom, 1978; Matsuda, 2001). Piaget's assertion that duration is estimated using nonduration perceptual information has been challenged, however. For example, Levin and her colleagues (Levin, 1979; Levin et al., 1978) showed that although succession can facilitate judgments of duration, children can judge duration without relying on speed and distance cues. Furthermore, preschoolers can perceive duration noninferentially in the absence of succession or order cues (Droit-Volet et al., 2001; Richie & Bickhard, 1988) and can use personal experience to estimate the duration of familiar events (Droit, 1995; Droit-Volet et al., 2001) or the intervals between familiar daily activities (Friedman, 1990).

Frequency (Rate of Occurrences)

No researchers have studied children's ability to estimate frequency of events, although several have shown that adults reference frequency (i.e., rates of occurrence per unit of time) when describing regularly repeated occurrences of similar events (Burton & Blair, 1991; Conrad, Brown, & Cashman, 1998; Menon, 1993, 1994; Menon, Raghubir, & Schwarz, 1995).

In all, studies designed to identify when the abilities to make specific temporal judgments emerge do not elucidate developmental trends in the use of these capacities when verbally describing experienced events. Whereas most researchers have examined specific temporal skills by focusing on the ability to estimate single temporal attributes, primarily using reconstruction and recognition tasks in laboratory settings (i.e., Brown, 1975; Carni & French, 1984; Droit-Volet, Tourret, & Wearden, 2004; Friedman, 1986, 1990), and some have studied children's verbal accounts of contrived events (Friedman, 1991;

Friedman & Lyon, 2005), none has examined children's spontaneous references to temporal attributes when recounting personally experienced, uncontrived real life events. In contrast with the experimental literature reviewed, the children's reports we studied involved negative, emotionally charged, and at times traumatic allegedly experienced events.

The present study was designed to explore the relationships among children's ages, the specific temporal attribute referenced, the retrieval mode (i.e., spontaneously or in response to requests for temporal information), and the way interviewers formulated their requests for information (i.e., whether tapping recall or recognition memory). Whereas laboratory studies typically ask participants to focus on single temporal characteristics, the forensic interviews examined in the present study afforded child witnesses opportunities to describe allegedly experienced events using a range of temporal attributes, both spontaneously and in response to temporal requests. In addition, the temporal scales employed in the present study for reporting real-life events were of much greater magnitude than those typically explored in the laboratory. Moreover, whereas the emphasis in laboratory studies is usually on temporal information provided during recognition-based processes, the emphasis in the present study was on recall-based processes. In forensic contexts, responses to individual free-recall prompts are typically 3 to 5 times more informative than responses to more focused prompts (e.g., Lamb et al., 1996; Sternberg, Lamb, Davies, & Westcott, 2001; Sternberg et al., 1996). The study reported here is the first to examine children's free-recall references to temporal attributes when recounting allegedly experienced events. Because the forensic interviews analyzed involved the NICHD Investigative Interview Protocol (Orbach et al., 2000; Sternberg, Lamb, Orbach, Esplin, & Mitchell, 2001), in which emphasis is placed on free recall of information, the children had ample opportunity to provide free-recall narratives and thus highlight their spontaneous reporting capabilities. The data provide a unique opportunity to learn about age-related changes in children's references to temporal attributes of real-life events that occurred much earlier in time and about the effects of different types of questions on the temporal references elicited.

Because the interviews explored uncontrived real-world events, however, accuracy could not be determined and the children's competence was measured by their ability to reference temporal attributes spontaneously in response to general prompts (i.e., "Tell me everything that happened") and responsively in response to interviewers' requests for temporal information (e.g., "When did it happen?"). Children's responsiveness (i.e., the match between their responses and the interviewers' requests) was determined by the appropriateness of the temporal category, the appropriate relational terminology, and the temporal scale used. Research in laboratory analog contexts has shown that freely recalled information is more likely to be accurate than information retrieved in response to recognition memory prompts, including those presented in yes–no and forced-choice formats (Dale, Loftus, & Rathbun, 1978; Dent, 1986; Dent & Stephenson, 1979; Goodman, Bottoms, Schwartz-Kenney, & Rudy, 1991; Hutcheson, Baxter, Telfer, & Warden, 1995; Ornstein, Gordon, & Larus, 1992). Young children's free recall reports are also as accurate as those of older children (e.g., Flin, Boon, Knox, & Bull, 1992; Oates & Shrimpton, 1991). Although it is typically impossible to assess the accuracy of information disclosed in forensic cases, close examinations of individual cases in which accuracy could be assessed have yielded findings consistent with those obtained in the laboratory (Lamb & Fauchier, 2001; Orbach & Lamb, 1999, 2001). Additionally, in the present study, case outcome information was examined to provide some indication of the children's veracity.

Although the study was theoretically motivated, it has important implications for policy and practice regarding the interviewing of child victims in the criminal justice system. By examining children's references to various temporal attributes when recounting events in relation to the children's ages, retrieval mode (spontaneous or requested), and type of memory tapped, the findings were expected to elucidate developmental differences and provide valuable information to researchers, clinicians, and forensic investigators about children's emerging abilities to reference different temporal attributes using the appropriate relational terminology. Knowledge about the development of skills required to understand temporal concepts may have significant practical implications, helping forensic interviewers recognize children's strengths and limitations when soliciting forensically important temporal information and thus guide them in formulating age-appropriate temporal requests.

On the basis of the research literature cited earlier and on previous field research documenting gradual increases with age in the amount of forensically relevant information reported by child witnesses, particularly in response to recall prompts (Lamb et al., 2000; Lamb et al., 2003; Orbach et al., 2000; Sternberg, Lamb, Orbach et al., 2001), we predicted age-related increases in the number of references to temporal attributes made by children overall, spontaneously and responsively. We also predicted that there would be more references to the forward than to the backward sequence within event components and that the number of references to backward sequencing, temporal location, duration, and frequency would increase sharply around 10 years of age. Additionally, we predicted that more temporal references would be elicited in response to either recall or free-recall prompts than in response to recognition memory prompts. We further expected that the number of children's references to temporal attributes would be positively correlated with the total amount of forensic information reported.

Method

Participants

All first-forensic interviews of alleged sexual abuse victims between 4 and 10 years of age conducted using the NICHD Investigative Interview Protocol (Orbach et al., 2000; Sternberg, Lamb, Orbach et al., 2001) between 1997 and 2001 by 23 police officers in two U.S. and one UK police departments were considered for inclusion in the study. Of a total of 399 interviews, 149 interviews were excluded: 73 because the victims did not make allegations, 73 because the interviewers did not adhere to the protocol, 1 because the victim was mentally handicapped, and 2 because the interview record was missing. The remaining 250 interviews—all protocol-guided, first-forensic interviews yielding explicit allegations of sexual abuse—were included in the sample. The alleged sexual abuse victims (176 girls, 74 boys; M age = 7.11 years), were distributed among the following age groups: age 4 ($n = 23$), age 5 ($n = 36$), age 6 ($n = 43$), age 7 ($n = 41$), age 8 ($n = 31$), age 9 ($n = 48$), and age 10 ($n = 28$). At the one site ($n = 126$) for which information about ethnicity was available, 77% of the interviewed children were Caucasian, 12% were Hispanic, and the rest were distributed among other ethnic groups. Just over half (53%) of the children came from poverty level, 19% from low income, 10% from moderate income, and 18% from above moderate income families. More than half (142) of the children reported two or more abusive incidents, and 108 reported a single incident. The alleged offenders were coresident family members in 91 cases, more distant relatives in 50 cases, familiar but unrelated individuals in 102 cases, and unfamiliar to the alleged victims in 7 cases. Eleven children reported exposure, 41 reported being fondled over their clothes, 124 reported touching under the clothes, and 74 described oral, anal, or vaginal penetration. There were no age differences with respect to the proportions involving different types of alleged abuse, relationship to the alleged perpetrator, or the reported number of abusive events. The reported delay between the last alleged incident and the date of the interview ranged from 1 day to 234 weeks (4 1/2 years) with $M = 33$ weeks (7 1/2 months) and $Mdn = 8$ weeks (2 months). All of the interviewers received extensive training from researchers at NICHD in the use of the NICHD protocol before and during the project.

The NICHD Investigative Interview Protocol

The NICHD Investigative Interview Protocol was designed to translate experimentally based professional recommendations regarding interviewing strategies (American Professional Society on the Abuse of Children [APSAC], 2002; Home Office & Department of Health, 2002; Poole & Lamb, 1998) into operational interviewing guidelines (Orbach et al., 2000; Sternberg, Lamb, Orbach et al., 2001). The protocol guides interviewers to give priority to open-ended recall prompts to maximize the amount of information recalled from memory without being contaminated by information provided by the interviewer. Recall prompts are known to elicit more accurate information than recognition prompts (Dale et al., 1978; Dent, 1986; Dent & Stephenson, 1979; Hutcheson et al., 1995; Oates & Shrimpton, 1991). To secure event-specific information, the child is asked whether the alleged abuse occurred once or more than once immediately after making an allegation and before the interviewer switches focus to the details of each of the reported incidents. By promoting the retrieval of event-specific accounts (about specific incidents, occurring at specific times and places), the protocol minimizes the retrieval of generic or script descriptions (about what usually happens) based on common features of several instances.

Utterance was defined in this study as a conversational turn, containing one or more substantive or nonsubstantive statements, questions, or imperatives (Lamb et al., 1996).

Coding Children's Information

The amount of information reported by the children was measured in the number of "details" reported. Details were defined as informative words or phrases identifying or describing individuals, objects, or events (including actions), which were part of the investigated event or events (Lamb et al., 1996). For example, in the sentence "He grabbed my arm," each word is counted as a detail if appearing for the first time in this context. Details were only counted when they were new and added to the understanding of the topic discussed. As a result, restatements were not counted unless they related to a different context (e.g., the same thing happens again at a later time during the investigated event).

Coding of Temporal References

References to temporal attributes made by children following a temporal marker (i.e., a temporal relational word provided by either the interviewer or by the child) were identified and measured. Each temporal reference ended when a new temporal marker was introduced or at the end of the response (e.g., 1 temporal unit was coded if the child spontaneously said, "He hugged me, *then* he said . . ." and 2 temporal units were coded if the same was said in response to the question, "*Then* what happened?"). Temporal references were categorized by attribute category, retrieval mode, and type of memory tapped (see Figure 1). The categorization of temporal references by retrieval mode (spontaneous – responsive) and prompt type (recall – recognition) enabled estimation of children's spontaneous and responsive capacities separately for each temporal category. References to temporal attributes that did not relate to a specific incident but rather summarized features common to more than one incident (e.g., what usually happens) were assigned to the appropriate temporal category (e.g., "He would close the door then sit next to me" would be categorized as sequencing). Generic statements that did not involve temporal information (e.g., "He always closed the door") but only implied the possibility that more than one incident happened (using words such as *usually, always, ever,* or *never*) could not be attributed to any of the temporal categories studied and thus were not coded as temporal information, although they were counted as details. Temporal references made in response to multiple temporal requests formulated as yes – no prompts posed in a single interviewer utterance (e.g., "Was it in the winter? Was it in day time?") were excluded from the statistical analyses because it was not possible to determine the prompt to which the response related.

Temporal attributes. References to temporal attributes were coded using five exhaustive and mutually exclusive categories: dating, sequencing, number of occurrences, duration, and frequency.

Sequencing was coded when the child ordered contiguous or noncontiguous within-incident event components or a series of abusive incidents temporally. Three subcategories were distinguished: (a) forward sequencing when an event component was said to have occurred after a temporal reference point (e.g., "He closed the door; then he locked it"), (b) backward sequencing when an event component was said to have occurred before a temporal reference point (e.g., "Before he kissed me, he put me on his lap"; "He was angry because I said I would tell my Mom"), and (c) simultaneous sequencing when an event component was said to have occurred at the same time as other event components (e.g., "He was touching me while we were watching TV").

Dating was coded when the child referenced the time of the alleged incident(s) by way of either temporal distancing, that is, general estimates of the length of time elapsing between the last incident and the interview (e.g., "long time ago"), or temporal location, that is, links between the alleged incident and a conventional time pattern (e.g., "it was on a Sunday"), an anchoring datable event (e.g., "last

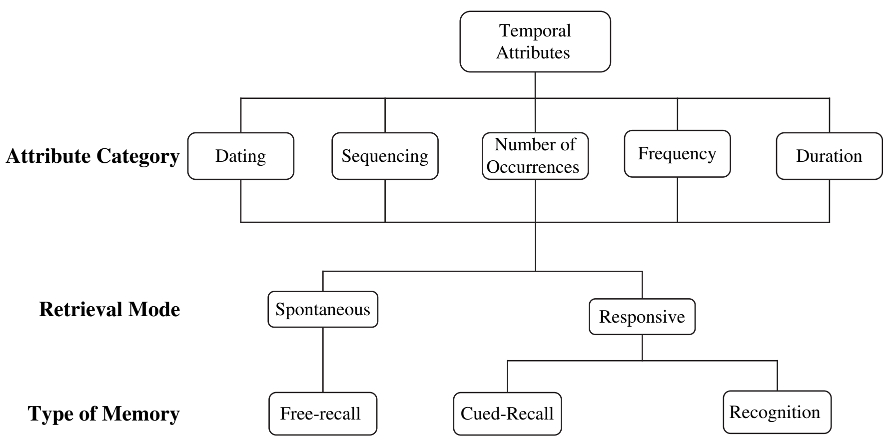

Figure 1. Coding temporal information.

Christmas''), or an extended period (e.g., ''when I was in kindergarten''), as defined by Friedman (1986, 1991). Temporal location was coded as specific when it involved the association between the alleged incidents and objective locations on conventional time scales (e.g., ''on September 23rd'') or datable anchor events (e.g., ''2 days before my birthday''), and as nonspecific when it involved linking the alleged incident to nondatable temporal locations such as part of the day, day of the week, or a season (e.g., ''it was on a Sunday'').

Number of occurrences was coded when the child estimated the number of times abusive incident(s) with the same perpetrator or allegation-related actions occurred, using either nonenumeration strategies that expressed the number of occurrences qualitatively (e.g., ''several times,'' ''more than one time'') or enumeration strategies that provided numerical information in the form of counts (e.g., ''two times''; Brown, 1997; Conrad et al., 1998).

Duration was coded when the child referenced the length of time elapsing between the initiation and termination of an abusive incident (e.g., ''The whole thing lasted more than an hour''), the length of time a within-event component lasted (e.g., ''He held me for 5 minutes''), or the length of the interval between two incidents of alleged abuse (e.g., ''He did not do it for two weeks'').

Frequency was coded when the child referred to the rate of recurrence of an event (as in the case of multiple incidents) or an event component per unit of time (e.g., ''It happened three times a week'').

Retrieval mode and types of recall. Referenced temporal attributes were coded with respect to the way they were triggered using two exhaustive and mutually exclusive categories: spontaneous and responsive.

Spontaneous (free-recall) temporal references involved temporal references of any category made by children in the absence of temporal requests. Examples included temporal references following interviewers' nonsubstantive utterances (i.e., procedural, not related to the investigated event, e.g., ''My job is to talk with children''), temporal references in extended responses to prompts requesting information of other types after providing the requested information (e.g., Interviewer: ''Where was it?'' Child: ''At my home, on Tuesday night''), or references to temporal information in responses to input-free general invitations (e.g., ''Tell me everything that happened''). All spontaneous references to temporal information involved free-recall memory, that is, were retrieved from the interviewee's memory without any limits imposed by the interviewer's prompt (see Lamb et al., 1996; Lamb et al., 2003).

Responsive temporal references were made in response to temporal requests (e.g., ''When did that happen? Then what happened?''), using the specific request category and the appropriate temporal markers and scale (e.g., Interviewer: ''What day of the week was it?'' Child: ''Tuesday''). All responsive references to temporal information were elicited in response to temporal requests by the interviewers tapping either cued recall or recognition memory (see Lamb et al., 1996; Lamb et al., 2003).

Cued-recall references involved references to temporal attributes made in response to open-ended prompts that refocus on previously disclosed information and provide a category for requesting additional information using follow-up invitations (e.g., ''*Then* what happened?''), time-segmenting cues (e.g., ''What happened *just before/after* [an earlier disclosed action]?''), and wh- questions (e.g., ''*When* did that happen?'' ''How old were you when that happened?'').

Recognition-memory references involved references to temporal attributes made in response to focused prompts that introduced previously undisclosed event-related details and asked the child to affirm, negate, or select among investigator-given options (e.g., ''Did it happen at night or during the day?'' ''It happened during the night, didn't it?'') regardless of whether they implied the expected response (option posing and suggestive prompts, respectively).

Temporal references made in response to requests for other types (categories or scales) of information (e.g., Interviewer: ''What day of the week was it?'' Child: ''Last month'') were deemed unresponsive. These were very few in number and were excluded from the analyses.

Procedure

Audio-taped recordings of the interviews were transcribed and checked to ensure their completeness and accuracy. Five raters coded the interview transcripts in preparation for statistical analyses. Three of the raters first identified, quantified, and categorized all temporal references by their attribute category, then categorized each temporal reference's relation to its eliciting utterance (i.e., whether it was provided in response to the interviewer's temporal request or spontaneously in the absence of a temporal request). All requested temporal references were further categorized as responsive (matching the requested attribute and scale) or unresponsive (not matching the requested attribute and scale). The other two raters categorized the type of memory tapped depending on the types of eliciting utterance.

Interrater Reliability

Coders were trained on an independent set of transcripts until they agreed at least 95% of the time with respect to the identification and categorization of all main categories and subcategories. During coding, 20% of the transcripts were independently coded by two coders to ensure that this level of reliability was maintained. Reliability for utterance types and temporal categories was assessed using Cohen's Kappa (Cohen, Cohen, West, & Aiken, 2003). Regarding utterance types, the overall Kappa was .96 and for individual categories ranged from .89 to .97. Regarding temporal categories, the overall Kappa was .97 and for individual categories ranged from .94 to 1.00. Regarding the reliability of identification of details, the proportion of agreement ranged from .90 to .95. All disagreements were discussed with an additional trained coder until consensus was reached.

Means and Percentages Reported

Throughout the results *M* designates the mean number of temporal references and is based on the full sample ($N = 250$). Reported percentages are unweighted mean percentages and are based on the number of children who made a given temporal reference. Except where otherwise indicated, mean percentages were based on $N = 247$.

Results

Preliminary analyses were conducted to test whether there were differences in the number of temporal references by children, in total and across age, due to gender, abuse type, number of occurrences, or reported delay. There were no significant differences; therefore, these independent variables were not included in subsequent analyses. A nonsignificant Pearson chi-square test of the association between age and whether children reported multiple incidents indicated that older children were not more likely to report multiple incidents than younger children.

On average, interviewers directed 52.66 ($SD = 30.86$) substantive utterances (related to the investigated event) per interview, whereas children produced 224.91 ($SD = 210.54$) forensically relevant details per interview. Of the total number of interviewer utterances, 9.81 ($SD = 7.77$) were temporal requests. On average, children produced 11.64 ($SD = 12.21$) responsive temporal units per interview, thereby providing 1.18 ($SD = 0.59$) responsive temporal units per temporal request.

Temporal References by Attribute Category

On average, children made 30.03 references (responsive and spontaneous) to temporal attributes ($SD = 32.50$) per interview. The majority of temporal references (64.61%, $SD = 21.56$) involved temporal sequencing ($M = 21.40$, $SD = 27.77$), followed by number of occurrences ($M = 4.03$, $SD = 3.92$; 18.13%, $SD = 15.12$), dating ($M = 3.87$, $SD = 4.52$; 15.30%, $SD = 14.87$), duration ($M = 0.66$, $SD = 1.42$; 1.79%, $SD = 3.49$), and frequency ($M = 0.07$, $SD = 0.32$; .17%, $SD = 0.84$). As expected, more of the sequencing references involved forward sequencing (68.91%, $SD = 21.94$, $N = 240$; $M = 15.78$, $SD = 23.23$) rather than backward sequencing (15.2%, $SD = 16.77$, $N = 240$; $M = 3.09$, $SD = 4.12$), $t(249) = 9.65$, $p < .001$, $\eta_p^2 = .27$.

Correlations

Correlations were computed to assess the linear association among the total number of temporal references (i.e., temporal units) to temporal attributes by children, the total amount of forensic information (i.e., details) provided by the children, the total number of temporal requests posed by the interviewers, and the children's age (see Table 1). Children's age was significantly and positively correlated with the total number of references to temporal attributes, total forensic information, and the number of temporal requests by the interviewers, indicating that as the age of the children increased they referenced more temporal attributes and provided more forensic information, whereas interviewers made more temporal requests. As expected, the total number of temporal references by the children was significantly and positively correlated with the amount of forensic information they provided, $r(248) = .87$, $p < .001$, and with the number of temporal requests made by the interviewers, $r(248) = .61$, $p < .001$, even after controlling for children's age, $pr(247) = .85$, and .59, *p*s $< .001$, for forensic information and temporal requests, respectively. As a result, analyses for age trends were conducted using analyses of covariance (ANCOVAs) controlling for both the total amount of forensic information (details) provided by the children and the total number of temporal requests made by the interviewers, except where otherwise indicated.

Temporal References by Age

Children's temporal references, on average, increased with age for the total temporal references provided and for the categories of sequencing, dating,

Table 1
Total Number of Details and Total Number of Temporal Units by Age

	Age							Total	
	4 (n = 23)	5 (n = 36)	6 (n = 43)	7 (n = 41)	8 (n = 31)	9 (n = 48)	10 (n = 28)	(N = 250)	
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	r
Total no. of details	83.61 (53.53)	138.11 (97.42)	205.21 (203.83)	215.66 (176.66)	246.97 (218.37)	264.58 (194.46)	403.93 (316.37)	224.91 (210.54)	.37***
Total no. of temporal units	12.17 (8.93)	17.81 (15.10)	24.26 (21.92)	26.44 (31.03)	36.13 (34.05)	33.04 (22.82)	62.64 (57.49)	30.03 (32.50)	.37***
Total no. of temporal requests	7.57 (4.33)	9.44 (8.98)	8.93 (5.07)	8.10 (4.95)	10.45 (7.64)	10.65 (7.95)	13.82 (12.52)	9.81 (7.77)	.18**

Note. Correlation is between the variable and age.
**$p < .01$. ***$p < .001$.

and number of occurrences, as shown in Table 2. Duration and frequency were referenced too seldom to permit meaningful analyses. ANCOVAs controlling for both the total amount of information provided by children and the total number of temporal requests yielded significant positive linear age trends in the total number of temporal references to temporal attributes and in the subcategory of backward sequencing. In addition, significant quadratic age trends emerged for specific temporal location and backward sequencing, indicating a reliable shift at the older ages for these two categories. Follow-up analyses of the adjusted means for specific temporal location and backward sequencing revealed that the quadratic effect was attributable to the performance of the 10-year-old children. When the 10-year-olds were not included in the analyses, the quadratic effects were no longer significant. Pairwise comparisons of the adjusted means showed that the 10-year-olds referenced backward sequencing significantly more than 5- to 7-year-olds. The simple slopes of the quadratic regression lines (Cohen et al., 2003) at each age became progressively steeper, with the largest increase at age 10 (.28, .41 .54, and .70, for the 7- to 10-year-olds, respectively, for specific temporal location, and .27, .53, .80, and 1.06, for the 7- to 10-year-olds, respectively, for backward sequencing).

Average Number of Temporal Units per Request by Temporal Category and Age

Age trends in the average number of responsive temporal units per temporal request were tested using ANCOVAs controlling for the total number of details provided by the children. There was a significant linear trend in the total number of responsive temporal units per temporal request, $F(1, 240) = 5.87$, $p < .05$, $\eta_p^2 = .02$, with more temporal units per request provided by children with increasing age (M = .90, .89, 1.10, 1.18, 1.29, 1.37, and 1.44 for 4- to 10-year-olds, respectively). Significant linear trends emerged in the category of total sequencing, $F(1, 227) = 5.24$, $p < .05$, $\eta_p^2 = .02$ (M = .93, .87, 1.19, 1.29, 1.50, 1.56, and 1.69 for 4- to 10-year-olds, respectively), and the subcategory of simultaneous sequencing, $F(1, 113) = 10.74$, $p < .01$, $\eta_p^2 = .04$ (M = .76, .84, .97, .96, 1.15, 1.07, and 1.86 for 4- to 10-year-olds, respectively). A significant quadratic age trend also emerged for number of occurrences, $F(1, 218) = 4.08$, $p < .05$, $\eta_p^2 = .02$ (M = .92, .94, 1.10, 1.02, 1.13, 1.04, and 1.00 for 4- to 10-year-olds, respectively). No significant age trend was evident in the number of temporal units reported per dating request.

Temporal References by Retrieval Mode

On average, 51.2% (SD = 22.80; M = 17.74, SD = 23.11) of the total number of temporal references were provided by children spontaneously, that is, not in response to interviewers' requests for temporal information; 46.36% (SD = 22.22; M = 11.66, SD = 12.20) were provided in response to temporal requests of the same category, that is, responsively; and 2.48% (SD = 6.38; M = .64, SD = 1.60) were provided unresponsively to requests for other categories of information. Because only a small percentage of requested temporal references were referenced unresponsively, our analyses focused on spontaneous and responsive temporal references. Overall, the number of temporal references provided in response

Table 2
Average Number of Total Temporal References by Temporal Category and Age

Category	Age							Linear		Quadratic	
	4 ($n = 23$) *M* (*SD*)	5 ($n = 36$) *M* (*SD*)	6 ($n = 43$) *M* (*SD*)	7 ($n = 41$) *M* (*SD*)	8 ($n = 31$) *M* (*SD*)	9 ($n = 48$) *M* (*SD*)	10 ($n = 28$) *M* (*SD*)	*F*	η^2	*F*	η^2
Total	12.17 (8.93)	17.81 (15.10)	24.26 $(21.92)_a$	26.44 (31.03)	36.13 (34.05)	33.04 $(22.82)_b$	62.64 $(57.49)_{a,b}$	4.38*	.02	$3.65^‡$	.01
Dating	1.61 (2.06)	2.33 (2.90)	3.26 (4.91)	4.05 (5.06)	4.39 (5.07)	4.46 (3.72)	6.79 (5.26)	$3.67^‡$	.02	0.00	.00
Distancing	0.35 (0.78)	0.50 (0.94)	0.30 (0.56)	0.61 (1.12)	0.52 (0.57)	0.58 (0.96)	0.54 (0.84)	0.28	.00	0.24	.00
Location	1.26 (1.86)	1.83 (2.49)	2.95 (4.75)	3.44 (4.49)	3.87 (4.87)	3.88 (3.49)	6.25 (5.32)	$3.66^‡$	.01	0.02	.00
Specific	0.39 (0.89)	0.36 (0.96)	.63 (1.40)	0.49 (1.16)	0.55 (1.23)	0.83 (1.65)	2.11 (3.59)	$3.75^‡$	.02	4.52*	.02
Nonspecific	0.87 (1.69)	1.47 (2.46)	2.33 (3.76)	2.95 (4.25)	3.32 (4.45)	3.04 (2.92)	4.14 (3.51)	1.47	.01	0.92	.00
Sequencing	8.00 (6.81)	12.36 (11.71)	16.16 (14.98)	17.95 (25.97)	26.52 (27.32)	23.54 (20.60)	47.82 (53.79)	1.84	.01	$3.45^†$	.01
Forward	4.78 (4.65)	9.64 (10.76)	11.77 (10.87)	12.93 (20.99)	19.74 (21.02)	17.38 (16.62)	35.93 (48.64)	0.82	.00	1.60	.01
Backward	1.30 (1.72)	1.03 $(1.16)_a$	2.30 $(2.93)_b$	2.54 $(3.19)_c$	3.97 (4.59)	3.60 (3.51)	7.36 $(7.01)_{a,b,c}$	8.06**	.03	6.64*	.03
Simultaneous	1.91 (2.73)	1.69 (1.86)	2.09 (2.77)	2.49 (3.68)	2.81 (3.13)	2.56 (2.96)	4.54 (3.82)	0.00	.00	1.60	.01
Number of occurrences	2.39 (2.02)	2.83 (2.66)	4.33 (4.21)	3.85 (4.00)	4.61 (4.43)	4.29 (3.84)	5.61 (4.81)	0.01	.00	0.85	.00
Enumeration	1.61 (1.16)	1.39 (1.52)	2.12 (2.11)	1.56 (1.57)	2.10 (1.97)	1.65 (1.38)	2.21 (1.85)	0.06	.00	0.14	.00
Nonenumeration	0.78 (1.28)	1.44 (2.16)	2.21 (3.00)	2.29 (3.35)	2.52 (3.14)	2.65 (3.44)	3.39 (3.98)	0.00	.00	0.84	.00
Duration	0.17 (0.65)	0.28 (0.74)	0.44 (0.80)	0.49 (1.03)	0.55 (0.93)	0.73 (0.94)	2.18 (3.10)	—	—	—	—
Frequency (rate of occurrence)	0.00 (0.00)	0.00 (0.00)	0.07 (0.26)	0.10 (0.49)	0.06 (0.36)	0.02 (0.14)	0.25 (0.52)	—	—	—	—

Note. Cell values are observed means. Linear and quadratic results are from analyses of covariance controlling for total details and total temporal requests, $df = 1, 242$. Dashes indicate there were too few instances to be meaningfully analyzed. Means with the same subscripts are significantly different at Dunn–Sidak adjusted $p < .05$.
$^†p < .07$. $^‡p < .06$. $^*p < .05$. $^{**}p < .01$.

to free-recall and cued-recall prompts represented 73.6% (SD = 0.21; M = 23.84, SD = 29.19) of the total number of temporal references, whereas temporal references provided in response to recognition prompts represented 26.4% (SD = 0.19; M = 5.89, SD = 5.82) of the total. A t test revealed that more temporal references were elicited in response to either recall, $t(249) = 10.44$, $p < .001$, $\eta^2 = .30$, or free-recall prompts, $t(249) = 4.66$, $p < .001$, $\eta^2 = .08$, than in response to recognition-memory prompts.

Temporal References Made Spontaneously by Category and Age

Spontaneous temporal references were distributed among the following attribute categories: sequencing (M = 12.77, SD = 19.45), dating (M = 2.25, SD = 3.29), number of occurrences (M = 2.09, SD = 3.10), duration (M = 0.56, SD = 2.48), and frequency (M = 0.06, SD = 0.31). As shown in Table 3, the mean number of temporal references made spontaneously increased with age for total number of temporal references and for all categories and subcategories, with sharp increases occurring at 10 years of age. ANCOVAs yielded significant positive linear age trends in the total number of spontaneous temporal references provided on average per interview, as well as in the category of sequencing and subcategory of backward sequencing. Significant quadratic trends also emerged in these same categories, supporting the reliability of the marked increase in temporal units produced by 10-year-olds. Follow-up pairwise comparisons of the adjusted means revealed that the 10-year-olds made significantly more spontaneous temporal references than 6-, 7-, and 9-year-olds. Likewise, 10-year-olds made significantly more references to sequencing than 6- and 9-year-olds, and significantly more references to backward sequencing than 5-, 6-, 7-, and 9-year-olds. In all cases, when the 10-year-olds were not included in the analyses, the quadratic trends were no longer significant. The simple slopes of the quadratic regression lines at each age became progressively steeper, with the greatest positive slope at age 10 (total spontaneous: 1.03, 2.10, 3.17, 4.24; sequencing: .75, 1.68, 2.61, 3.53; backward sequencing: .24, .50, .77, 1.03; for the 7- to 10-year-olds, respectively). The likelihood that children of each age would make spontaneous references in all the temporal categories is presented in Table 4.

Age Differences in Responsive References

Responsive temporal references were distributed among the attribute categories of sequencing (M = 8.25, SD = 10.90), dating (M = 1.45, SD = 2.10), number of occurrences (M = 1.88, SD = 1.57), duration (M = 0.07, SD = 0.31), and frequency (M = 0.01, SD = 0.09). As shown in Table 5, means for the number of responsive temporal references increased with age. ANCOVAs yielded significant positive linear age trends in the category of dating and the subcategories of location, specific location, and nonspecific temporal location. Significant quadratic effects emerged in the number of temporal units given responsively in the category of number of occurrences as well as in the subcategories of specific location and nonenumerative number of occurrences. Follow-up analyses revealed that the quadratic effect was attributable to a marked increase in references to nonspecific locations by 10-year-olds. Pairwise comparisons revealed that the 10-year-olds had a significantly higher mean than any of the other ages. No significant differences between means for the other age groups were found. When 10-year-olds were not included in the analysis, the quadratic trend was no longer significant. The simple slope of the regression line at each age became progressively steeper, with a marked increase at age 10: −.09, .08, .40, and .88, for the 7- to 10-year-olds, respectively. The quadratic age trends revealed a different pattern for number of occurrences and nonenumeration: The highest mean occurred at a younger age then declined with the older children.

Discussion

This study was the first to examine the kinds of temporal references that children provide when describing uncontrived nonstaged events. Researchers have demonstrated that verbal references to temporal attributes are associated with developmental improvements in several cognitive skills required for the understanding of temporal concepts, the representation of time, and related linguistic and communicative skills (Carni & French, 1984; French & Nelson, 1981; Friedman, 1986). Our findings elucidate age-related trends in the ability to reference several temporal attributes in response to both recall and recognition prompts that are consistent with those found in laboratory experiments exploring the ability to estimate single temporal attributes in response to recognition memory tests. Moreover, our study provides new insights into children's developing capacities to produce temporal references spontaneously (i.e., not in response to temporal requests) while structuring specific narrative accounts of allegedly experienced events that were

Table 3
Average Number of Temporal References Made Spontaneously by Temporal Category and Age

	Age							Linear		Quadratic	
	4 (n = 23)	5 (n = 36)	6 (n = 43)	7 (n = 41)	8 (n = 31)	9 (n = 48)	10 (n = 28)				
Category	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	F	η^2	F	η^2
Total	4.70 (4.59)	7.44 $(6.32)_a$	14.12 $(17.22)_b$	16.07 $(23.82)_c$	22.10 (23.29)	19.02 $(15.34)_d$	42.64 $(39.53)_{a,b,c,d}$	7.67**	.03	5.12*	.02
Dating	.87 (1.63)	1.28 (1.88)	2.00 (3.54)	2.34 (4.12)	2.68 (3.21)	2.50 (2.98)	4.00 (3.91)	1.25	.01	0.00	.00
Distancing	0.17 (0.39)	0.25 (0.55)	0.19 (0.45)	0.32 (0.79)	0.26 (0.45)	0.35 (0.79)	0.39 (0.74)	0.82	.00	0.03	.00
Location	0.70 (1.43)	1.03 (1.73)	1.81 (3.45)	2.02 (3.71)	2.42 (3.07)	2.15 (2.71)	3.61 (3.79)	0.98	.00	0.00	.00
Specific	0.35 (0.88)	0.08 (0.28)	0.37 (0.95)	0.24 (0.97)	0.35 (0.80)	0.38 (1.10)	0.79 (1.79)	0.34	.00	1.57	.01
Nonspecific	0.35 (0.98)	0.94 (1.76)	1.44 (2.81)	1.78 (3.60)	2.06 (2.71)	1.77 (2.20)	2.82 (3.33)	0.76	.00	0.31	.00
Sequencing	2.87 (2.88)	4.89 (4.39)	9.79 $(12.32)_a$	11.20 (19.55)	16.52 (19.42)	13.35 $(12.89)_b$	32.79 $(36.45)_{a,b}$	4.76*	.02	4.18*	.02
Forward	1.26 (1.48)	3.31 (3.93)	7.05 (8.56)	7.63 (15.41)	11.65 (14.05)	9.35 (10.62)	23.11 (31.94)	2.44	.01	1.72	.01
Backward	0.65 (0.98)	0.75 $(1.05)_a$	1.47 $(2.30)_b$	1.93 $(2.68)_c$	3.19 (4.67)	2.56 $(2.82)_d$	6.21 $(6.44)_{a,b,c,d}$	8.89**	.04	7.61**	.03
Simultaneous	0.96 (1.80)	0.83 (1.11)	1.28 (2.24)	1.63 (3.13)	1.68 (2.47)	1.44 (1.62)	3.46 (3.70)	0.97	.00	2.98	.01
Number of occurrences	0.83 (1.37)	1.06 (1.88)	1.91 (2.92)	2.02 (3.05)	2.29 (2.57)	2.65 (3.61)	3.68 (4.41)	0.62	.00	0.01	.00
Enumeration	0.43 (0.66)	0.39 (1.02)	0.49 (0.91)	0.54 (0.90)	0.87 (1.41)	0.69 (1.22)	1.04 (1.86)	0.79	.00	0.13	.00
Nonenumeration	0.39 (0.94)	0.67 (1.22)	1.42 (2.57)	1.49 (2.73)	1.42 (1.78)	1.96 (3.11)	2.64 (3.30)	0.24	.00	0.00	.00
Duration	0.13 (0.63)	0.22 (0.72)	0.37 (0.69)	0.44 (1.00)	0.55 (0.93)	0.50 (0.85)	1.96 (3.06)	—	—	—	—
Frequency (rate of occurrence)	0.00 (0.00)	0.00 (0.00)	0.05 (0.21)	0.07 (0.47)	0.06 (0.36)	0.02 (0.14)	0.21 (0.50)	—	—	—	—

Note. Cell values are observed means. Linear and quadratic results are from analyses of covariance controlling for total details and total temporal requests, $df = 1, 242$. Dashes indicate there were too few instances to be meaningfully analyzed. Means with the same subscripts are significantly different at Dunn–Sidak adjusted $p < .05$.
$*p < .05$. $**p < .01$.

Table 4
Temporal References Made Spontaneously as a Proportion of Total Temporal References by Temporal Category and Age

	Age							
	4 (*n* = 23)	5 (*n* = 36)	6 (*n* = 43)	7 (*n* = 41)	8 (*n* = 31)	9 (*n* = 48)	10 (*n* = 28)	Overall (*N* = 250)
Category	*p*	*p*	*p*	*p*	*p*	*p*	*p*	*p*
Total	0.39	0.42	0.58	0.61	0.61	0.58	0.68	0.59
Dating	0.54	0.55	0.61	0.58	0.61	0.56	0.59	0.58
Distancing	0.50	0.50	0.62	0.52	0.50	0.61	0.73	0.57
Location	0.55	0.56	0.61	0.59	0.63	0.55	0.58	0.58
Specific	0.89	0.23	0.59	0.50	0.65	0.45	0.37	0.48
Nonspecific	0.40	0.64	0.62	0.60	0.62	0.58	0.68	0.61
Sequencing	0.36	0.40	0.61	0.62	0.62	0.57	0.69	0.60
Forward	0.26	0.34	0.60	0.59	0.59	0.54	0.64	0.56
Backward	0.50	0.73	0.64	0.76	0.80	0.71	0.84	0.75
Simultaneous	0.50	0.49	0.61	0.66	0.60	0.56	0.76	0.62
Number of occurrences	0.35	0.37	0.44	0.53	0.50	0.62	0.66	0.52
Enumeration	0.27	0.28	0.23	0.34	0.42	0.42	0.47	0.35
Nonenumeration	0.50	0.46	0.64	0.65	0.56	0.74	0.78	0.66
Duration	0.75	0.80	0.84	0.90	1.00	0.69	0.90	0.85
Frequency (rate of occurrence)			0.67	0.75	1.00	1.00	0.86	0.82

Note. p = Spontaneous references/Total references. Total references (Table 2) = Spontaneous (Table 3) + Responsive (Table 5) + Unresponsive (not shown). Proportions in this table were computed using values from Tables 2 and 3 and are weighted proportions based on the total sample or the sample of each grade. They may differ from proportions in the text, which are unweighted mean proportions.

personally meaningful and often long, complex, emotionally draining, and distant in time. The findings thus complement the results of laboratory-based research designed to explore the ability to make specific temporal judgments about contrived events (Brown, 1975; Carni & French, 1984; Droit, 1995; Friedman, 1977, 1986, 1990; Friedman & Lyon, 2005) primarily in response to direct questioning, via reconstruction- and recognition-based processes. In addition, the study provides unique comparative data on 4- to 10-year-olds' references to different temporal attributes of allegedly experienced events. These may be of significance both for understanding the developing skills associated with conceptual development and for applied clinical and legal practice. Two significant examples of the study's contribution to the understanding of children's abilities are the age-related quadratic trends in the number of references to both specific temporal location and backward sequencing, indicating a marked shift due to the performance of the 10-year-old children.

As expected, we found high positive correlations between the amount of temporal information (represented by the total number of temporal units in the temporal categories analyzed) and the total amount of forensic information (represented by the total number of details) provided by the children during forensic interviews. The causal direction, however, is not obvious: Although children have more opportunities to engage in temporal structuring when they provide more information, producing temporal references may also serve as contextual cues for further elaboration and may make it easier to generate longer narratives.

The age-related increases in the number of references to temporal attributes may be attributable to the increasing capacity to elaborate using sequence relational markers (Hudson & Shapiro, 1991; Lamb et al., 2002; Nelson, 1993). Age-related increases in the number of references to nonsequence temporal categories, however, indicate that children's extended familiarity with other temporal attributes also contributes to that effect. The infrequent occurrences of spontaneous references to some temporal attributes by children in the two youngest as opposed to the older age groups may indicate the relative unfamiliarity of children at these age levels with these temporal attributes and the related linguistic markers. In addition, the infrequent (or absent) references to some of the temporal categories undoubtedly contribute to the large within-group variability on most measures at each age level. It is interesting that despite the relative prominence of spontaneous temporal references, we found positive correlations between the number of temporal requests by interviewers

Table 5
Average Number of Temporal References Made Responsively by Temporal Category and Age

	Age							Linear		Quadratic	
	4 (n = 23)	5 (n = 36)	6 (n = 43)	7 (n = 41)	8 (n = 31)	9 (n = 48)	10 (n = 28)				
Category	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*	η^2	*F*	η^2
Total	7.00 (4.99)	9.58 (10.74)	9.74 (7.16)	9.05 (6.77)	13.77 (12.22)	13.48 (11.43)	19.46 (23.41)	0.00	.00	0.17	.00
Dating	0.57 (0.90)	0.75 (1.46)	1.16 (2.02)	1.37 (1.58)	1.65 (2.32)	1.81 (2.35)	2.79 (2.81)	8.14**	.03	0.11	.00
Distancing	*0.09 (0.29)*	*0.08 (0.28)*	*0.12 (0.32)*	*0.17 (0.50)*	*0.26 (0.51)*	*0.17 (0.43)*	*0.14 (0.36)*	0.92	*.00*	*1.25*	*.01*
Location	*0.48 (0.85)*	*0.67 (1.43)*	*1.05 (1.85)*	*1.20 (1.42)*	*1.39 (2.11)*	*1.65 (2.21)*	*2.64 (2.82)*	*7.87***	.03	*0.37*	*.00*
Specific	*0.04 (0.21)*$_a$	*0.22 (0.90)*$_b$	*0.26 (0.66)*$_c$	*0.22 (0.52)*$_d$	*0.19 (0.60)*$_e$	*0.42 (0.99)*$_f$	*1.32 (2.26)*$_{a,b,c,d,e,f}$	*7.16***	.03	*5.49**	.02
Nonspecific	0.43 (0.84)	0.44 (1.08)	0.79 (1.47)	0.98 (1.25)	1.19 (1.97)	1.23 (1.88)	1.32 (1.33)	*5.46**	*.02*	0.01	.00
Sequencing	4.96 (4.53)	7.08 (9.41)	6.09 (5.38)	5.98 (6.13)	9.81 (9.95)	9.83 (10.72)	14.68 (21.82)	0.64	.00	0.73	.01
Forward	*3.48 (3.75)*	*6.19 (8.82)*	*4.53 (4.69)*	*4.54 (5.13)*	*7.87 (9.01)*	*7.83 (8.69)*	*12.61 (19.80)*	*0.27*	*.00*	*1.04*	*.00*
Backward	*0.52 (0.90)*	*0.22 (0.48)*	*0.81 (1.33)*	*0.59 (0.95)*	*0.81 (1.33)*	*0.94 (1.44)*	*1.00 (1.36)*	*0.01*	*.00*	0.28	.00
Simultaneous	*0.96 (1.26)*	*0.67 (1.17)*	*0.74 (1.14)*	*0.85 (1.28)*	*1.13 (1.20)*	*1.06 (2.13)*	*1.07 (1.36)*	*1.78*	*.01*	0.05	.00
Number of occurrences	1.48 (0.85)	1.75 (1.36)	2.40 (1.95)$_{a,b}$	1.66 (1.37)	2.32 (2.23)	1.63 (1.14)$_a$	1.86 (1.81)$_b$	1.85	.01	5.72*	.02
Enumeration	1.17 (0.78)	1.03 (1.13)	1.60 (1.59)	1.00 (1.20)	1.23 (1.15)	0.96 (0.80)	1.14 (1.11)	*1.98*	*.01*	0.82	.00
Nonenumeration	0.30 (0.70)	0.72 (1.28)	0.79 (0.99)	0.66 (0.85)	1.10 (1.64)	0.67 (0.93)	0.71 (1.36)	*0.10*	*.00*	*4.65**	*.02*
Duration	0.00 (0.00)	0.00 (0.00)	0.07 (0.34)	0.02 (0.16)	0.00 (0.00)	0.21 (0.50)	0.14 (0.45)	—	—	—	—
Frequency (rate of occurrence)	0.00 (0.00)	0.00 (0.00)	0.02 (0.15)	0.02 (0.16)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	—	—	—	—

Note. Cell values are observed means. Linear and quadratic results are from analyses of covariance controlling for total details and total temporal requests, $df = 1, 242$. Dashes indicate there were too few instances to be meaningfully analyzed. Means with the same subscripts are significantly different at Dunn–Sidak adjusted $p < .05$.
$^*p < .05$. $^{**}p < .01$.

and the production of temporal references by children. Interviewers requested more temporal information from older children and thus analyses were conducted using ANCOVAs to control for both the total number of details provided and the total number of requests made.

Sequencing was the most commonly referenced temporal category and it occurred at a much earlier age than predicted by Piaget (1927/1971), with linear increases between the ages of 4 and 10 years. As predicted, children made fewer references to backward sequences than to forward sequences overall, and fewer temporal references per request for backward sequencing than for forward sequencing, regardless of age. Even after controlling for the total number of details and the number of temporal requests, there were large increases with age in the overall number of references to sequencing information. This was especially compelling in spontaneous production, with significant linear increases overall as well as for backward sequencing. In addition, a significant quadratic trend documented a marked shift at age 10 for children's spontaneous references to backward sequencing, as predicted. A similar, but unpredicted, quadratic trend emerged for the total number of spontaneous sequencing references. The findings reported here are consistent with earlier reports that the temporal attributes involving sequencing are referenced by children as young as 4 years of age and that the number of such references gradually increases with age (Brown, 1975; Carni & French, 1984; Fivush & Mandler, 1985; Friedman, 1977, 1990; Strube & Weber, 1988; Thompson et al., 2000). The findings are also in line with those reported by Friedman and Lyon (2005) in a study examining the ability of 4- to 13-year-old children to reconstruct the time of past events. These researchers demonstrated that children from first grade onward recalled the order of two contrived events experienced within 2 days of one another accurately following a 3-month delay.

A significant quadratic trend revealed that responsive references to number of occurrences (total and nonenumerative) decreased after age 8, following a marked upward shift between ages 7 and 8. It is possible that because such information is mostly related to repeated similar occurrences of alleged abuse, it was reported by older children spontaneously. Contrary to our expectations, children made very few references to distancing, either spontaneously or responsively, when dating events. Younger children did not reference distancing (e.g., "long time ago") more than older children did, contrary to our prediction, and children of all ages provided more references to temporal location (e.g., "it was on a Sunday") than to distance. Moreover, after controlling for the total number of details and the number of temporal requests, trend analyses revealed a positive linear trend in children's responsive references to total dating and the subcategory of temporal location. The expected marked upward shift for temporal location around age 10 was not found. This was surprising because for children to associate experienced events with temporal locations, they must be able to represent conventional time patterns and to locate events on long conventional time scales, an ability that is typically acquired between ages 8 and 9 (Friedman, 1991, 1992). It is possible that because sexual assaults occurred within familiar daily activities, the temporal structuring task was easier, enabling young children to link the timing of the events to familiar daily activities (e.g., "Every day when I returned from school"). Familiarity with the context in which their memories were embedded may have enhanced the children's ability to reference nonspecific temporal locations with which even preschoolers are familiar (Friedman, 1992; Friedman & Lyon, 2005; Tartas, 2001). Thus, the young children in our sample may have referenced temporal locations involving familiar short-term time patterns rather than those involving less familiar and more complex material (Friedman, 1977, 1990, 1991; Montangero, 1992; Tartas, 2001), and the significant linear trend we found may reflect children's ability to link events or event components to short-scale conventional time patterns, such as time of the day or day of the week (i.e., nonspecific temporal locations), rather than to long-scale conventional time patterns, such as months of the year or calendar dates (i.e., specific temporal locations). In support of this argument, the trend analysis on the number of references to specific and nonspecific temporal location revealed, in addition to the positive linear trends for the number of responsive temporal references involving both specific (e.g., "last Thursday," "on September 23rd") and nonspecific (e.g., "a school day") temporal locations, a significant quadratic trend in the number of responsive temporal references to specific temporal locations, as we expected (Friedman, 1987, 1993).

To explore whether the marked increase in the number of responsive references to specific temporal locations at age 10 reflected the increased number of requests for specific temporal locations, we examined the types of temporal requests that elicited references to specific temporal locations. Although 10-year-olds referenced specific temporal locations in response to temporal location requests more than younger children did, more than one third of these references were not made in response to location requests (e.g., "Did that happen on your birthday?") but rather in response to general requests for dating information (e.g., "When did that happen?" or "How long ago did that happen?"). Taken together, references to specific temporal locations in response to general dating requests and spontaneous references to specific temporal location accounted for 83% ($SD = 0.27$, $n = 15$) of the total specific temporal location references by 10-year-olds. Thus, the marked shift in the number of references to specific temporal location at age 10 could only partially be attributed to more frequent prompting by the interviewers because most of the references to specific temporal location were initiated by the children. Children's references to dating in this study thus demonstrate that young children, like adults, remember the times of past events by reconstructing their locations relative to time patterns. Adults, however, are capable of using both short- and long-scale time patterns, whereas the children mostly referenced short-scale time patterns or anchored their memories to familiar daily activities. Future research on children's reports of real-life events may elucidate the functions of both distancing and location processes in the development of young children's dating ability.

Our findings show that children produce a substantial amount of temporal information spontaneously. Nearly 72% of the children's spontaneous temporal references involved temporal sequencing, perhaps because the eyewitness accounts examined in the present study involve children's event memories. Moreover, these are elicited primarily using open-ended invitations—as recommended by the NICHD Investigative Interview Protocol—and thus involve many verbal narratives. These recall narratives are typically structured using sequencing temporal markers. Sequencing requests trigger much information about events and their components, including additional references to sequence information, whereas nonsequence temporal requests mostly elicit specific information (e.g., dating, number of occurrences) about the whole event and not much elaboration. Our findings that spontaneous references to sequencing become increasingly common with increasing age are especially important because they are associated with children's developing ability to generate and structure more extensive narratives (Fivush & Haden, 1997; Hudson & Shapiro, 1991; Nelson, 1993). Beyond the information they impart, sequence references have forensic value because they help structure the investigated events, enabling eyewitnesses to reconstruct their past experiences, report event components in chronological order, and elaborate on what happened before a disclosed event component, or if prompted, refer to causally related event components. Additionally, recall narrative accounts facilitate the evaluation of children's credibility (Hershkowitz, 2001; Raskin & Esplin, 1991; Undeutsch, 1982). Students of conceptual development also emphasize that the spontaneous production of conceptual exemplars, rather than mere identification or recognition, reflect greater mastery of the related concepts (Klausmeier et al., 1974). By showing that free-recall prompts elicit a large amount of temporal information from children, the findings show that forensic investigators need not rely as much on the more risky (potentially contaminating) yes–no and forced-choice questions to obtain this information.

To determine whether children referenced the more specific and forensically important temporal categories (such as enumerative number of occurrences or specific temporal locations) without being prompted using specific recognition prompts, we examined children's spontaneous references and their responses to open-ended recall prompts in these two categories. Although spontaneous references to both categories were scarce, enumerative number of occurrences was mostly referenced responsively, whereas specific temporal locations were as likely to be referenced spontaneously as responsively (See Table 4). Most references to number of occurrences in the present study were indeed elicited in response to the specific forced-choice (recognition) prompt scripted in the NICHD protocol (i.e., "Did it happen one time or more than one time?") rather than an open-ended prompt requesting an enumerative response (i.e., "How many times did that happen?"). The protocol's scripted prompt was designed to allow young children to provide global estimates of the number of occurrences. With respect to specific temporal location, references made spontaneously and those made in response to general dating (e.g., "When did that happen?") or distancing (e.g., "How long ago did that happen?") requests accounted for 76% of the total number of references generated (rather than in response to specific temporal location request, e.g., "Did that happen on the 4th of July?"). Thus, although we do not know whether children can give spontaneous enumerative estimates of the number of occurrences when given recall prompts, our findings demonstrate that children who refer to specific temporal locations make proportionally more references of this sort in response to recall prompts than to recognition prompts.

The main limitation of the present study is our inability to determine the accuracy of the temporal references made by the children. Because the present data were gathered in forensic interviews, accuracy could not be determined and the study focused solely on children's references to temporal attributes (e.g., sequencing, dating) and the appropriate use of linguistic markers (i.e., relational words such as *then, before,* or *after*) and scales (days of the week, months of the year). It is thus important not to overestimate children's temporal capacities. Experimental laboratory and field research in which accuracy could be measured, however, has demonstrated that although young children tend to provide briefer accounts of their experiences than do older children and adults, their accounts are accurate (e.g., Goodman & Reed, 1986; Johnson & Foley, 1984; Oates & Shrimpton, 1991; Orbach & Lamb, 1999). Moreover, free-recall information is significantly more accurate than information provided in response to recognition prompts (Ceci & Huffman, 1997; Ceci, Huffman, Smith, & Loftus, 1996; Ceci, Leichtman, & Bruck, 1995; Dent & Stephenson, 1979; Hutcheson et al., 1995; Lamb & Fauchier, 2001; Oates & Shrimpton, 1991; Orbach & Lamb, 1999, 2001). Consistent with these general findings, Friedman and Lyon (2005) recently reported that when 4- to 13-year-olds were prompted to recount their memories of two recent contrived school events, they almost never produced information about dating or the contiguity and order of events in response to open-ended questions, whereas direct questions led them to produce a considerable amount of incorrect information (Friedman & Lyon, 2005).

Of the total number of references to temporal attributes in the present study, more than 50% were provided spontaneously, that is, not in response to interviewer requests for temporal information. Moreover, close to 30% of the total number of temporal references were provided by children in response to free-recall prompts and 46% in response to cued-recall prompts, summing to a compelling 74% from recall memory. Such information is likely to be accurate, and because accuracy could not be evaluated in this study, we examined case outcome information to get a rough indication of the children's veracity. Only 9% of the cases were dismissed by the police because allegations were deemed unfounded and 51% involved charges that led to alleged perpetrators' arrests, suggesting that most of the alleged abuse probably occurred. Because the accuracy of children's reports can seldom be assessed in forensic contexts, it remains necessary to conduct laboratory analog studies including children's reports of known experienced neutral events. We are currently conducting such an experiment in the United Kingdom (Brown, Lamb, Pipe, Orbach, & Lewis, 2007).

Our findings also highlight children's familiarity with the relational terminology essential for reporting diverse types of temporal information and their tendency to use the appropriate terminology spontaneously to structure narratives when recounting allegedly experienced and complex real-life events. In addition, by allowing us to compare the number of references with different temporal attributes, our findings reveal which kinds of temporal attributes are more rare (e.g., frequency) or more common (e.g., sequencing) in children's retrospective accounts and thus help frame hypotheses about the role of the different temporal attributes (e.g., within-event forward sequencing) when constructing or recounting memories of past events. The fact that forward sequencing is a dominant temporal attribute in children's accounts may indicate that a lot of order information is stored in memory, allowing the reconstruction of the temporal structure of experienced events (W. J. Friedman, personal communication, December 25, 2005). Such findings underscore the need for more research on the abilities underlying memory for order of event components and on the potential use of temporal references as contextual cues for eliciting more elaborated accounts and event-specific memories (Dijkstra & Kaup, 2005; Lamb et al., 2003). Future field and laboratory research involving children older than those studied here would provide further insight into the developing use of more complex temporal attributes, such as duration and frequency, and of developmental changes in the strategic use of temporal landmarks. It would also be valuable to explore the accuracy of children's reports of temporal information about personally experienced events when these are objectively recorded.

In sum, our most important findings demonstrate that, as predicted, a marked shift occurs at age 10 in the number of references to backward sequencing (overall and spontaneously) and to specific temporal location (overall and responsively). Although in both categories the number of references increased linearly with age, the slope became progressively steeper with age and accelerated significantly at age 10. Moreover, even when we controlled for the total number of details and the total number of temporal requests, the quadratic trend in the number of references to these categories of information remained significant.

The findings have profound implications in applied contexts, including policy and practice regarding the interviewing of child victims or witnesses about events they may have experienced or witnessed. In the context of forensic interviews, the ability to provide information about the number of incidents, the time of occurrences, and the sequence of event components may allow children to define specific episodes of allegedly experienced criminal incidents, increasing their competence as witnesses and the prospects that their cases will be pursued in the criminal justice system. Additionally, awareness that some temporal skills are acquired late in development may discourage attorneys from attempting to discredit child witnesses, or doubt their competence as witnesses, when they fail to provide the requested temporal information. Our findings may thus help forensic interviewers to recognize the strengths and limitations of children's capabilities and thus enhance their ability to obtain essential temporal information using age-appropriate techniques.

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