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Event memory and suggestibility in abused and neglected children: Trauma-related psychopathology and cognitive functioning

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ABSTRACT

This study examined event memory and suggestibility in 3- to 16-year-olds involved in forensic investigations of child maltreatment. A total of 322 children were interviewed about a play activity with an unfamiliar adult. Comprehensive measures of individual differences in trauma-related psychopathology and cognitive functioning were administered. Sexually and/or physically abused children obtained higher dissociation scores than neglected children, and sexually abused children were more likely to obtain a diagnosis of posttraumatic stress disorder than physically abused children, neglected children, and children with no substantiated abuse histories. Overall, older children and children with better cognitive functioning produced more correct information and fewer memory errors. Abuse status per se did not significantly predict children's memory or suggestibility whether considered alone or in interaction with age. However, among highly dissociative children, more trauma symptoms were associated with greater inaccuracy, whereas trauma symptoms were not associated with increased error for children who were lower in dissociative tendencies. Implications of the findings for understanding eyewitness memory in maltreated children are discussed.

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Introduction

A paucity of research on child maltreatment and memory development has contributed to heated theoretical debate about how memory processes are influenced by traumatic experiences. It has been suggested that adults with a history of childhood maltreatment are likely to evince hyperarousal symptoms and increased attention to trauma-related information as a preparatory response to a generalized expectation of danger (e.g., Carlson, Furby, Armstrong, & Shales, 1997), which can, in principle, result in enhanced memory, particularly for stressful information (e.g., Alexander et al., 2005; Rieder & Cicchetti, 1989; Vrana, Roodman, & Beckham, 1995). However, it has also been proposed that childhood maltreatment may have a detrimental effect on memory performance due to maltreatment-related sequelae (e.g., Bremner & Narayan, 1998; Cicchetti & Rogosch, 2001a, 2001b), as indicated by empirical findings that adults with maltreatment histories are more likely than comparable controls to have autobiographical memory deficits (e.g., Henderson, Hargreaves, Gregory, & Williams, 2002; but see Ogle et al., 2009). To understand the effects of childhood maltreatment on memory, a crucial starting point is to examine memory development in maltreated children (e.g., Howe, Toth, & Cicchetti, 2011).

Given the heated theoretical debates, surprisingly little research exists on maltreatment-related differences in children's memory (for reviews, see Goodman, Quas, & Ogle, 2010; Howe, Cicchetti, & Toth, 2006). This area of study is crucial not only for theoretical reasons but also for resolving legal controversies about children's eyewitness memory. Maltreated children are particularly likely to be interviewed in forensic contexts. Thus, it is important to determine such children's abilities to provide accurate and complete accounts of their experiences and to resist memory errors brought on by suggestive questioning. Although children's eyewitness testimony often concerns stressful events, it may also concern nonstressful incidents. For example, if children experience a neutral event but suspicions of impropriety arise, the children may be questioned by adults (e.g., asked leading questions) about what happened (e.g., whether a crime occurred). Concerns have been raised as to whether children with trauma histories are particularly prone to false report and increased suggestibility (Goodman, Bottoms, Rudy, Davis, & Schwartz-Kenney, 2001).

Maltreatment and children's memory for nonstressful events

There is scant research on maltreated children's memory for nonstressful life experiences. A growing body of research concerns maltreated children's memory for laboratory stimuli such as lists of words. Such research has yielded mixed results. In a study by Howe, Cicchetti, Toth, and Cerrito (2004), maltreated and nonmaltreated children's recognition and recall performance for a series of neutral word lists did not differ significantly. Similarly, Valentino, Cicchetti, Rogosch, and Toth (2008b) failed to find significant differences in recall of self-referent attribute words among abused, neglected, and nonmaltreated children. In their review of investigations on maltreatment and memory, Howe and colleagues (2006) concluded that children's basic memory processes are not reliably related to their maltreatment status. In contrast, Valentino, Cicchetti, Rogosch, and Toth (2008a) found significant maltreatment-related differences in children's memory for affectively valenced stimuli. Abused children displayed impairments in recall of positive and negative mother-referent attribute words compared with neglected and nonmaltreated children.

Although such studies provide valuable information about maltreatment and children's basic memory processes, questions remain about the possible influence of maltreatment on children's memory for life experiences. Relevant to these questions are studies of maltreatment-related differences in the form and content, as opposed to the accuracy, of children's and adolescents' event memory. Valentino, Toth, and Cicchetti (2009) evaluated memory for nontraumatic events in abused, neglected, and nonmaltreated children. Children were asked to generate a specific personal memory in response to a series of emotional cue words. Abused children demonstrated more overgeneral memory—that is, the tendency to report memories in general terms without reference to specific details—than neglected and nonmaltreated children. Similarly, in a study by Johnson, Greenhoot, Glisky, and McCloskey (2005), adolescents who were recently exposed to family violence generated more

overgeneral memories, shorter memories, and lower rates of negative memories for childhood events in comparison with teens with little or no current violence exposure. However, in these studies documentation of the events recalled by the children and adolescents was absent and, thus, memory accuracy could not be assessed.

To our knowledge, no published research exists on the accuracy of maltreated children's memory and suggestibility for nonstressful life events, with the exception of a study by Goodman and colleagues (2001) in which children's eyewitness memory for an engaging social interaction was examined. In that study, 3- to 10-year-olds who allegedly experienced physical and/or sexual abuse and matched children with no known history of abuse participated in a play session individually with an unfamiliar adult and were interviewed about the event 2 weeks later. Abused and nonabused children performed similarly with several exceptions, namely that nonabused children were more accurate in answering specific questions, made fewer errors in identifying the unfamiliar adult in a photo identification task, and (at least for younger boys) freely recalled more information. Because the differences in abused and nonabused children's performance tended to be fairly miniscule, it was concluded that abuse histories do not necessarily affect children's event memory. However, the sample size may have been too small to detect significant differences.

In the current study on maltreated children's memory and suggestibility for a nonstressful event, we extended the previous work by testing a considerably larger number of children. We also included children with known neglect histories but no known sexual or physical abuse experiences, as well as children with no substantiated maltreatment histories, and analyzed memory differences across maltreatment status categories. Furthermore, a broader age range was included to examine whether developmental differences exist in the links between childhood maltreatment and possible memory deficits.

Individual differences in trauma-related psychopathology and cognitive functioning

Childhood maltreatment places individuals at increased risk of trauma-related psychopathology, such as dissociation and posttraumatic stress disorder (PTSD), which are linked with certain memory problems and increased suggestibility among adults (e.g., Bremner, Shobe, & Kihlstrom, 2000; Hyman & Billings, 1998). Moreover, maltreatment experiences are likely to result in language and intellectual delays (e.g., Eigsti & Cicchetti, 2004; McFadyen & Kitson, 1996), which have potentially negative effects on children's memory accuracy (e.g., Henry & Gudjonsson, 2003). Owing to such individual differences, maltreatment may be associated with memory performance deficits when children are questioned about their experiences.

Dissociation

On average, maltreated children demonstrate greater dissociative tendencies than nonmaltreated children (e.g., Eisen, Goodman, Qin, Davis, & Crayton, 2007; Macfie, Cicchetti, & Toth, 2001a, 2001b; Valentino et al., 2008b). Such tendencies are believed to reflect defensive responses triggered to psychologically avoid a traumatic situation, resulting in failed information processing (Bower & Sivers, 1998; for a review, see Carlson, Armstrong, & Loewenstein, 1997). Thus, it is theoretically predicted that maltreated children who score high in dissociation employ coping mechanisms to deal with adversity that come at the expense of accurate memory. Eisen and colleagues (2007) showed that, when interviewed about an anogenital examination plus venipuncture, children with sexual and/or physical abuse histories provided more correct information and were more resistant to false suggestion than children with neglect histories, but pervasive effects of abuse status on memory were not uncovered. Nevertheless, for children who obtained higher dissociation scores, greater stress during the anogenital examination and venipuncture in combination with more self-reported trauma symptoms was associated with greater memory errors and suggestibility, whereas such associations were not observed for children low in dissociative tendencies. Thus, when highly dissociative children who exhibit a relatively high number of trauma symptoms become distressed, their memory for stressful events might be impaired, supporting theoretical ideas about dissociation and memory.

To our knowledge, no empirical research has been conducted on maltreated children's dissociative tendencies as related to their memory accuracy and suggestibility about nonstressful life incidents.

Although dissociation might be less likely to influence children's memory and suggestibility for emotionally neutral or positive events, we expected maltreated children with higher dissociation to evince memory performance impairment in general as well as greater suggestibility, as has been shown for adults; for example, dissociation predicted increased suggestibility for an emotionally neutral event in college students (Eisen & Carlson, 1998). Furthermore, it was of interest to determine whether Eisen and colleagues (2007) findings of poorer memory performance for a stressful experience in children with heightened dissociation and greater self-reported trauma symptoms would also emerge for a nonstressful experience. If so, the findings would suggest a general deficit in memory performance in such children. Thus, the current study investigated the effects of dissociation on memory and suggestibility for a nonstressful play event.

PTSD

Children exposed to extremely stressful events, such as sexual and/or physical abuse, are at risk for developing PTSD (e.g., Eisen et al., 2007; Porter, Lawson, & Bigler, 2005), which is a chronic psychiatric disorder characterized by anxiety and memory problems (Sullivan & Gorman, 2002). Studies conducted with adults have shown that trauma survivors, particularly victims with a diagnosis of PTSD, are at times hypervigilant to and demonstrate heightened memory for trauma-related information (e.g., Field et al., 2001; Paunovic, Lundh, & Ost, 2002). However, an overfocus on trauma cues by abused individuals with PTSD may interfere with everyday memory performance for nonstressful events. Indeed, studies have found that adults with PTSD related to childhood abuse, compared with adults without PTSD (whether they have an abuse history or not), tend to evince poorer memory for non-trauma-related information (e.g., Bremner et al., 2000). These findings suggest that, at least for adults, when traumatization is severe enough to warrant a PTSD diagnosis, there may be observable beneficial or detrimental effects on memory.

Relatively few empirical studies of PTSD and memory have been carried out with children. With regard to memory for stressful events, Eisen and colleagues (2007) failed to find any significant relations between PTSD diagnosis and 3- to 16-year-olds' memory and suggestibility for stressful medical procedures. Research on PTSD and children's memory for nonstressful events has provided inconsistent findings. In a study by Moradi, Neshat-Doost, Taghavi, Yule, and Dalgleish (1999), 11- to 17-year-olds with a diagnosis of PTSD showed poorer performance than nontraumatized controls without any history of psychiatric problems on a measure tapping everyday memory. However, it is not clear whether the memory differences were due to the presence of PTSD or other trauma-related psychopathology. Beers and De Bellis (2002) failed to obtain significant differences in memory performance assessed by a test of learning and memory between 11- and 12-year-olds with and without a diagnosis of PTSD, although the small sample size may have precluded significant effects of PTSD on memory. Hence, empirical evidence is still needed to address whether PTSD, which is related to memory performance during adulthood, might also predict memory during childhood. To extend and refine previous work, the current study examined associations between PTSD and children's memory and suggestibility.

General psychopathology

Child maltreatment has been related to additional types of psychopathology, such as depression and anxiety (Eisen et al., 2007; Goodman et al., 2001; Porter et al., 2005; Valentino et al., 2009), which in turn may contribute to impaired memory. Depression during childhood and adolescence has been associated with significant deficits in memory for experimental stimuli (Pine et al., 2004) and impaired neurocognitive performance on verbal memory tasks (Gunther, Holtkamp, Jolles, Herpertz-Dahlmann, & Konrad, 2004). Children and adolescents with depressive symptoms also tend to demonstrate more generic or overgeneral memory retrieval, producing a summary of events rather than specific examples such as of time and place (Johnson et al., 2005; Orbach, Lamb, Sternberg, Williams, & Dawud-Noursi, 2001; Valentino et al., 2009; for a review, see Williams et al., 2007). In addition, children and adolescents with anxiety disorders demonstrated memory deficits for nonemotional experimental stimuli (Vasa et al., 2007) and reduced abilities in verbal and design memory tasks (Pine, Wasserman, & Workman, 1999). In the current study, we examined whether symptoms

associated with these types of psychopathology would predict children's event memory accuracy and suggestibility while taking other individual difference factors into consideration.

Cognitive functioning

Child maltreatment is associated with delays in cognitive development, with more severe maltreatment experiences predicting greater cognitive deficits (e.g., Carrey, Butter, Persinger, & Bialik, 1995; Eigsti & Cicchetti, 2004; but see Ayoub, O'Conner, Rappolt-Schlichtmann, Fischer, & Rogosch, 2006). Child neglect in particular has been related to significant cognitive underperformance (e.g., low IQ scores, language deficits), likely due to deprived environments characterized, for example, by insufficient intellectual stimulation, inattention by parents, and/or absence of basic needs (e.g., Eckenrode, Laird, & Doris, 1993; Gaudin, 1999; Gowan, 1993). Research has implied that children with limited intellectual skills might evince impaired event memory and heightened suggestibility. For example, Eisen, Qin, Goodman, and Davis (2002) showed that maltreated children's short-term memory skills and nonverbal reasoning performance were inversely associated with memory errors about a clinical interview in the context of child maltreatment investigations. In addition, in the study by Eisen and colleagues (2007), better cognitive functioning, as measured by short-term memory, intelligence, and language ability, was positively related to correct responses to free recall and cued recall questions and negatively related to commission errors in response to specific and misleading questions for the stressful medical procedures. Based on these empirical findings, the current study examined maltreated children's memory and suggestibility for a nonstressful event in relation to cognitive functioning, the latter in terms of short-term memory, intelligence, and verbal skills.

The current study

The purpose of this study was to investigate whether maltreatment experience would be related to 3- to 16-year-olds' memory accuracy for a social interaction with an unfamiliar adult. In addition, we examined whether individual differences in psychopathology (dissociation, PTSD, depression, anxiety, and general psychological adjustment) and cognitive functioning (intellectual ability, language comprehension, and short-term memory), which might reflect children's differential responses to maltreatment, would moderate memory performance. Specifically, based on previous research, we tested the following hypotheses. First, we predicted that children with abuse and/or neglect histories would exhibit greater psychopathology and lower cognitive functioning than children with no substantiated maltreatment reports. Second, we predicted that children with greater psychopathology and lower cognitive functioning would show less accurate event memory and greater suggestibility. Third, to the extent that child maltreatment per se may have an effect on children's eyewitness memory performance, aside from psychopathology and cognitive functioning, we tested the hypothesis that children with abuse and/or neglect histories would generally evince poorer memory performance (e.g., fewer units of correct information in free recall, greater error in answering specific and misleading questions) than children with no substantiated histories of maltreatment, even with individual difference factors statistically controlled. Fourth, we predicted that younger children would demonstrate less accurate memory and less resistance to misleading information than their older counterparts. In addition to testing these hypotheses, we explored possibly differential effects of maltreatment subtype (i.e., sexual abuse, physical abuse, and neglect) on memory, including in interaction with child age. Finally, we also examined whether highly dissociative children who self-reported high levels of trauma symptoms would evince particularly high levels of memory errors regarding a neutral event, as found by Eisen and colleagues (2007) for a stressful experience.

Method

Participants

Participants were 322 children (178 girls and 144 boys), consisting of 3- to 5-year-olds (M = 4.1 years, n = 106), 6- to 10-year-olds (M = 7.8 years, n = 154), and 11- to 16-year-olds (M = 12.3 years,

$n = 62$), who were recruited from a Midwestern US inpatient hospital unit evaluating child abuse and neglect. Most of the referrals to the hospital unit were from the Child Protective Services agency, family physicians, and school counselors. The participants were mainly from urban families of low socioeconomic status (SES) and predominantly of minority status (70.4% African American, 15.2% Latino, 13.7% Anglo, and 0.6% other ethnic background). Some children were in the custody of Child Protective Services ($n = 221$), whereas others were still in the custody of their parents or legal guardians ($n = 101$). For the former, informed consent was provided by Child Protective Services, whereas for the latter, parents or guardians provided informed consent.

Based on information obtained from Child Protective Services records and the hospital unit's assessment, participants were divided into five abuse status groups: (a) sexually abused group (CSA), consisting of 55 children (17 3- to 5-year-olds, 21 6- to 10-year-olds, and 17 11- to 16-year-olds); (b) physically abused group (CPA), consisting of 73 children (17 3- to 5-year-olds, 39 6- to 10-year-olds, and 17 11- to 16-year-olds); (c) both sexually and physically abused group (SPA), consisting of 29 children (6 3- to 5-year-olds, 18 6- to 10-year-olds, and 5 11- to 16-year-olds); (d) neglected group (NEG), consisting of 129 children with no indication of abuse (47 3- to 5-year-olds, 66 6- to 10-year-olds, and 16 11- to 16-year-olds; and (e) no substantiated abuse/neglect control group (CTRL), consisting of 36 children who were inpatients of the unit for suspicions of maltreatment but for whom abuse or neglect was never substantiated (19 3- to 5-year-olds, 10 6- to 10-year-olds, and 7 11- to 16-year-olds).[1] Child Protective Services records and hospital assessment results were missing for 38 and three children, respectively, and both sources were unavailable for one child. Abuse status classifications for these children were assigned based on information from either of the two sources, the state's abuse telephone hotline, and physical examination at the hospital unit. Although it was not possible to be certain of the children's actual maltreatment experiences, the abuse status groups we designated reflected the children's classifications within the Child Protective Service system.[2]

Materials

All measures of trauma-related psychopathology, general psychological functioning, and cognitive functioning were selected to have adequate psychometric properties (e.g., test–retest reliability >.76) for the age groups in question. The memory measures were designed specifically for the current study.

Dissociation

Children's Perceptual Alteration Scale (CPAS). The CPAS (Evers-Szostak & Sanders, 1992a) is a standardized self-report assessment of dissociation for children age 6 years and older. For 28 items describing dissociative experiences (e.g., "I feel like I am somebody else watching me"), children rate on a 4-point scale (1 = *never* to 4 = *almost always*) how often each experience happens to them. The CPAS has been shown to be a valid instrument discriminating between normal and clinical groups (Evers-Szostak & Sanders, 1992b).

Dissociative Experiences Scale for Adolescents (A-DES). The A-DES (Armstrong, Putnam, Carlson, Libero, & Smith, 1997) is a self-report measure of dissociation for use with children age 11 years and older. For 30 items reflecting dissociative experiences (e.g., "Something inside of me seems to make me do things that I don't want to do"), children indicate on an 11-point scale (0 = *never* to 10 = *always*) how often they have such experiences. The A-DES has high reliability, internal validity, and discriminant validity (Armstrong et al., 1997).

[1] The children for whom the authorities and hospital staff could not substantiate abuse served as a control group for current purposes. These children also had no past substantiated maltreatment histories. Although it is possible that some of these children had suffered maltreatment, misclassification would result in a conservative test of our hypotheses. For simplicity, in the rest of the article, the children with no substantiated abuse are referred to as the CTRL (control) group.

[2] To determine whether the different abuse status groups had different mean ages, a one-way abuse status analysis of variance (ANOVA) was conducted for each age group, with age as the dependent measure. There were no significant mean age differences among the abuse status groups.

Child Dissociative Checklist (CDC). The CDC (Putnam, 1985) is an observer report assessment to measure behavioral dissociation of children age 4 years and older. For 20 items that describe dissociative behaviors (e.g., "Child goes into a daze or trance-like state at times or often appears 'spaced out'. Teachers may report that he or she daydreams frequently in school"), parents/caretakers rate whether such behavior is characteristic of the child now or within the past 12 months on a 3-point scale (0 = *not true* to 2 = *very true*). In the current study, only the adults who had been caring for the child for at least 2 months completed the checklist. The measure has been demonstrated to have high reliability and validity and to differentiate among normal, sexually abused, and dissociative-disordered children (Putnam, Helmers, & Trickett, 1993).

General psychological functioning

Global Assessment of Functioning (GAF). A clinical psychologist provided a GAF rating (American Psychiatric Association, 1994) for each child on a hypothetical continuum from illness to mental health, using a 100-point scale (1 = *serious dysfunction* to 100 = *superior functioning*), with regard to the child's psychological, social, and educational functioning. The GAF scale is a widely used measure of general psychosocial functioning (Endicott, Spitzer, Fleiss, & Cohen, 1976; Sohlberg, 1989).

Other trauma-related measures

Child Depression Inventory-Short Version (CDI-S). The CDI-S (Kovacs, 1992) is a self-report measure to assess depression in children age 7 years and older. For 10 items, children are requested to pick one sentence from three (e.g., "I am sad once in a while," "I am sad many times," "I am sad all the time") that best describes the way they have been for the past 2 weeks.

Trauma Symptom Checklist-Child Version (TSC-C). The TSC-C (Briere, 1989) is a self-report checklist for use with children ages 8–15 years and measures a wide range of trauma symptoms such as anxiety, depression, anger, posttraumatic stress, dissociation, and sexual concerns. For 54 items, children rate how often they have each experience (e.g., "Getting scared all of a sudden and don't know why") on a 4-point scale (0 = *never* to 3 = *almost all of the time*).

Cognitive functioning

Wechsler Intelligence Scale for Children-3rd edition (WISC-III) and Wechsler Preschool and Primary Scale of Intelligence (WPPSI). Children older than 6 years were administered the WISC-III Short Form containing the subtests of Vocabulary and Block Design. Combined scores of the two subtests have high correlations with the WISC-III full scale scores. The Vocabulary and Block Design subtests of the WPPSI (Wechsler, 1991) were administered to children age 6 years and younger.

Peabody Picture Vocabulary Test-Revised (PPVT-R). Children of all ages were administered the PPVT-R (Dunn & Dunn, 1981) to assess their receptive language skills. For this test, children are presented with a series of plates containing four pictures and asked to choose a picture corresponding to a stimulus word from the four pictures of each plate.

Short-Term Memory (STM) subtests of Stanford–Binet Intelligence Scale-4th edition (SB-4). For children age 7 years and older, STM scores were derived from three subtests of the SB-4 (Thorndike, Hagen, & Sattler, 1986): Memory for Sentences and Memory for Digits, both of which assess auditory STM, and Memory for Objects, which measures visual STM. Because of a lack of standardization for younger children for two of the three tests, children younger than 7 years were administered the Memory for Sentences subtest only.

Memory measure

A questionnaire was constructed for the current study to assess each child's memory for a play activity that occurred during the hospital stay. The memory questionnaire began with a free recall question (e.g., "Tell me everything you can remember about the time you went into the hallway to play. What happened?"), followed by one prompt ("What else happened? I need to know everything

that happened"), and then proceeded to a mix of four cued recall questions (e.g., "What color hair did the adult have?"), 19 specific yes/no questions (e.g., "Was there a table out there in the hallway," "Did s/he touch your leg?"), and 16 misleading yes/no questions that presupposed incorrect details of the events (e.g., "Wasn't it a picture of a lion's face that you threw the beanbags through?" "There wasn't a chair out there in the hallway, was there?"). The specific and misleading yes/no questions were designed to yield roughly the same numbers of correct yes and correct no answers.[3]

Procedure

Play session

On the 2nd day of each child's hospitalization, the child engaged in an enjoyable interactive experience that centered around a beanbag game with a researcher. Specifically, the child and researcher went into a hallway just beyond the hospital unit and then took turns tossing beanbags through a picture of a clown. After the event, which was videotaped, the researcher rated the child's stress level on two scales. One scale (1 = *very happy* to 6 = *very unhappy*) assessed children's general affect during the event. The second scale (1 = *not crying* to 6 = *hysterical*) assessed children's level of crying. All children were rated as happy and not crying, precluding statistical analyses.

Memory interviews

On the 5th day of children's hospitalization, a researcher who had not been present during the play activity interviewed each child about that event. The interview was videotaped. After the memory interview, right before children left the hospital, they were thoroughly debriefed about the purpose of the questions.

Individual difference assessments

As part of the hospital evaluation, each child individually took part in a clinical interview at some point during the 5-day stay (usually on the 3rd day). During the interview, a clinical psychologist (or doctoral student) asked questions about alleged abuse, probed for symptoms of trauma, and assessed children's mental status, level of emotional and cognitive functioning, and affective responses to the alleged abuse. The clinician (not a doctoral student) also made a GAF rating for each child. Finally, the clinician determined whether or not to give each child a PTSD diagnosis based on DSM-IV (*Diagnostic and Statistical Manual of Mental Disorders*-4th edition) criteria. The clinicians worked independently of the researchers and were blind to the other data collected for the study.

Several additional assessments were administered, including dissociation measures (CPAS, A-DES, CDC), trauma symptom measures (CDI-S, TSC-C), intelligence and vocabulary tests (WISC-III, WPSSI, PPVT-R), and STM tests (Memory for Sentences, Objects, and Digits of the SB-4). Because children participated in a variety of activities during the hospitalization, the timing of these measures could not be standardized across children. The entire sessions were videotaped.

Coding

Each statement children provided during the memory interview in response to free recall and cued recall questions was broken into units of information, and each unit was scored as correct or incorrect. For example, a child's statement, "I threw the beanbag and hit the window and couch," would have received three correct units ("I," "threw," and "beanbag") and three incorrect units ("hit," "window," and "couch") if the child threw a beanbag but did not hit anything. Responses to specific and misleading questions were coded as correct responses, commission errors, omission errors, and "don't know" answers. Two independent coders scored 11% of the memory interviews. Proportion agreement was .81 for units of information for free recall and cued recall questions and .96 for responses to specific

[3] One question was excluded from the analyses, "That person you played the games with, did s/he put her/his hand through the holes of the pictures of the clown?" because it was too ambiguous to score given the actions performed.

and misleading questions. Discrepancies were resolved, and each coder scored half of the remaining interviews.

Results

Results of the statistical analyses are presented in four major sections: (a) abuse-related differences in psychopathology and cognitive functioning, (b) children's memory and suggestibility as linked to individual difference factors, (c) children's memory and suggestibility as related to age and abuse status controlling for individual difference factors, and (d) event memory in children who varied in dissociative tendencies and trauma symptoms. Dependent variables included correct and incorrect units of information in response to free recall and cued recall questions and proportion errors in response to specific and misleading questions. Analyzes of commission or omission errors are also reported separately when informative. Because of missing data for some variables, the number of participants for each analysis is indicated. All significant findings are reported.

Abuse status and individual difference variables

Our first hypothesis was that children with abuse and/or neglect histories would exhibit greater psychopathology and lower cognitive functioning than children with no substantiated maltreatment reports. Means for psychopathology and cognitive functioning variables for children in different age and abuse status groups are provided in Table 1. Of note, 49.81% of the children reached the clinical cutoff of 70 for GAF ratings, and 26% of the children fell at or above the clinical cutoff of 12 on the CDC. The clinical cutoff for most subscales of the TSC-C is 65 (*T* scores); here 9% of the children reached the TSC-C clinical cutoff for the PTSD symptoms subscale, and 12% reached the clinical cutoff for dissociation. For the CDI-S, 12% of the children obtained a *T* score of 65 or above, which is considered as clinically significant in a high-risk sample.

To reduce the number of individual difference variables involved, composite measures of psychopathology and cognitive functioning were formed through principal component analyses using varimax rotation. The principal component analysis was first conducted on the variables of trauma symptoms assessed by four self-report measures (A-DES, CPAS, TSC-C, and CDI-S) and three observer ratings (CDC, PTSD diagnosis, and GAF ratings). Two factors emerged, with the four self-report measures loading on the first factor (eigenvalue = 3.01, factor loadings $\geqslant$.50) and the three observer measures loading on the second factor (eigenvalue = 1.10, factor loadings $\geqslant$.57). When combined, the two factors explained 58.7% of the variance. A composite score of self-report trauma symptoms was generated by averaging *z* transformations of the scores on the four self-report measures (Cronbach's α = .87). Note that this composite score was not possible for 3- to 5-year-olds due to the absence of self-report measures. Because the three observer measures did not have sufficient reliability to establish a valid scale, scores on these measures were used individually in further analyzes. A principal component analysis conducted on cognitive functioning variables generated one factor, with an eigenvalue = 2.02, which explained 67.2% of the variance. The three cognitive scores of STM, receptive language comprehension, and intelligence loaded highly on this factor (factor loadings $\geqslant$.78). A composite score of general cognitive functioning level was computed by averaging *z* transformations of the three scores (Cronbach's α = .76).

Once the composite measures were formed, it was of interest to determine whether the abuse status groups differed on the individual difference measures. A series of separate one-way abuse status group analyses of covariance (ANCOVAs) was performed with age as the covariate and self-report trauma symptoms, CDC, GAF, PTSD, and cognitive functioning as the dependent measures. The main effect of abuse status was significant for the CDC measure, $F(4, 185) = 3.58$, $p < .01$, and PTSD diagnosis, $F(4, 313) = 5.74$, $p < .001$. Sexually and/or physically abused children (i.e., CSA, CPA, and SPA victims) obtained higher CDC scores than neglected children. In addition, CSA and SPA children were more likely to obtain a PTSD diagnosis than CPA victims, neglected children, and CTRL group children. Although causal inference is not recommended based on these data, the findings are consistent with

Table 1
Means and standard deviations for individual difference variables for each age and abuse status group.

Measure	Age group (years)			Abuse status group				
	3–5	6–10	11–16	CSA	CPA	SPA	NEG	CTRL
Trauma (N = 212)		.08 (.86)	−.10 (.81)	−.15 (.77)	.11 (.87)	.35 (.77)	.01 (.91)	−.19 (.67)
CPAS		56.70 (13.65)	52.50 (12.75)	53.66 (11.70)	55.84 (13.60)	59.41 (15.02)	55.65 (14.19)	52.41 (11.43)
A-DES			2.56 (1.92)	2.42 (1.77)	2.82 (2.05)	3.14 (1.62)	2.08 (2.16)	2.98 (1.88)
CDI-S (T score)		52.80 (11.28)	49.89 (9.51)	49.03 (9.47)	53.92 (12.01)	54.44 (7.64)	52.17 (11.43)	47.19 (7.66)
TSC-C (T score)		37.22 (21.31)	37.85 (22.71)	38.17 (20.51)	39.31 (21.23)	43.67 (23.73)	33.24 (22.78)	37.36 (23.28)
CDC (N = 191)	9.82 (7.00)	6.76 (6.20)	8.03 (6.00)	8.12 (6.12)	9.03 (6.89)	11.26 (8.61)	5.97 (5.17)	8.22 (6.92)
GAF (N = 254)	68.86 (12.01)	69.38 (12.90)	67.27 (9.89)	68.30 (10.98)	67.53 (12.05)	64.68 (11.15)	70.66 (12.51)	69.76 (12.52)
PTSD% (N = 319)	4.59	13.07	20.63	22.41	10.67	31.03	5.47	2.86
Cognitive (N = 320)	−.15 (.70)	.08 (.71)	.04 (.75)	.12 (.78)	−.06 (.58)	−.15 (.79)	−.05 (.72)	.20 (.81)
STM	95.75 (11.65)	93.01 (13.44)	87.13 (13.73)	94.56 (14.14)	91.53 (12.04)	91.43 (13.66)	92.33 (12.88)	95.08 (15.20)
PPVT	69.47 (17.24)	67.92 (17.18)	70.66 (16.97)	71.63 (18.43)	66.95 (15.73)	63.28 (18.35)	68.39 (16.54)	75.44 (17.25)
WPPSI	14.62 (3.98)	12.48 (4.88)		15.05 (4.31)	13.71 (3.93)	11.30 (4.03)	13.85 (4.15)	16.20 (4.24)
WISC		11.65 (4.43)	11.37 (4.79)	12.34 (4.74)	11.61 (3.79)	11.94 (4.93)	11.06 (5.09)	11.13 (3.76)

Note. CSA, sexual abuse; CPA, physical abuse; SPA, sexual and physical abuse; NEG, neglect; CTRL, no substantiated maltreatment controls; Trauma, self-report of trauma symptoms composite score; CPAS, Children's Perceptual Alteration Scale; A-DES, Dissociative Experiences Scale for Adolescents; CDI-S, Child Depression Inventory-Short Form; TSC-C, Trauma Symptom Checklist for Children; CDC, Child Dissociative Checklist total scores; GAF, Global Assessment of Functioning ratings; PTSD, posttraumatic stress disorder diagnosis; Cognitive, cognitive functioning composite score; STM, Short-Term Memory subtests of Stanford–Binet Intelligence Scale; PPVT, Peabody Picture Vocabulary Test; WPPSI, Wechsler Preschool and Primary Scale of Intelligence; WISC, Wechsler Intelligence Scale for Children.

Table 2
Correlations among age, individual difference variables, and memory.

Variable	Age	Trauma	CDC	GAF	PTSD	Cognitive
Individual differences						
Age	–					
Trauma	−.17*	–				
CDC	−.11	.28**	–			
GAF	−.05	−.20**	−.21**	–		
PTSD	.19**	.17*	.17*	−.21**	–	
Cognitive	.11*	−.07	−.16*	.13*	.07	–
Memory						
Free recall correct	.57***	−.06	−.13+	.09	.14*	.22***
Free recall incorrect	−.08	.21**	−.04	−.02	−.05	−.05
Cued recall correct	.56***	−.09	−.13+	.06	.02	.18**
Cued recall incorrect	−.21***	.02	.09	.05	−.05	−.03
Specific questions proportion incorrect	−.65***	.16*	.19**	−.03	−.13*	−.23***
Misleading questions proportion incorrect	−.61***	.22**	.18*	−.02	−.12*	−.27***

Note. $N \geqslant 144$. PTSD, posttraumatic stress disorder diagnosis (0 = *no PTSD*, 1 = *PTSD*). For other abbreviations, see Table 1.
+ $p < .10$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

the possibility that experiences of physical and/or sexual abuse led to heightened dissociation and that experiences of sexual abuse led to PTSD symptoms.

Individual differences in memory and suggestibility

We hypothesized that children with greater psychopathology and lower cognitive functioning would show less accurate event memory and greater suggestibility. First, correlations among individual difference variables and children's memory were calculated (Table 2). Children with greater self-report trauma symptoms were likely to receive lower GAF ratings, higher CDC scores, and a PTSD diagnosis. Children with higher cognitive functioning were more likely to obtain higher GAF ratings and lower CDC scores. Memory performance was significantly correlated with age, cognitive functioning, self-report trauma symptoms, CDC, and PTSD. Older children and children with fewer self-report trauma symptoms, lower CDC scores, no PTSD diagnosis, and higher cognitive functioning provided more correct information and fewer errors.

Multiple regression analyses were then performed to examine the unique contribution of age and each individual difference variable (i.e., self-reported trauma symptoms, CDC, GAF, PTSD, and cognitive functioning) to memory performance (Table 3). The regression models were significant for correct information in free recall, $F(6, 137) = 13.40$, $p < .001$, and cued recall, $F(6, 137) = 11.85$, $p < .001$. Older children provided more correct information in response to free recall and cued recall questions. Children with higher cognitive functioning provided more correct information in response to free recall questions. The regression models for incorrect information in response to free recall and cued recall questions were not significant, $Fs(6, 137) \leqslant 1.32$. The regression models were significant for proportion errors in response to specific questions, $F(6, 137) = 19.06$, $p < .001$, and misleading questions, $F(6, 137) = 17.19$, $p < .001$. Age and cognitive functioning were significant predictors, such that older children and children with higher cognitive functioning made fewer errors in response to specific and misleading questions.

Age, abuse status, and memory performance

We also predicted that, to the extent that child maltreatment per se (aside from psychopathology and cognitive functioning) may have an effect on children's memory performance, children with abuse and/or neglect histories would generally evince poorer memory and greater suggestibility (e.g., fewer

Table 3
Regression analyses predicting memory and suggestibility ($N = 144$).

Variable	Free recall				Cued recall questions				Specific questions		Misleading questions	
	Correct		Incorrect		Correct		Incorrect		Proportion errors		Proportion errors	
	β	t	β	t	β	t	β	t	β	t	β	t
Age	.56	7.88***	−.03	−0.39	.57	7.81***	−.20	−2.33*	−.61	−9.26***	−.56	−8.29***
Trauma	.08	1.08	.24	2.65**	.05	0.64	−.03	−0.34	.02	0.30	.10	1.38
CDC	−.05	−0.67	−.10	−1.16	−.03	−0.43	.09	1.03	.09	1.32	.06	0.91
GAF	.11	1.55	−.01	−0.08	.06	0.85	.05	0.61	−.03	−0.48	.00	0.03
PTSD	.04	0.60	−.07	−0.76	−.08	−1.10	−.01	−0.08	−.03	−0.47	−.03	−0.36
Cognitive	.14	2.01*	−.04	−0.49	.12	1.64	.00	−0.00	−.14	−2.15*	−.19	−2.83**

Note. For free recall correct, $R^2 = .37$***; free recall incorrect, $R^2 = .06$; cued recall correct, $R^2 = .34$***; cued recall incorrect, $R^2 = .06$; proportion errors in response to specific questions, $R^2 = .46$***; and proportion errors in response to misleading questions, $R^2 = .43$***. PTSD, posttraumatic stress disorder diagnosis (0 = *no PTSD*, 1 = *PTSD*). For other abbreviations, see Table 1.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

units of correct information in free recall, greater error in answering specific and misleading questions) than children with no substantiated histories of maltreatment, even with individual difference factors statistically controlled. We also sought to examine possible effects of type of maltreatment on memory and suggestibility and whether such effects interact with children's age. To examine these issues, a series of 3 (age: 3- to 5-year-olds vs. 6- to 10-year-olds vs. 11- to 16-year-olds) × 5 (abuse status: CSA vs. CPA vs. SPA vs. neglected vs. CTRL) ANCOVAs was conducted with individual difference factors (i.e., CDC, GAF, PTSD diagnosis, and cognitive functioning) as covariates for children's responses to free recall, cued recall, and specific and misleading questions.[4] One individual difference variable, self-report trauma symptoms, was not included in the analyzes given that the self-report measures were not collected for 3- to 5-year-olds. As shown in Table 4, significant age effects emerged for units of correct information in response to free recall and cued recall questions, $Fs(2, 271) \geqslant 28.94$, $ps < .001$, partial $\eta^2 s \geqslant .18$, units of incorrect information in response to cued recall questions, $F(2, 271) = 6.20$, $p < .01$, partial $\eta^2 = .04$, and proportion errors in response to specific and misleading questions, $Fs(2, 271) \geqslant 70.24$, $ps < .001$, partial $\eta^2 s \geqslant .34$, with older children providing more correct information and fewer errors. No significant abuse-related differences or age × abuse status interactions were found in children's memory performance. When 2 (age: 6- to 10-year-olds vs. 11- to 16-year-olds) × 5 (abuse status: CSA vs. CPA vs. SPA vs. neglected vs. CTRL) ANCOVAs were conducted comparable to those just mentioned but including the self-report trauma symptoms as an additional covariate, the pattern of results was the same. Thus, abuse status per se was not found to significantly affect children's memory or suggestibility, whether considered alone or in interaction with age.

Event memory in children with dissociative tendencies and trauma symptoms

Finally, we sought to determine whether more highly dissociative children who self-reported high levels of trauma symptoms would evince particularly high levels of memory errors regarding a neutral event, as found by Eisen and colleagues (2007) for a stressful experience. To examine the relations among dissociative tendencies, other trauma symptoms, and children's memory accuracy, regression analyses were performed separately for high and low dissociators to predict commission and omission errors, as conducted by Eisen and colleagues (2007). Children were divided into high and low dissociation groups based on CPAS scores; children with scores above the mean ($M = 1.98$) were classified as high dissociators ($M = 2.41$, $SD = 0.35$, $n = 97$), and children with scores below the mean were

[4] Given that GAF and CDC scores were missing for a number of children (68 and 131, respectively), missing data were imputed. The missing GAF data reflected clinical psychologists' absence during the session. Regarding the missing CDC data, parents/caretakers normally complete the CDC measure but were not always available for the current study given the children's situations.

Table 4
Age, abuse status, and performance on memory and suggestibility tests.

Questions	Age group (years)			Abuse status group					
	3–5 (n = 106)	6–10 (n = 154)	11–16 (n = 62)	CSA (n = 55)	CPA (n = 73)	SPA (n = 29)	NEG (n = 129)	CTRL (n = 36)	Total (N = 322)
Free recall questions									
Correct units	2.41[a] (5.81)	14.14[b] (12.38)	25.73[c] (18.55)	14.35 (16.59)	13.33 (13.21)	13.24 (16.17)	11.68 (15.33)	10.39 (11.64)	12.51 (14.77)
Incorrect units	0.85 (2.79)	1.14 (2.92)	0.24 (0.56)	0.60 (2.17)	0.81 (2.42)	1.14 (3.56)	1.14 (2.93)	0.22 (0.76)	0.87 (2.61)
Cued recall questions									
Correct units	0.52[a] (0.77)	1.88[b] (1.61)	2.90[c] (1.44)	1.78 (1.98)	2.07 (1.63)	1.53 (1.42)	1.46 (1.47)	1.20 (1.38)	1.63 (1.61)
Incorrect units	0.33[a] (0.47)	0.16[b] (0.31)	0.08[b] (0.18)	0.13 (0.24)	0.18 (0.38)	0.19 (0.30)	0.24 (0.38)	0.24 (0.48)	0.20 (0.37)
Specific questions proportion incorrect									
Overall error	.35[a] (.12)	.17[b] (.08)	.13[c] (.06)	.21 (.13)	.18 (.11)	.24 (.15)	.24 (.13)	.25 (.12)	.22 (.13)
Commission	.20[a] (.14)	.05[b] (.07)	.01[c] (.03)	.08 (.11)	.06 (.08)	.12 (.14)	.11 (.13)	.10 (.12)	.09 (.12)
Omission	.15[a] (.09)	.12[b] (.05)	.12[b] (.05)	.13 (.06)	.13 (.07)	.12 (.07)	.13 (.07)	.15 (.06)	.13 (.07)
Misleading questions proportion incorrect									
Overall error	.37[a] (.20)	.12[b] (.09)	.07[b] (.04)	.17 (.17)	.16 (.16)	.21 (.20)	.22 (.21)	.18 (.17)	.19 (.19)
Commission	.24[a] (.18)	.04[b] (.08)	.01[b] (.04)	.08 (.14)	.07 (.10)	.11 (.19)	.13 (.17)	.09 (.15)	.10 (.15)
Omission	.14[a] (.09)	.07[b] (.05)	.06[b] (.04)	.09 (.07)	.09 (.08)	.09 (.05)	.09 (.07)	.09 (.07)	.09 (.07)

Note. Values are means with standard deviations in parentheses. For age comparisons, different superscripts in a row indicate significant planned comparisons, $Fs(1, \geqslant 166) \geqslant 13.36$, $ps < .001$. For abbreviations, see Table 1.

Table 5
Regression analyses predicting memory errors by dissociation group.

Variable	Commission errors		Omission errors	
	β	t	β	t
Low dissociators (N = 94)				
Age	−.45	−4.94***	.01	0.13
Trauma	.09	0.89	.02	0.13
GAF	.10	1.01	.07	0.59
PTSD	−.07	−0.74	.02	0.17
Cognitive	−.23	−2.41*	.06	0.55
High dissociators (N = 81)				
Age	−.38	−3.70***	−.32	−2.75**
Trauma	.30	2.85**	−.12	−1.01
GAF	−.17	−1.53	−.10	−0.80
PTSD	−.05	−0.53	.11	0.94
Cognitive	−.17	−1.74+	−.11	−1.03

Note. For low dissociators, proportion commission errors in response to specific and misleading questions, $R^2 = .27^{***}$, $F(5, 88) = 6.54$; proportion omission errors in response to specific and misleading questions, $R^2 = .01$, $F(5, 88) = 0.20$. For high dissociators, proportion commission errors in response to specific and misleading questions, $R^2 = .32^{***}$, $F(5, 75) = 7.04$; proportion omission errors in response to specific and misleading questions, $R^2 = .10$, $F(5, 75) = 1.72$. PTSD, posttraumatic stress disorder diagnosis (0 = *no PTSD,* 1 = *PTSD*). For other abbreviations, see Table 1.

+ $p < .10$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

classified as low dissociators ($M = 1.62$, $SD = 0.20$, $n = 116$). Highly dissociative children had significantly higher CPAS scores than children with lower dissociation, $F(1, 211) = 419.31$, $p < .001$, and the two groups did not significantly differ in abuse status, $\chi^2(4, N = 213) = 0.77$. The CPAS was the self-report measure with the broadest age range, 6–16 years (3- to 5-year-olds could not be included in these regression analyses). The results were essentially the same when the CDC scores were used.

The regression model for commission errors in response to specific and misleading questions by low dissociators was significant, $F(5, 88) = 6.54$, $p < .001$ (Table 5). Age and cognitive functioning inversely predicted low dissociators' commission errors. The regression model for omission errors in response to specific and misleading questions by low dissociators was not significant, $F(5, 88) = 0.20$. The regression model for commission errors in response to specific and misleading questions of high dissociators was significant, $F(5, 75) = 7.04$, $p < .001$. For high dissociators, age and self-reported trauma symptoms were the significant predictors; specifically, younger children and children with greater trauma symptoms made more commission errors in response to specific and misleading questions. However, because the CPAS was used to classify the children into high and low dissociative groups but was also included in the self-reported trauma variable, the appropriate interpretation of the latter finding is that, among highly dissociative children, more self-reported trauma symptoms (including more dissociation) were associated with greater commission errors. The relation between cognitive functioning and commission errors approached significance. The regression model for omission errors in response to specific and misleading questions by high dissociators was not significant, $F(5, 75) = 1.72$. These findings replicate those reported by Eisen and colleagues (2007).

Discussion

The current study examined memory and suggestibility for a nonstressful play interaction in 3- to 16-year-olds with substantiated maltreatment histories and children without known histories of abuse or neglect. Findings obtained shed light on maltreated children's eyewitness memory for experienced events.

Maltreatment and memory

We examined whether children with abuse and/or neglect histories would evince poorer memory performance than children with no substantiated histories of maltreatment. However, relations between maltreatment history and memory/suggestibility were not observed. Compared with neglected children, children with substantiated sexual and/or physical abuse were more dissociative. Children who suffered sexual abuse and those who suffered both sexual and physical abuse were more likely to obtain a PTSD diagnosis than physically abused or neglected children and children without substantiated maltreatment histories. Nevertheless, when individual differences such as these were statistically controlled, maltreated children's memories were overall as accurate as those of age-comparable children without substantiated histories of maltreatment. Our results provide support for the view that memory accuracy of maltreated children does not significantly differ from that of nonmaltreated children (for reviews, see Goodman et al., 2010; Howe et al., 2006) and also extend previous empirical findings on maltreatment experiences and the accuracy of children's memory for experienced events (Eisen et al., 2002, 2007; Goodman et al., 2001) and for experimental stimuli (Howe et al., 2004; Valentino et al., 2008a; but see Valentino et al., 2008a). Hence, although there is some evidence that abused children remember highly stressful incidents better than neglected children, possibly due to abused children's hypervigilance to traumatic information or the greater trauma relevance of such incidents to abused children compared with neglected children (Eisen et al., 2007), such maltreatment-related differences in memory performance were not observed for the non-trauma-related event that we studied. Thus, based on the investigations conducted to date, we tentatively conclude that detrimental effects of child maltreatment on event memory during adulthood, as implied by previous research (e.g., Edwards, Fivush, Anda, Felitti, & Nordenberg, 2001), do not seem to emerge during childhood or adolescence, at least for relatively neutral events.

However, firm conclusions about possible effects (or noneffects) of child maltreatment on memory are complicated by a lack of random assignment to abuse groups, precluding causal inference. Moreover, differences across studies complicate comparison of results. Studies differ, for example, in the age groups tested, type of event, age at start and end of abuse, chronicity of abuse, severity of abuse, and so forth. Furthermore, effects of maltreatment may at times be obscured by changes concomitant with normal development. In addition, maltreatment may need to be particularly severe or long-standing so as to be associated with relatively permanent neurobiological changes (e.g., changes in levels of cortisol) in order to see effects on general memory functioning.

Dissociation, PTSD, general psychopathology, and memory

Although maltreatment per se was not associated with memory performance deficits, self-reported trauma symptoms predicted greater commission errors (i.e., suggestibility) among highly dissociative children, whereas this was not the case for children who were lower in dissociative tendencies. Such relations are consistent with findings on memory for highly stressful medical procedures (Eisen et al., 2007). Hence, when trauma symptoms accompany high levels of dissociation, children seem to have impaired event memory accuracy. Children with more trauma symptoms who also exhibit high degrees of dissociation might have greater difficulty in remembering previous events in general (e.g., due to memory monitoring problems) or may be subject to response bias tendencies or greater suggestibility, as has been found for adults (e.g., Eisen & Carlson, 1998; Hyman & Billings, 1998).

It was predicted that children diagnosed with PTSD would display worse memory than children without PTSD. However, overall PTSD diagnosis did not uniquely contribute to children's memory accuracy. Empirical research conducted with children to date has not revealed consistent relations between memory performance and maltreatment-related PTSD (e.g., Eisen et al., 2007); in contrast, in several studies with adults, PTSD predicted impaired memory performance (e.g., Bremner et al., 2000). Developmental differences in the relation between PTSD and memory might be explained by the effects of PTSD on the hippocampus, a brain region associated with memory. Significant reductions in hippocampal volume have been found among adults diagnosed with trauma-related PTSD (e.g., Bremner et al., 2003). However, such changes in brain structure have generally not been shown in children or adolescents with PTSD, whose brains are still developing (e.g., De Bellis, Hall, Boring, Frustaci,

& Moritz, 2001; but see Carrion, Weems, & Reiss, 2007). Before making conclusions about PTSD and children's memory, further investigations should be conducted employing a continuous measure of PTSD symptoms administered by clinicians who are blind to children's maltreatment histories.

Overall, the findings suggest that children with certain forms of trauma-related psychopathology, specifically highly dissociative children who self-report an elevated number of trauma symptoms, might be at particular risk for commission errors during memory interviews. Such children may profit from greater rapport building and/or use of an open-ended questioning style (Lamb, Hershkowitz, Orbach, & Esplin, 2008). It is possible that such children are especially distracted and anxious while they are with an unfamiliar adult, which might interfere with optimal encoding or retrieval. Thus, they might be less able to efficiently organize the information, have more difficulty both in answering interview questions in an organized manner and in dealing with lengthy and complicated questions, and/or experience more trouble with the social context of the interview. Further research is needed to pinpoint the mechanisms underlying the current findings.

Cognitive functioning and memory

As predicted, children's cognitive functioning, which in the current study represented their short-term memory, intelligence, and verbal skills, was associated with memory and suggestibility. Specifically, children with higher cognitive functioning provided more correct responses to free recall and cued recall questions and made fewer errors in response to specific and misleading questions, even with age and other individual difference variables statistically controlled. Children with poorer short-term memory skills might be less able to keep track of the content of questions relative to their experiences. Also, children with lower intelligence might lack efficient memory strategies and certainty in their own memories. Finally, children with limited verbal skills may have difficulty in understanding questions or describing their experiences, especially when involved in a long and complicated interview. Our findings regarding cognitive functioning are consistent with those of studies on nonmaltreated children (e.g., Chae & Ceci, 2005).

Age and memory

As expected, older children evinced better memory and less suggestibility overall than their younger counterparts. One area of performance where significant age differences did not appear concerned incorrect answers to free recall questions, as shown previously for nonmaltreated children (e.g., Cassel & Bjorklund, 1995; Poole & Lindsay, 2002). By examining maltreated children's memory for a neutral event and finding quite consistent patterns with those of prior studies, we demonstrated the broad generality of the age trends.

Caveats

Although the current findings have notable implications for understanding the event memory and suggestibility of maltreated children, this work has limitations. First, given that we recruited the CTRL group children (for whom allegations of abuse could not be substantiated) as well as maltreated participants from a child abuse evaluation unit, the CTRL group children might have been from more adverse environments compared with nonmaltreated controls in other studies. They also may have suffered child maltreatment even though substantiation was not possible. However, note that our groupings of children's maltreatment status reflect those typical within the Child Protective Services system. To increase confidence in the maltreatment status classification, a comparison group of children not involved in investigations could have been included in the current study. However, comparisons of the maltreated group with that control group would have been confounded by numerous factors (e.g., no removal vs. removal from home, familiarity with the hospital unit). Second, the events and memory interviews were conducted during the 5-day hospital stay, whereas in forensic interview contexts children are often questioned repeatedly and several months or years after the incidents. Future research would benefit from examining whether maltreatment experiences and related

psychological sequelae predict children's memory and suggestibility measured over repeated interviews and after long delays.

Conclusion

The current study examined event memory and suggestibility in children with substantiated maltreatment experiences and children without known maltreatment histories in relation to individual differences in trauma-related psychopathology and cognitive functioning. In general, memories of children with substantiated maltreatment experiences were as accurate as those of children with no known past maltreatment. Trauma-related psychopathology and cognitive functioning were uniquely associated with memory performance in predicted directions. Typical age effects were observed in memory and suggestibility. To date, our study is relatively unique in examining memory accuracy for a nonstressful life experience in children with substantiated maltreatment histories. In addition, this research is one of the few studies that took various individual difference factors into account to investigate whether maltreatment-related sequelae predict children's event memory and suggestibility. The current findings should help scientists to resolve theoretical debates about childhood trauma and memory and should help legal professionals to evaluate the eyewitness testimony of maltreated children.

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