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RUNNING HEAD: Children's source monitoring

Children's Ability To Distinguish Between Memories From Multiple Sources: Implications For The Quality And Accuracy Of Eyewitness Statements

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Abstract

Identifying the sources of memories (e.g., who carried out an action, whether an event happened or was suggested, when an instance of a repeated event occurred) is an important skill in providing accurate accounts of events in forensic investigations. Sensitivity to the nature and development of children's source-monitoring skills can inform interviewing practices. Five perspectives addressing alternate aspects of the development of children's source monitoring are outlined (source-monitoring theory, fuzzy-trace theory, schema theory, the person-based perspective, and the mental-state reasoning model). Six main areas of empirical research stemming from these theories are then discussed with emphasis on how the findings relate to the forensic arena: The similarity of sources, the identity of the agent, prospective processing, the relation of source monitoring to other cognitive skills, metacognitive understanding, and the stringency of source-monitoring decisions. The research reviewed is used to address two main applications to forensic investigations: (a) expectations of child witnesses, and (b) interviewing protocols.

Children's Ability To Distinguish Between Memories From Multiple Sources: Implications For The Quality And Accuracy Of Eyewitness Statements

One of the most important investigative tools in forensics is the interview. Interviewing victims of and witnesses to crimes is especially important in investigations where there is little physical evidence and the main evidence therefore comes from eyewitness accounts. Concern has been raised about the reliability of eyewitness testimony, however, because many factors can have adverse effects on the length, quality, and accuracy of testimony. In addition to providing an accurate account of exactly what transpired during a crime, witnesses must also accurately identify the *sources* or origins of event details. Examples include identifying the source of an action (e.g., Who did it, Perpetrator A or Perpetrator B?), the source of a voice (e.g., Who said it, me or the perpetrator?), the reality status of a past event (e.g., Did it really happen or did I just dream it? Did I really see it happen or did I just hear about it?), and identifying one incident from a series of incidents (e.g., Did he touch me the first time he babysat or the last time he babysat? Did he touch me in the bedroom or the bathroom?). In all of these examples, child victims and witnesses must retrieve their memories and identify the precise source of those memories. Research on the development of such "source monitoring" (Johnson, Hashtroudi, & Lindsay, 1993; Johnson & Raye, 1981) can provide us with accurate expectations of child witnesses' capabilities, contribute to the development of appropriate interviewing protocols, and shed light on interviewers' judgments of child witnesses' credibility.

There are numerous source distinctions relevant to the forensic arena (see Table 1 for examples). Witnesses need to monitor various sources contained in a target incident (i.e., the alleged crime) such as distinguishing witnesses' actions from those of the perpetrators. Witnesses also must distinguish memories of the target incident from memories of other, non-target events that relate in some way to the target incident (e.g., television programs, hearing friends' similar experiences, informal interviews with parents or teachers, other instances of the alleged crime; Roberts & Powell, in press). Related events may take place before the target incident (preevent experiences) or after the target incident (postevent experiences) and have

positive or negative effects on memories and source monitoring of the target incident. If children are exposed to pre- or postevent information that is consistent with the target experience, the memory traces of the target incident can be strengthened, making them more resistant to decay and suggestive influences (Brainerd, Reyna, Howe, & Kingma, 1990; Pezdek & Roe, 1995; Warren & Lane, 1995). The preservation of a detailed memory of an event may help source monitoring in two ways: (a) the source can be easily and accurately recalled (e.g., Reyna & Brainerd, 1998) and/or (b) well-rehearsed memories of actual events contain perceptual and contextual information that is typical of memories of actually-experienced events, resulting in attributions that the events actually occurred (Johnson et al., 1993; Johnson & Raye, 1981). There are times, however, when the details in target and non-target events (i.e., pre- or post-event experiences) are inconsistent, resulting in confusions between memories of target and non-target events (Poole & Lindsay, 2001a; Roberts & Blades, 1999; Thierry, Spence, & Memon, in press).

It may be helpful to consider two main factors that can result in source errors. First are suggestive interviewing techniques in which alternate representations of reality are presented, thereby leading to later confusion between memories of experienced and suggested details. In investigations, then, it may be worthwhile to take a history of all informal discussions about the alleged incident that took place between the alleged child victim and others. Investigators may then be able to assess how suggestive those discussions may have been and thus gain an estimate of potential source problems. A second factor that may promote source errors includes aspects integral to children's memories of the events themselves (e.g., similarity of incidents, lengthy delays between incident and investigation). Investigations may reveal conditions that do or do not promote source errors. I address both suggestive interviewing and event characteristics in this review.

The review is split into four parts. The development of source-monitoring skills is complex and so the first section outlines the main characteristics of the developmental path. In the second section I review the main theories that address the development of source monitoring. The theories each have a different focus, thus providing contrasting conceptions of what source

monitoring entails. Their value lies in the foundation they provide for processing the now large amount of empirical research on source-monitoring development, research that is reviewed in the third section. Finally, I summarize the relevance of theory and research on children's source monitoring to the forensic arena.

Characteristics of the Source-Monitoring Developmental Path

Substantial effort has been made over the last 15-20 years into investigating the development of source monitoring, although much of the recent research has focused on tracking its development in preschoolers. It is now clear that significant improvements in source monitoring take place in the 3- to 8-year age range.

The development of source monitoring skills is not uniformly linear. Children gain competence at some types of source distinctions (e.g., memories of actions performed by the self vs. another person) before other types (e.g., memories of performed vs. imagined actions; Foley & Johnson, 1985). Although there is some improvement between the ages of 3 and 4 years in the latter kind of source monitoring as well as in distinguishing memories of performed and pretended actions, there is no concomitant improvement at this age in the ability to distinguish between pretended and imagined actions (Welch-Ross, 1995). Pretended and imagined actions differ because only the former includes motor behavior. The varied developmental pathways of children's source monitoring provides clues to factors that are important for its development. That children could distinguish performed from pretended actions before pretend-imagine distinctions, for example, suggests that children's understanding of fictional mental states is associated with the development of these specific kinds of source-monitoring skills (Welch-Ross, 1995).

The development of children's source monitoring is gradual rather than abrupt. Children as young as 3 years old appropriately rely on informative sources more than uninformative sources (e.g., knowing that someone who has looked at an object is better informed than one who has not; Robinson, 2000). Children younger than 5 or 6, however, cannot later explain how they know certain information (e.g., what the object was), suggesting that the development of

"implicit" source monitoring occurs before explicit awareness of sources or the ability to reflect on sources (Robinson, 2000). As with adults' cognitive skills, children's source-monitoring accuracy is sensitive to the nature of tasks, and so judgments about children's competence must be considered with task factors in mind. For example, 3- to 4-year-olds were able to distinguish memories of performed and pretended actions when tested non-verbally but not when tested verbally (Roberts & Blades, 1995). Sensitivity to different tasks is relevant to the forensic arena because the level of source confusions is dependent on interview technique. As an example, children make fewer source errors when they are allowed to freely recall events than when interviewers question them specifically about individual details (Roberts & Blades, 1998; Roberts & Blades, 1999).

Before reviewing the empirical literature, I first provide a brief outline of the major theories on the development of source monitoring. These theories set the foundation for an appraisal of the research that is then reviewed.

Theories of Source Monitoring Development

According to *source-monitoring theory* (Johnson et al., 1993; Johnson & Raye, 1981), source is attributed through an examination of the characteristics of memories and through strategic decision making. According to source-monitoring theory, then, source is inferred at the time of recollection rather than encoded at the time of the event. Memories of events that were actually perceived contain more perceptual, contextual, sensory, semantic, and affective information than do memories of non-perceived events; memories of non-perceived events lack these characteristics but contain more information about the cognitive operations that took place at the time of the event (e.g., imagery, generative processes). The qualitative characteristics of retrieved information can provide cues to source (e.g., memory of a distinctive body odor may cue recognition of the particular person who carried out the action). Source decisions can be carried out automatically with little awareness or strategic processes such as using general knowledge can be used to infer source (e.g., Person A could not have carried out the action because she was on vacation at the time). Strategic processes can be used in parallel or in

addition to an examination of memories. Although source-monitoring theory does not contain an explicit outline of developmental mechanisms, the quality of recalled memories and the use of strategic decision making are central tenets of source-monitoring theory, and so the development of *memory* skills and *strategy use* necessarily affect source-monitoring development.

According to *fuzzy-trace theory* (Brainerd & Reyna, 1990; Reyna & Brainerd, 1998), the focus of children's source errors lies in the *storage and retrieval* of the memory trace. Dual representations of each detail are stored: A gist representation of what the detail or event was about, and a verbatim representation of the exact detail as it was presented. In contrast to source-monitoring theory, according to fuzzy-trace theory "source" is encoded and represented as verbatim details that may or may not be retrieved at the time of test. There are two main ways that source errors can thus be made: first, by failing to retrieve the verbatim representation, and second, by retrieving verbatim representations of different sources. Developmental improvements in memory for source are observed because young children lose verbatim information more rapidly than older children and adults, and because children's verbatim representations are more susceptible to interference from gist processing (Ackerman, 1992, 1994; Reyna & Brainerd, 1995).

A third account identifies children's *cognitive processing demands* as the likely cause of source confusions. According to script theories (e.g., Fivush, Kuebli, & Clubb, 1992; Hudson, 1990; Nelson, 1986; Schank & Abelson, 1977), children build up a general event representation of similar events (e.g., what happens at daycare). This general event representation (or script) enables children to recall large amounts of information about events. Each detail that varies from event to event is represented in the general event representation by a slot (e.g., color of shirt, day of week) and the exact instantiations of the details (e.g., red, blue, green for the shirt example) are stored as lists. An instantiation from each list is chosen to fit each slot although the mechanisms that drive the choice of instantiations is not well articulated in script theories. Source errors, then, can be made because the wrong detail is retrieved (e.g., a detail from a different event), as also outlined in fuzzy-trace theory. According to *schema confirmation-*

deployment theory (see Farrar & Goodman, 1990), younger children take longer to build up a script than older children because of limited cognitive resources. Because all cognitive energy is focused on extracting the general, invariant details that will form the script, there are few cognitive resources left to note deviations from the script with the result that individual sources are "swallowed" into the general event representation.

A fourth account of source-monitoring errors, the *person-based perspective* (Foley & Ratner, in press; Ratner & Foley, 1996), focuses mainly on predicting confusions between memories of actions. This approach acknowledges the central importance of cognitive operations in making source judgments (as outlined in source-monitoring theory, Johnson et al., 1993) but attaches special significance to one kind of cognitive operation which can be loosely grouped as *prospective processes*. Prospective processes include anticipating an action sequence, planning actions, re-activating memories of previous related actions, and so on. Prospective processing (and, hence, source monitoring) can be affected by (a) the perspective (self or other) adopted by the individual during the activity, and (b) the goals of an activity and its meaning to the individual. Activities that have clear goals associated with them can lead to an increase in source-monitoring errors because the goal-directed nature of the task detracts attention away from source (e.g., Ratner, Foley, & Gimpert, 2000). For example, in collaborative activities a child and another person each perform actions to reach a desired goal. Each partner must anticipate and plan the other person's actions so that they can co-ordinate their own actions. Young children are prone to later mistakenly claiming that they carried out their partner's actions (colloquially known as the "I did it" bias; Foley, Ratner, & Passalacqua, 1993a), possibly because the children were recoding their partner's actions as if the children carried out the actions themselves. Foley and Ratner have argued that the perspective adopted (e.g., first-person, third-person) and the goals of the task affect the prospective processing carried out during the task, and that the preservation of source information is not central to the purpose of collaborative and goal-directed tasks. While this aids learning (because children can assimilate the partner's actions), it ultimately results in source errors. The person-based perspective, then, is unique

among the theories discussed in this review because of its emphasis on the social meaning of an event to an individual.

Finally, the *mental-state reasoning model* (Welch-Ross, 2000) was developed to outline several potential mechanisms involved in preschoolers' suggestibility. As an ability to identify the source of target and postevent details is related to resistance to suggestibility (e.g., Ackil & Zaragoza, 1995; Leichtman, Morse, Dixon, & Spiegel, 2000; Poole & Lindsay, 2001a; Welch-Ross, Diecidue, & Miller, 1997), source monitoring is a central component in the model and is associated with children's *understanding of knowledge states*. Such multifaceted understanding develops between the ages of 3 and 6 (see Flavell, Miller, & Miller, 1986) and includes a recognition that the mental state of knowing comes from informative experiences, that specific knowledge comes from specific informative experiences (e.g., seeing, hearing), and that a single reality can be represented by multiple, sometimes conflicting and counterfactual, representations. Understanding of these knowledge states is associated with improved source monitoring (as discussed later under Metacognitive Understanding). The mental-state reasoning model, then, incorporates key preschool developments into its explanation of source-monitoring skills.

Empirical Research on the Development of Source Monitoring

The theories reviewed above have stimulated empirical research into factors that affect children's source monitoring. In this section, I will identify and review six major factors of current research: (a) the similarity of the sources, (b) the identity of the agent (source), (c) prospective processing, (d) the relationship of source monitoring to other cognitive skills, (e) metacognitive understanding, and (f) the stringency of source decisions.

The Similarity Issue

Many child eyewitnesses have been victims of abuse on multiple occasions, as in the case of repeated incidents of sexual or physical abuse. Research on children's reports after multiple experiences of a similar event shows that children are often confused between the different incidents, for example, reporting a detail from one incident as if it occurred during a different one (e.g., Connolly & Lindsay, 2001; Powell, Roberts, Ceci, & Hembrooke, 1999). Research on

children's source monitoring can be useful in understanding what developmental and situational factors are associated with confusions between memories of similar events.

According to the source-monitoring framework, memories of events that are similar are more difficult to distinguish than are memories of events that are dissimilar (e.g., Johnson et al., 1993; Lindsay et al., 1991). Characteristics of target events will inevitably influence the kinds of information that are encoded in memories and, given that one method of monitoring source is assessing the qualitative characteristics of memories (Johnson et al., 1993), it is not surprising that several researchers have found that memories of similar sources are harder to distinguish from each other than are memories of dissimilar sources (Day, Howie, & Markham, 1998; Foley, Aman, & Gutch, 1987; Foley, Harris, & Hermann, 1994; Lindsay, Johnson, & Kwon, 1991; Roberts & Blades, 1999). For example, children had more difficulty distinguishing between words spoken by two speakers of the same gender than those spoken by a male and a female (Lindsay et al., 1991, Experiment 1). In other studies (e.g., Day et al., 1998; Roberts & Blades, 1999), children were more confused when asked to make source judgments about similar than dissimilar actions. When similar information is encoded from separate sources, there is little distinguishing information that can be accessed during retrieval that can help in a source judgment. In general, preschoolers appear to be more confused between similar sources than do older children and adults (Lindsay et al., 1991).

Researchers have found that the effects of similarity extend beyond perceptual and semantic similarity; functional similarity of sources also affects source monitoring. In a series of studies, children between the ages of 3 and 8 years enacted everyday actions (e.g., talking on the telephone) using a toy, an object substitute (e.g., a wooden block) or a gestural substitute (e.g., using an imaginary telephone; Foley et al., 1994). When they were asked to say how they had carried out each action, the children could accurately identify the actions they had performed with toys but the younger children were more likely than the older children to inaccurately claim that they had used a toy when they had only used a substitute. As the number of source misattributions was equal for object and gestural substitutes, Foley et al. concluded that the 3-

year-olds were confused because of the *functional* similarity of the actions rather than any perceptual similarity between the toys and the substitutes. These results reveal that the basis for similarity effects in source misattributions of actions may lie in the activation of motoric representations that actions elicit rather than the actual properties of the items (Day et al., 1998).

When the characteristics of to-be-distinguished sources are similar, successful source monitoring can be achieved by directing attention at retrieval to those memory characteristics that provide distinguishing information between the sources. In one study, 7- to 10-year-olds traced some objects using two different instruments that varied by condition: Some children traced objects with a pencil and other objects with a finger, others traced with a stylus (pencil with no lead) and a finger, and the remainder traced with a pencil and a stylus. The children were later shown the objects and asked to say how they had traced them. Discrimination by the children who had used a pencil and a finger was better than discrimination by the children who used a finger and a stylus and those who used a pencil and a stylus (Foley et al., 1987). Given that tracing actions are highly similar regardless of whether a pencil, a finger, or a stylus is used, successful source monitoring by the children in Foley et al.'s study could be achieved if they intensively inspected their memories for the presence of information that was different for each kind of action. In the present case, memories of both kinesthetic information (what it felt like) and visual consequences differed in the pencil-finger condition, whereas the visual consequences were similar in the finger-stylus condition (both actions had no visual consequences) and the kinesthetic information was similar in the pencil-stylus condition (felt the same to hold a pencil and a stylus). Hence, discrimination was easier for children in the pencil-finger condition when kinesthetic and visual information were useful cues to source than in the other conditions when only one cue to source was available. It may be possible that children have greater difficulty than adults in selecting the most useful source cues for particular source judgments.

A further possibility for Foley et al.'s (1987) findings is that children are deficient in the kind of cognitive flexibility that is needed to use multiple source cues. Interacting in events (as opposed to simply observing) often results in stronger and more detailed memories of those

events (e.g., Tobey & Goodman, 1992). But when 4-, 6-, and 9-year-olds participated in a live, staged event and then carried out similar actions when viewing a perceptually-similar interactive video, they were later more confused between the events than were same-age children who interacted in the live event but merely watched the video (Roberts & Blades, 1998). Roberts and Blades argued that, although there was little distinguishing perceptual information between the live and video events, the difference in the cognitive operations and kinesthetic feedback involved in interacting in the live event versus watching the video provided a basis for discrimination. These data highlight the flexibility that is needed in source judgments in the use of different cues. Only cognitive and kinesthetic cues would have been useful discriminators in Roberts' and Blades' study because perceptual and sensory characteristics were similar for both the live event and the video. Young children do not always show such cognitive flexibility, and so this may underlie some of their failures in source identification (Foley, Wilder, McCall, & Van Vorst, 1993b).

To summarize thus far, similar sources are (in general) more difficult to later discriminate than those that differ. Similarity can have at least two effects at encoding. First, similar properties of the events may be laid down in memory representations, providing fewer cues at retrieval that can be used to distinguish between items. Second, the events may elicit similar motoric representations, cognitive operations, or affective reactions which are also represented in memory and, again, the amount of discriminating cues available at retrieval is therefore reduced. The effects of similarity, then, are seen not just in event similarity (e.g., similar actions) but also in the activation of similar operations at the time of the event.

Another kind of discrimination that is relevant to the forensic arena is distinguishing between memories of actions carried out by the same person. For example, children may need to distinguish between actions carried out on multiple occasions by the same perpetrator. Also, false accusations may occur because children imagine suggested but fictitious actions by a person and later mistakenly believe that those actions were actually carried out by that person (e.g., Ceci, Loftus, Leichtman, & Bruck, 1994). The similarity effect can be useful when

predicting whether source confusions are likely to occur. For example, Lindsay et al. (1991, Experiment 3) compared 7- to 10-year-olds' abilities to distinguish memories of performed and imagined actions involving the same or different actors. Children either performed and imagined themselves performing actions or watched a confederate perform actions and imagined the confederate performing actions (the same-actor conditions). Other children performed actions and imagined the confederate performing actions or watched the confederate perform actions and imagined themselves performing the actions (labeled the different-actor conditions because the actor of the performed and imagined actions were different). Lindsay et al. found that the children were more confused between performed and imagined actions in the same-actor than different-actor conditions. Similar findings were also reported by Markham (1991). Lindsay et al.'s and Markham's results suggest that children's source confusions between performed and imagined actions were the result of the similarity effect, that is, that similar sources are more confusable than are less similar sources.

Accumulating evidence, however, shows that difficulty discriminating between similar sources is not the sole reason for developmental differences in source monitoring. Foley and Ratner (1998, Experiment 1) carried out an experiment replicating the same- and different-actor conditions of Lindsay et al.'s (1991) experiment described in the above paragraph. Foley and Ratner also added the similarity of actions (similar vs. dissimilar) as a between-subjects factor in their design and carried out the experiment with adults and 6-year-olds. Based on the similarity effect, one would predict that most source confusions by the children would be observed for discriminations between the most similar sources (i.e., when participants in the same-actor conditions were asked to discriminate highly similar actions). This prediction was not, however, supported. Foley and Ratner found that the 6-year-olds confused the similar actions more than the dissimilar actions only when they imagined the confederate carrying out actions. Interestingly, this effect was observed regardless of whether the memories of the imagined actions were compared with memories of performed actions carried out by the children themselves or the confederate (i.e., regardless of whether the actor of the performed and the

imagined actions was the same or different). Foley's and Ratner's findings imply that the similarity effect was insufficient in explaining their pattern of results and that the identity of the agent of the imagined actions affected the level of children's confusions. An important difference between Lindsay et al.'s (1991, Experiment 3) study and Foley's and Ratner's (1998) study is the age of the participants. In Lindsay et al.'s study, the mean age of the children was almost nine years and in Foley's and Ratner's study, the children were just 6 years old. Hence, identity of the agent may affect the source-monitoring performance of younger children only. The effects of the identity of the agent in source-monitoring decisions is discussed more fully in the following section.[1]

Agent Identity

As described above, some researchers have claimed that the level of source confusions varies depending on the identity of the agent of the to-be-discriminated actions (e.g., self, friend, unfamiliar person; Foley & Johnson, 1985; Foley, Johnson, & Raye, 1983; Foley & Ratner, 1998b). Many researchers have demonstrated superior source identification for decisions regarding the *self* in comparison to source identification regarding other people (Anderson, 1984; Baker-Ward, Hess, & Flannagan, 1990; Foley & Johnson, 1985; Foley, Johnson, & Raye, 1983; Roberts & Blades, 1998). Six- and 9-year-olds, for example, were more accurate at identifying the source of words they had spoken themselves than words that they had heard spoken by a confederate (Foley et al., 1983) and this finding was replicated using performed actions as stimuli (Foley & Johnson, 1985). Foley and colleagues argued that the advantage in source discrimination for self-generated items was because the self-other distinction is well developed in school-age children, and they provided evidence to show that the children in one experiment used this conceptualization to cluster their recall (Foley & Johnson, 1985).

Baker-Ward et al. (1990) argued that the self-generated advantage is dependent on "the extent to which preexisting knowledge is utilized to provide a meaningful mnemonic representation" (p.67). Note that this "elaboration hypothesis" does not attach special status to the self per se, but suggests that the kinds of processing carried out when familiar agents are

involved is more elaborate than when less familiar agents are involved. This hypothesis is relevant to the forensic arena because perpetrators are known to children in some crimes (e.g., many cases of physical abuse, sexual abuse, abduction). Support for the "elaboration hypothesis" came from a study in which children performed some actions and watched either a familiar or a less familiar peer carry out other actions (Baker-Ward et al., 1990, Experiment 2). On a later source-discrimination test, children who had watched a less familiar peer carry out actions remembered the actions they themselves had performed better than those of their unfamiliar partner. Children who had watched a familiar peer perform actions, however, remembered the familiar peer's actions as well as their own. Baker-Ward et al. argued that the improvement in memory of the peer's actions occurred because children could relate the peer's actions to a rich self-schema which increased the availability and accessibility of the items. Hence, the self-generated advantage occurs because the self is a rich construct of supporting knowledge that promotes elaboration of encoded information (see Symons & Johnson, 1997, for a review). In a say-imagine source-monitoring task (i.e., Did you really say it or did you imagine saying it?), the responses from 7- to 10-year-olds to metamemory questions regarding their source attributions after imagining themselves, a parent, or a friend showed that these children spontaneously engaged in the kinds of elaborative processing involving familiar people outlined by Baker-Ward et al. (Foley, Santini, & Sopasakis, 1989).

Superior source identification for self-generated items has not been observed in children younger than age 6, suggesting that the development of a sense of self during the preschool years may be a critical factor for source identification of self-generated items. For example, after participating in an interactive event, 6- and 9-year-olds made fewer source errors when they answered questions related to actions they had performed compared to questions related to actions they had watched a confederate carry out. In contrast, the 4-year-olds made more source confusions in response to questions about their own actions than they did about the confederate's actions (Roberts & Blades, 1998). Children develop a sense of self during the preschool years, and some researchers have argued that this is one of the main reasons for the development of

autobiographical memory and the offset of childhood amnesia at this time (Howe, 1998; Howe, Courage, & Peterson, 1994).

Although source monitoring for memories of familiar agents may be superior to that of less familiar agents by age 6, children's strategic reasoning about familiar sources may still be hindered by their limited metamnemonic capacities. In one study (Foley et al., 1983), 6- and 17-year-olds said and imagined saying words. When later presented with the target words as well as distracter items and asked if they had said the words, imagined the words, or if they were new words, the 17-year-olds' errors on the distracter items reflected a tendency to claim that that they had imagined saying (rather than actually saying) the distracter item, but the 6-year-olds were equally likely to say that they had said or imagined a distracter. Foley and colleagues explained the "I-must-have-imagined-it" bias of the adults in terms of metamemory assumptions: As people are aware that memories vary in strength and that memories of deeds are stronger than memories of actions, they will attribute a vague 'memory' of a distracter item to the "imagine" condition. According to Foley et al., the children in this study did not exhibit this bias because they do not yet use the same metamemory rules. These data highlight the gradual development of competent source monitoring and suggest that source monitoring for self-generated items may also be dependent on the gradual development of metacognitive understanding during the preschool period (see Frye & Moore, 1991; Olson, Astington, & Harris, 1988; Wellman, 1990). Further examples are presented in the section Metacognitive Understanding.

Prospective Processing

In this section, I focus on the role of cognitive operations in source monitoring with particular emphasis on "prospective processes," that is, the kinds of cognitive operations that are carried out to enable one to plan and execute actions. As discussed in the previous section, children aged 6 and older showed an advantage for the identification of familiar (e.g., self, friend) compared to unfamiliar sources and this was due, in part, to the elaborative processing that was spontaneously evoked (Baker-Ward et al., 1990; Foley et al., 1989). Moreover, children and adults are consistently more accurate at self-other source monitoring under conditions where

the self actions required substantial cognitive effort (e.g., Foley, Durso, Wilder, & Friedman, 1991; Johnson, Raye, Foley, & Foley, 1981). Cognitive operations for actions may include anticipating how one would perform the action, anticipating the action's consequences, and reflecting on the cognitive effort associated with carrying out the action (Ratner et al., 2000).

Records of these cognitive operations can later be useful cues when discriminating memories of sources that required substantial cognitive effort from other sources that did not elicit such cognitive effort (e.g., Foley et al., 1991). In other circumstances, however, the kinds of cognitive operations produced during events may hinder later source discrimination. Foley and Ratner (1998, Experiment 2), for example, asked 6-year-olds to perform and imagine performing some actions. The kinds of prospective processing involved in imagining the actions was manipulated such that half of the children were encouraged to think about how it would feel to carry out the actions (kinesthetic condition) and the others were instructed to consider what they would look like if they carried out the actions (visual condition). On a later source test to see how well the children discriminated memories of the performed and imagined actions, Foley and Ratner found that the children in the kinesthetic condition were more confused than those in the visual condition. Foley and Ratner argued that the kinesthetic condition encouraged the adoption of a first-person perspective whereas the visual condition supported a third-person perspective. Records of the prospective processing in the kinesthetic condition, then, would be less helpful in a source judgment between performed and imagined actions than would the records of the prospective processing in the visual condition (when the perspective differed between the performed and imagined actions). Task-evoked cognitive operations, then, affect the accuracy of future source judgments (Johnson et al., 1993). It may be fruitful, then, to study children's automatic and deliberate use of their own cognitive operations to better understand how source monitoring develops through childhood.

The quality of the cognitive operations carried out during a target event are also affected by the context of the event. Within the person-based perspective model of source monitoring (see Foley & Ratner, 1998a, in press; Ratner & Foley, 1996; Ratner et al., 2000), two important

contextual aspects are the presence of clear goals in the task and the level of collaborative activity. The effect of goals on source monitoring is demonstrated in a study where 4-year-olds traced and imagined tracing pictures (Ratner et al., 2000). Children in one condition did so in the context of a purposeful, goal-related story whereas the remaining children worked with the exact same pictures without the story context. Although the children in the Story condition later remembered the pictures better than those in the Standard condition, the Story children were more confused than were the Standard children regarding whether they had traced or imagined tracing the individual pictures. The presence of a goal, then, aided memory but hindered source monitoring. The study demonstrated the complex relationship between memory and source monitoring and demonstrated that source errors during the preschool years may actually be reflecting other aspects of cognitive development. I return to this topic in the following section.

The effect of goals on source monitoring shows developmental variability. Children aged 6 and older are quite good at distinguishing memories of what they have done and what a partner has done in a goal-oriented, collaborative task (e.g., Foley & Johnson, 1985; Foley et al., 1983; Foley et al., 1993a; Roberts & Blades, 1998). Compared to older children, those younger than 6 years make more errors in self-other source monitoring and there is a bias to exaggerate their responsibility in the task (Foley et al., 1993a; Roberts & Blades, 1998). In one study (Foley et al., 1993a, Experiment 1), 4-, 6-, and 8-year-olds alternated placing pieces on a board to make a collage of a familiar animal. When later asked who placed which pieces on the board, the preschoolers more often inaccurately claimed that they had placed the adults' pieces on the board than did the older children. Interestingly, this "I did it" bias is only observed in such collaborative, goal-oriented contexts as building a collage together; when the adult began the collage but then allowed the child to complete it alone (i.e., when only the child's goal was driving performance), the bias was not evidenced (Foley et al., 1993a, Experiment 3).

Foley and Ratner argued that, in collaborative contexts, preschoolers anticipate how their own and their partners' actions will accomplish the goal, thus resulting in a "recoding" of the partners' actions as their own. At test, the cognitive operations (anticipations) that are retrieved

for the partners' actions resemble those of self-performed actions (Foley & Ratner, 1998a; Foley et al., 1993a). Manipulations of the recoding process result in predictable effects on the presence and strength of the bias. When 4-year-olds were told to "think about how *you* would put my pieces on when it's my turn" in the collage task, the bias was exaggerated; when recoding was minimized by instructions to "think about how *I* would put my pieces on when it's my turn," the bias was eliminated altogether (italics added, Foley & Ratner, 1998a). Hence, the adoption of a first-person perspective in a collaborative task involving actions by self and another person can lead to an increase in source errors.

Given that sexual abuse can be highly interactive (e.g., removing other person's clothing, touching) and that interviews are social situations, the person-based perspective (e.g., Ratner et al., 2000) may improve our understanding of children's, especially preschoolers', source monitoring in the forensic arena. Also, the person-based perspective can contribute to our understanding of children's abuse allegations because the perspective focuses on the *meaning* of the event to the individual which, in turn, affects the nature of prospective processing.

The Relationship of Source Errors to Other Cognitive Skills.

Why might preschoolers show the aforementioned biases in collaborative contexts? Theories of learning can help explain this phenomenon. Children who engage with adults on tasks can later carry out the task alone better than children who did not have such previous collaborative experience (e.g., Rogoff, 1980). Children are effectively assimilating their partners' knowledge when they recode their partners' actions. Source-monitoring confusions in some circumstances, then, may actually index efficient learning (Ratner et al., 2000). This proposition was supported in a study in which kindergartners' (mean age 5 years 6 months) memory and categorization skills for furniture placement in a doll's house were compared with their source-monitoring errors in collaborative or non-collaborative contexts (Ratner et al., 2000, Experiment 2). In the Collaboration condition, each child chose the rooms and the furniture to go in the rooms but the child and adult alternated placing the pieces in the room; in the No-Collaboration condition, the experimenter had already placed half of the pieces into designated rooms and the

child was merely required to place the remaining pieces in the rooms. Compared to children in the No-Collaboration condition, those who collaborated were more confused when asked to indicate who placed which pieces into the house and showed the "I did it" bias (i.e., claimed that they had placed the experimenters' pieces). However, the children in the Collaboration condition also showed superior organizational memory when asked to place the pieces back into the house. Hence, the children who made most source-monitoring errors were also the children who learned the most from the task. Ratner and colleagues argued that this was because the collaborative nature of the task allowed children to recode their partners' actions as if they were their own, which was an opportunity denied to those in the No-Collaboration condition. Follow-up research showed that exposure to the experimenters' plans and actions, the child's own planning of actions, and turn-taking were not responsible for the pattern of results (Ratner et al., 2000).

Rather than conceptualizing source confusions as undesirable cognitive errors, then, Foley's and Ratner's research suggests that source confusions may be epiphenomena of processes that promote learning (Ratner et al., 2000). It has also been suggested that at times of intense learning (such as during the preschool period), it is more important to focus cognitive resources on extracting the *content* of encountered information than deploy valuable processing capacity on encoding and retrieving information that enables accurate source judgments (Roberts, 2000; Roberts & Blades, 2000). This has implications for our understanding of children's testimony because of the importance of accurately retrieving encoded information about experienced events. In some justice systems, alleged child victims of multiple sexual abuse are required to provide specific details of each incident such as the time, place, and exact actions that transpired (S. vs. R., 1989). This requires, then, that children remember the details (i.e., the content) of what occurred and tag those details to the context in which it occurred (e.g., time and place); in other words, they must monitor the source of the retrieved information. In laboratory settings, children who have experienced multiple, similar events find it difficult to retrieve a detail from a particular incident (Fivush et al., 1992; Hudson, 1990; Powell et al., 1999). An analysis of children's errors, however, shows that they have impressive memories of what they

have experienced: Children most commonly erred by reporting a detail from one experienced incident as if it had happened in another experienced incident (e.g., claiming that they heard the story about Supercat during the last incident, when they actually heard the Supercat story in the penultimate incident, Powell et al., 1999). In other words, although children were confused about *when* something happened, they could accurately recall *what* happened. Applied to the above discussion, children who showed poor source monitoring had actually learned the material well (i.e., remembered information from the different incidents). In some US jurisdictions, the requirement to identify the time of individual incidents is relaxed for multiple events, thus acknowledging the particular difficulties that child witnesses have when recalling multiple events. Interested readers are referred to Roberts and Powell (in press) regarding the application of research on children's memories of repeated experiences to investigations of chronic sexual abuse.

A consideration of the cognitive processes evoked during the target event can help explain why material that is familiar or well-learned may be most susceptible to source confusions. It has been demonstrated in several studies that source judgments regarding material that is easily processed are more difficult than source judgments for material that required some effortful processing (Finke, Johnson, & Shyi, 1988; Foley et al., 1991). Foley et al. (1991) presented a set of words and pictures to 6-year-olds, 9-year-olds, and adults. Half of the words and half of the pictures were of simple items and the rest comprised complex items (according to norms published by Snodgrass & Vanderwart, 1980). All participants were later more confused about the origin (word or picture) of the simple than the complex items. As the simple items required little cognitive effort to process, Foley and colleagues argued that the processing involved in imaging the objects represented by words resembled relatively automatic perceptual processing of a picture, thus making later source discrimination difficult because of the lack of cognitive operations cues. Similarly, when adults were shown shapes and told to imagine half-shapes whole, those who were classified as "vivid imagers" were more confused between whether they had seen or imagined shapes than were "low imagers" (Markham & Hynes, 1993).

The authors reasoned that the low imagers would have memories containing useful cognitive operations given that it should take them more effort to image than it would vivid imagers.

Research on the role of effortful cognitive operations in source monitoring can be applied to forensic investigations. If children are asked a suggestive question (i.e., asked about something that they have not spontaneously mentioned) that relates to a detail that is nevertheless familiar to children, the item may be easily processed because previous memories may be re-activated and/or the non-experienced details may be easily and vividly imaged. This can have at least two detrimental effects on memory: (a) children may assume that it must have happened because the suggestion evoked elaborative and associative processes which allowed the detail to be incorporated into a rich network, and (b) at a later time, if the content of the suggestion is remembered, children may assume that it must have happened given the absence of effortful operations in their memories. This may explain why script-consistent or plausible suggestions are more readily accepted than are script-inconsistent items (Pezdek, Finger, & Hodge, 1997). Presumably, the script-consistent items are easily and automatically processed into a rich, associative network that accommodates the detail easily. During later questioning about the item, few effortful cognitive operations may be present in the memory representation and the item may be misattributed to an actual experience rather than to a suggestive utterance.

Hence, although source-monitoring errors are generally considered to reflect immaturities of the developing memory system, several scenarios have been presented that show that these errors are sometimes accompanied by improvements in other cognitive skills. Applied to investigative interviews, young children who make source errors are not necessarily providing inaccurate reports in general. The exact nature of the relationship between memory, source monitoring, and other cognitive developments, however, has yet to be determined.

Metacognitive Understanding

Very young children may not make accurate source decisions simply because they do not see the need to distinguish memories of different sources of information. Taylor, Esbensen, and Bennett (1994) taught preschoolers facts that they did not know prior to the study (e.g., cats

chase mice, bears are brown). When they subsequently asked the preschoolers to state where they had learned the information, children under 5-years and even some 5-year-olds reported that they had always known the information. It was only when the learning 'event' was made salient (by explicitly telling the children that they were going to be taught something new) that they could identify the time at which they learned the facts. Taylor and colleagues argued that the children did not understand that access to a source of knowledge (e.g., through hearing or seeing some information) is a necessary condition of knowing. Although children younger than 5-years can sometimes accurately distinguish sources (e.g., some types of action memories) as well as older children (e.g., Foley et al., 1993a; Roberts & Blades, 1995), preschoolers tend to make more source-monitoring errors than older children (Foley et al., 1993a; Lindsay et al., 1991; Poole & Lindsay, 2001a; Roberts & Blades, 1999). Perhaps these young children have not yet realized that the connection between knowledge and its source is important or perhaps they fail to consistently apply this understanding.

Not only must young children appreciate knowledge-source connections, they must also learn to make assessments about the reliability of the sources of information to which they are exposed. It has been argued that young children indiscriminately treat information that they have gained through direct experience as more reliable than information that an adult tells them (e.g., Perner, 1991). Recent evidence shows that, in some circumstances, children do make appropriate distinctions between more and less informative sources irrespective of whether the source was direct experience. In a series of experiments, Robinson and colleagues showed that 3- to 5-year-olds relied on information presented by a knowledgeable source more than that from a less informed source, regardless of whether the child or an experimenter was the knowledgeable source (Robinson, 2000; Whitcombe & Robinson, 2000). In one study (Whitcombe & Robinson, 2000), 3- to 5-year-olds saw pairs of objects that looked the same but felt different (e.g., a full and an empty bottle of dishwashing liquid) or looked different but felt the same (e.g., a red ball and a blue ball). One of the objects was secretly removed and either the child or the experimenter was allowed to see or feel the object; when the experimenter inspected the object, she stated

what it was. Clearly, looking at the object is more informative when the object feels the same but looks different to its partner, and feeling the object is more informative when it feels different to its partner but looks the same. Additionally, the person who sees or feels the object is more informed than the one who did not have the opportunity to inspect the object. At test, the children were highly accurate at naming which object was taken from the pair showing sensitivity to the informativeness of different sources, regardless of whether the child or experimenter inspected, and whether the object was seen or felt. The children had difficulty, however, stating *how* they knew what the object was and this was particularly apparent for the youngest children.

The data reported by Robinson (2000) and Whitcombe and Robinson (2000) demonstrate that even very young children can use knowledge from different sources appropriately and are not uniformly reliant on adults' statements; however, the fact that they cannot reflect on their judgments provides further evidence that difficulty with reflective skills partly underlies the development of source monitoring. The finding that the children treated the utterances of a less knowledgeable experimenter (compared to themselves) more cautiously than when the experimenter was knowledgeable suggests that use of an introductory statement in a forensic interview declaring ignorance on the part of the interviewer (e.g., "I wasn't there that day and so don't know what happened. It's your job to tell me everything that happened so that I will know.") serves a useful purpose. However, if young children encounter a source that claims or is perceived to be knowledgeable (e.g., someone who is coaching the child to report a fictitious event, or an interviewer with a priori beliefs), according to Robinson's findings, the result may be false reports or false memories of events that did not occur. Recent research on children's suggestibility further informs this reasoning. Preschoolers who show an understanding that another person can hold a belief that is false were more misled by a knowledgeable interviewer than a naïve interviewer, even after controlling for age and memory (Welch-Ross, 1999a). In other words, when given a choice between the original information in the target event (in this case, a story) and the suggested (inaccurate) information provided by an interviewer who

claimed to know about the story, children chose the suggested information more often than the original story information. An understanding that specific knowledge originates with specific sources, then, may be an important prerequisite of source-monitoring development and is supported by research showing that origins-of-knowledge understanding precedes some kinds of source monitoring (see data reported in Welch-Ross, 2000).

According to the mental-state reasoning model (Welch-Ross, 2000), the development of source monitoring is related to the development of representational understanding. Of particular interest is the relation between preschoolers' understanding of conflicting mental representations and their suggestibility. Conflicting mental representations about a single entity arises from different sources of information. One may have conflicting mental representations, for example, about a sponge that is painted to look like a rock (Flavell, Flavell, & Green, 1983). One representation corresponds to its appearance (a rock) and the other to reality (a sponge). Children aged 3 years and younger can only reason about one of the representations at a time, the exact one being determined by the focus of the task. The ability to consider both representations is present at about age 5. In an experiment examining the relation between the understanding of conflicting mental representations and suggestibility (Welch-Ross et al., 1997), 3-, 4-, and 5-year-old children listened to a story and were later misled about some details in the story. Children who understood conflicting mental representations were less suggestible a week later, even after age and memory were controlled. In another study, children who could reason about conflicting mental representations were also less resistant to suggestions when first presented (Welch-Ross, 1999b). Welch-Ross argued that the children who could not reason about conflicting mental representations simply updated their memories of the story when they encountered the conflicting postevent misinformation, thus reasoning about just one representation (Welch-Ross et al., 1997, Welch-Ross, 1999b). There is some debate regarding whether the proposed updating mechanism involves source-monitoring skills. One possibility is that the children with little understanding of conflicting mental representations failed to consider source information when processing information about the experienced events.

It should be noted, however, that an understanding of conflicting mental representations is no guarantee against source errors. According to the mental-state reasoning model of suggestibility (Welch-Ross, 2000), children who understand multiple, mental representations can still be confused between experienced and suggested information if they are able to retrieve both versions of events. Indeed, among preschoolers who understood conflicting mental representations, those with good memories of the event were more suggestible than those with poorer memories of the event (Welch-Ross, 1999b). Welch-Ross argued that those with good memories of the event were more likely to remember both the original and suggested information and be confused between the two versions of events. In support of this, those with higher conflicting mental representation scores took longer to produce the incorrect answer (i.e., the suggested version) than did those with lower conflicting mental representation scores, suggesting that the former were actually considering both representations. Hence this research suggests that preschoolers may be suggestible because they often do not consider multiple sources (i.e., the original and suggested information), but even when they do consider multiple representations, they can still be confused when tagging the source to the information. The mental-state reasoning model, then, specifies several components that may be involved in a source-monitoring judgment. Although an understanding of conflicting mental representations may be necessary for source monitoring, it is not alone sufficient to guarantee source accuracy.

In summary, research on representational understanding has implications in the case of children's eyewitness reports because sometimes interviewers can present information to children that conflicts with what the child remembers about the event. The research reviewed above suggests that although children under 5 years may be able to use knowledge sources appropriately according to the level of informativeness, in some circumstances, they may not be able to reflect on those sources. Indeed, these young children may not have the hardware to carry out sophisticated source-monitoring operations because the frontal lobe, which has been functionally implicated in source monitoring judgments, is immature in children of this age (Newcombe, Drummey, Fox, Lie, & Ottinger-Alberts, 2000; Schacter, Kagan, & Leichtman,

1995). With the exception of one study (Thierry et al., in press), attempts to train source-monitoring skills have not been as successful with 3- and 4-year-olds as they have with older children (Leichtman et al., 2000; Poole & Lindsay, 2001a, 2001b). The issue of training source-monitoring skills is more fully discussed in the next section.

The Stringency of Source Decisions

As discussed earlier, source monitoring can be carried out automatically or with deliberate effort, and automatic and deliberate processes may be used together (Johnson et al., 1993). Distracting attention away from deliberate source monitoring, then, should increase errors in source discrimination; similarly, increasing the required stringency of the source decision-making process should reduce errors in source discrimination. Source errors are generally reduced, though not eliminated, following explicit instructions to consider the sources of information (Lindsay, in press; Lindsay, Gonzales, & Eso, 1995; Lindsay & Johnson, 1989; Zaragoza & Lane, 1994). In a study reported by Lindsay and colleagues (Lindsay, in press; Lindsay et al., 1995) children were questioned about a story they had read and about which a confederate had provided misleading information. Half of the children were explicitly told that the confederate had made some mistakes and that they should not report anything that the confederate had told them. In free recall, third-graders supplied the original detail and chose it more often in a forced-choice recognition test comprising the original detail, the misled detail, and a distracter than did third-graders who were not given the warning. The warning also reduced preschoolers' reporting of the suggested details in the recognition test but had no effect on the frequency of providing the original details in free recall. Lindsay et al.'s results show that merely highlighting multiple sources and instructing children to report information from only one source reduced the number of source errors made, and this increased resistance to suggestive influences.

Interviewing protocols that reduce children's source errors are clearly beneficial in the field of forensic interviews because interventions to reduce source confusions can usually only be carried out at the investigative stage. Because police officers have no control over the number

of potentially contaminating sources to which child victims and witnesses have been exposed (e.g., television, informal interviews, peer conversations), they need ways of minimizing the reporting of source errors at formal interviews. There are two main ways that researchers have tried to investigate procedures that increase the stringency of source decision processes after children have observed or interacted in complex events: By "inoculating" children against source errors before they are asked to give their reports, and by using source-monitoring questions as a "recantation" device. I explore the small number of relevant studies in turn.

Both fuzzy-trace and source-monitoring theories predict that reinforcing memories will result in more accurate source discrimination though each postulates different mechanisms. According to fuzzy-trace theory, procedures that keep the verbatim trace intact improve the chances of *retrieving* the source information associated with the detail (e.g., Brainerd et al., 1990). According to source-monitoring theory, intact memory traces contain information that can be used to make an *attribution* about source (see Johnson et al., 1993). For example, a memory with vivid perceptual and sensory information leads to an attribution that one was touched, whereas a memory with degraded sensory information about touching may lead one to make the attribution that the touching could only have been watched on television.

Parker (1995) found that children who were interviewed immediately after they had performed and imagined actions in a set of vignettes were more accurate at identifying the source of actions when tested two weeks later than children who did not have an immediate interview. Parker argued that reinforcing memory had an inoculatory effect on source monitoring. In more recent studies, reinforcing children's memories has been as beneficial in reducing children's source errors as explicitly directing attention to the sources of experienced information. In one study, 3- and 5-year-olds watched a video, heard a story, and played with some toy frogs (Dixon, 1996, reported in Leichtman et al., 2000). The key details in each of the three experiences were then reviewed with (source-reinforced condition) or without (memory-reinforced condition) reference to source. A control group of children did not undergo the reinforcement phase. All children then heard misinformation about each of the experiences. Later the children were given

a forced choice test between the original and suggested details followed by a source-monitoring question to see whether the children could tag the detail to the correct source. Although the 3-year-olds performed below chance in all conditions, the 5-year-olds in the source-reinforced and the memory-reinforced conditions reported the original details and accurately identified the source of details more often than children in the control condition. There was no difference, however, in memory and source monitoring between the two reinforcement conditions. Using a similar design, Thierry et al. (in press) also found that the effects of rehearsing memory of the content of the events (in this case, a real-life and a video) on 5- to 6-year-olds' reports were similar to the effects of rehearsing the source of the information. In contrast to Leichtman et al.'s results, however, Thierry et al. did find that the source-monitoring questions lowered 3- and 4-year-olds' source confusions.

Even if the techniques were found to be effective, the feasibility of using these in a forensic context needs examination. In forensic investigations, interviewers often do not have the luxury of knowing which sources may interfere with children's reports of a target event. An inoculation procedure will be most useful in the field, then, if it is a general procedure that can be used even when the exact sources are not known. Poole and Lindsay developed a procedure that can be used whenever it is at least known that children must distinguish between what they have actually experienced and what they have heard (Poole & Lindsay, 2001b). In Poole's and Lindsay's study, 3- to 8-year-olds interacted in a set of science demonstrations and, three months later, listened to a story containing misleading information about the science experiments. Immediately before the interview about the target event (the science experiments), half of the children watched the interviewer carry out some actions (e.g., wiping the tape recorder) and heard about (but did not witness) other actions (e.g., "sometimes I push the blue button"). The children were then asked about the actions that the interviewer had just carried out and the interviewer reinforced and highlighted to the children which actions were actually witnessed and which were only heard about. When asked focused questions about the target event, the 7- to 8-year-olds, but not the younger children, reported fewer story events as if they had actually

happened than did children whose interview did not begin with an inoculation phase. As the inoculation procedure had no effect on the reporting of experienced events, these results suggest that children can be encouraged to increase the stringency of their source monitoring without other adverse effects on their reports. As with much research on strategy improvement (see Kail, 1990), however, younger children failed to generalize their learning from one task to another. This result is unfortunate given that young children are those most in need of additional support for their source-monitoring judgments.

Using source-monitoring questions to provide children with a way to recant their false reports also appears to have some, albeit limited, value. As with source error inoculation, children older than about 6 years benefit more than younger children, but not all source errors are eliminated. Most studies have investigated children's source errors for experienced and non-experienced events; in most studies, the non-experienced event corresponds to hearing misinformation about the event either before (Leichtman & Ceci, 1995) or after (Bruck, Melnyk, & Ceci, 2000; Poole & Lindsay, 2001a) the target event, although in one study (Jens, Gordon, & Shaddock, 1990) the non-experienced event took the form of imagined actions. In all studies, children who falsely reported non-experienced (suggested) information were then given a source-monitoring question about each falsely-reported detail (e.g., Did you really see that or did you hear about it?). The source-monitoring questions, in essence, allowed children to retract their false reports. As can be seen in Table 2, the recantation rates in these studies following the source-monitoring questions show age-related increases, with 3- to 4-year-olds evidencing low recantation rates and 8-year-olds the highest. Clearly, differences in procedural aspects of these studies, such as the length of time from the target event to test and the salience of the fictitious events, resulted in differences in findings, but the studies do suggest that a significant amount of false reports can be retracted by encouraging children to monitor the source of recalled information. Given that social pressures may encourage children to maintain a consistent story, one can speculate that the rate of retractions would be higher with a source-monitoring procedure

set in a non-accusatory context, although retractions can also be the result of compliance with the interviewer leading to false positives.

The studies reviewed above highlight the malleability of children's source monitoring. Children, especially those older than about 6 years, showed sensitivity to the stringency of source decision processes. Source errors were reduced through relatively easy manipulations before and after reports of a target event were elicited. In line with the research discussed throughout the review, very young children (i.e., under age 4) appeared to have little or no ability to reflect on where they heard non-experienced events.

Summary of Forensic Implications

There are many applications of source-monitoring research to the forensic arena. Two major areas stand out: (a) the expectations of child witnesses, and b) interviewing protocols.

Expectations of Child Witnesses

Children's testimony can be challenged on the basis of their confusions regarding when and where an incident occurred. As previously mentioned, prosecution in some jurisdictions is only possible when children have been able to separate their memories of individual occurrences. Clearly, if children cannot specify individual incidents, it is difficult for prosecutors to collect corroborating information and it is also difficult for alleged perpetrators to exonerate themselves by providing alibis for individual incidents. Also, given that punitive consequences in confirmed cases often depend on the number as well as the nature of the criminal acts, it is important that witnesses identify individual incidents. Research on children's source monitoring, however, raises the question of whether this standard is too high when children have experienced multiple similar events. According to source-monitoring theory and as demonstrated in the research discussed above, events that are similar and predictable can be difficult for children (and adults) to distinguish (Connolly & Lindsay, 2001; Lindsay et al., 1991; Powell et al., 1999; Roberts & Blades, 1999). Given that the nature of sexual abuse often entails similar, predictable events as indexed by children's testimony such as "it was the same as last time" or "he always does it like this" (Roberts & Powell, in press), conditions in sexual abuse cases in particular (compared to

typical one-time crimes such as road traffic accidents, adbuctions) are ripe for source confusions which may seriously impede prosecution. This is tragic given that the children who have been abused the most (i.e., repeatedly) may be the least able to provide accurately source-indexed reports. (It is noteworthy, however, that children's memories after a series of repeated events can be accurate and highly resistant to suggestions when the details of each of the events do not vary; Powell et al., 1999).

This also speaks to a wider issue regarding our conceptions of source errors. Traditionally, source confusions have been conceptualized as a negative aspect of cognitive behavior. Source confusions index failures in the processes that lead to successful cognitive skills and, in the legal system, are impediments to successful prosecution. As discussed above, however, children who were confused about the origin of actions evidenced better learning of a task (Ratner et al., 2000), children with an understanding of mind and good memories of multiple sources committed source errors (Welch-Ross, 1999b), and children who confused memories of multiple incidents rarely reported entirely false information (Powell et al., 1999). In other words, young children's competence in other cognitive skills may have been at the expense of their source monitoring. A balanced view of children's reports, then, can acknowledge the seriousness of the presence of source errors but also note the sophisticated skills that children are bringing to the interview situation: The presence of source errors does not necessarily indicate that children's reports about what occurred is inaccurate.

Although exposure to non-target sources (e.g., post-event discussions, interviews) can sometimes improve memories and source monitoring of a target event through reinstatement (Marche, 1999; Principe, Ornstein, Baker-Ward, & Gordon, 2000; Roberts, Lamb, & Sternberg, 1999; Warren & Lane, 1995), some errors in children's testimony are the result of confusing target information and suggested information (e.g., Bruck et al., 2000; Poole & Lindsay, 2001a). The extent of children's suggestibility is partly determined by factors beyond children's control, such as lengthy delays in the criminal justice system, suggestive questioning in formal

interviews, and so on (see Bruck & Ceci, 1999 for a review). The responsibility for reducing children's source errors, then, lies in the system as much as in children's abilities.

Finally, we are relatively naïve in our expectations about children from special populations. Children with autism (Farrant, Blades, & Boucher, 1998) and others with 'mental retardation' (Jens et al., 1990) showed no source-monitoring deficits compared to age-matched controls, but Lorsbach has consistently found that children with learning difficulties have difficulty distinguishing the sources of their memories (Lorsbach & Ewing, 1995; Lorsbach, Katz, & Cupak, 1998) possibly because they have difficulty with reflective processing and verbal tests (Lorsbach, 2000). Given that children from special populations can suffer higher rates of crimes against them, it is important to ensure that children from diverse backgrounds are included in source-monitoring research if we are to develop accurate expectations and appropriate interviewing protocols.

Interviewing Protocols

There are several reasons why specialized interviewing protocols that address children's source confusions are beneficial. First, the questions asked in forensic interviews often implicitly require children to spontaneously monitor source by asking them to retrieve information from the target event and to gate out or inhibit information from competing sources, such as that encountered in pre-event or post-event experiences. Yet children do not always spontaneously use the source-specifying information that they have stored in their memories to accurately discriminate sources. Accurate source identification often involves more strategic decision making and it is possible that children have a tendency to report the information that they remember without recalling its source or engaging in a more intensive and strategic analysis of its source. Second, although children's reports about actual and fictitious events sometimes do differ qualitatively (e.g., Alonso-Quecuty, 1995; Santtila, Roppola, & Niemi, 1999; Roberts, Lamb, Zale, & Randall, 1998), in some circumstances (e.g., after repeated, suggestive interviews) children's true and false reports are often qualitatively indistinguishable even by those with extensive experience with children's reports (e.g., Ceci et al., 1994). Hence, research

on helping children to strategically reduce their own source errors may help improve the accuracy of their testimony.

Increasing the stringency of children's source monitoring by deliberately directing attention to potentially contaminating sources either before or after reports are given can reduce (but not eliminate) children's source errors (e.g., Lindsay, in press; Lindsay et al., 1995; Poole & Lindsay, 2001a, 2001b). The effectiveness of these procedures are age-related. Very young children aged 4 and under have difficulty identifying source even when they are directly questioned about the sources. More research on source-monitoring interventions is needed before definitive conclusions can be drawn about their potential usefulness in the field, especially as the interventions have not appeared to reduce source errors in young children's recall (e.g., Lindsay, in press; Poole & Lindsay, 2001b). Theoretically-driven training studies can extend our understanding of how children monitor source. Given the developmental variability in source monitoring discussed above, age-specific interventions may be needed. It may be that children who have less well developed reflective (Lorsbach, 2000), metamnemonic (Foley et al., 1983), strategic (Thierry et al., in press), and inhibitory (Roberts & Powell, 2001) skills, such as young children, stand little to gain from these kinds of procedures.

Conclusions

The development of children's source monitoring occurs in conjunction with other childhood developments such as a sense of self, representational understanding, and metamnemonic skills. Interestingly, source errors can be considered markers of competent cognitive functioning in other domains. Although there is a general reduction in source errors as children age, there is considerable variability in the development of different kinds of source monitoring. Rudimentary source skills are evident before children can explicitly reflect on the sources of learned information but, in general, children's competence at explicit source monitoring develops towards the end of the preschool period and continues to about age 8 or 9.

Although source confusions may be an inevitable part of children's cognitive development and can provide us with realistic expectations of child witnesses, source confusions

in crime allegations are nevertheless problematic. Understanding what underlies children's source errors can help develop interviewing protocols that reduce the likelihood of errors. The theories and research reviewed here suggest three main avenues of source errors in children aged under 10: Memory problems, the automatic or deliberate use of cues in source judgments, and deficiencies in strategic processing. First, as source can sometimes be directly recalled (e.g., Reyna & Brainerd, 1998), and (even if source is not directly recalled) recalled information can be used to make a source attribution (Johnson et al., 1983), research can focus on the development of children's memory skills, particularly encoding, storage, and retrieval mechanisms. Second, although an examination of the qualitative characteristics of memories can lead to source identification (Johnson et al., 1993), children may not take advantage of the information stored in their memories. Preschoolers, for example, may not be aware that specific knowledge originates from specific origins and, thus, they may be unaware that memories of different sources have distinct qualitative profiles. A lack of understanding about mental operations may result in deficits in the ability to use cognitive operations represented in memories to make a source identification (recall that cognitive operations are vitally important cues to source, see Foley et al., 1993b; Johnson et al., 1993). Additionally, children may not engage in a thorough search of their memories, perhaps considering only one kind of information. As reviewed in the literature above, flexibility in the examination of memory characteristics and a consideration of multiple cues aids accurate source monitoring. Thirdly, strategic decision processes can be used to identify source when source cannot be recalled and when an examination of the characteristics of memories does not aid in a source judgment. The use of cognitive strategies develops through to adolescence and so it is likely that this source-monitoring mechanism is the last to develop of the three avenues outlined here. Such strategies may include deliberate reflection on the sources of information, using general knowledge to infer source, and voluntarily altering the stringency of source decision making.

The research reviewed above shows that children's source monitoring is affected by the nature of the target event(s), individual differences, and the nature of the source-monitoring task.

Children's evidence can be informative even when there are source errors. It is the responsibility of players in the justice system to take advantage of children's capabilities and make adjustments whenever possible to minimize those source errors that are detrimental to the prosecution of those who perpetrate crimes against children. Such adjustments may require attention to "system variables" (e.g., delays between incidents and investigations; Wells, 1983) and developing age-appropriate expectations of child witnesses that feed into effective interviewing protocols.

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Table 1

Examples of source judgments in the forensic arena

Source judgment	Examples
Within-Event	Which of two people carried out an action in a target incident? Did he take your clothes off or did you take them off?
Event-Postevent	Did X actually happen in the event or did Y tell you about it when she interviewed you?
Preevent-Event	Did Y tell you that it was going to happen or did you really see it happen in the event?
Multiple Event	Were you touched on your bottom during the first incident or the second incident?
Credibility judgments	Interviewers' judgments about the sources of children's memories (e.g., accounts of experienced or imagined events) based on interviewers' own source decision-making biases

Table 2

The rates of recantation in response to source-monitoring questions probing false reports of fictitious events

Study	Origin of false report	Age	Recantation rate
Poole and Lindsay (2001a)	Heard about touching events	3-4 years	0%
		7 years	67%
		8 years	63%
Bruck et al. (2000)	Heard suggestions at interview	3-6 years	14%
Jens et al. (1991)	Imaginary actions	6 years	78%
		6 years with mental retardation	54%
Leichtman and Ceci (1995)[a]	Heard suggestions before target event	4-6 years	50-75%

[a]Recantation rates were estimated using information in the text and figures.

Footnote

[1]Readers interested in further theoretical discussions about the treatment of the similarity issue in source-monitoring and fuzzy-trace theories should consult Lindsay & Johnson (in press), Reyna (in press), and Reyna and Lloyd (1997).