



Age-appropriate cues facilitate source-monitoring and reduce suggestibility in 3- to 7-year-olds

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Abstract

Providing cues to facilitate the recovery of source information can reduce postevent misinformation effects in adults, implying that errors in source-monitoring contribute to suggestibility (e.g., [Lindsay, D. S., & Johnson, M. K. (1989). The eyewitness suggestibility effect and memory for source. *Memory & Cognition*, 17, 349–358]). The present study investigated whether source-monitoring plays a similar role in children's suggestibility. It also examined whether the accuracy of source judgements is dependent on the type of source task employed at test. After watching a film and listening to a misleading narrative, 3–4- and 6–7-year-olds ($n = 116$) were encouraged to attend to source memory at retrieval. This was achieved either via sequential “question pairs”, which are typically used in children's source-monitoring research, or via a novel “posting-box” procedure, in which all source options were provided simultaneously. Performance elicited by each type of source task was compared with that evoked by old/new recognition procedures. Posting-box, but not question pair, source cues were effective at reducing the magnitude of the suggestibility effect, relative to that observed under recognition conditions. Furthermore, source question pairs provoked a bias to respond affirmatively for 3–4-year-olds. The findings imply that children's suggestibility may be partially explained by sub-optimal use of intact source information, which may be activated by age-appropriate strategies at retrieval.

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If individuals are exposed to misinformation after witnessing an event, they may incorporate the misleading detail into subsequent reports of that event. This phenomenon, commonly referred to as the “postevent misinformation effect”, has been demonstrated in both adults (Loftus, Miller, & Burns, 1978) and children (Bruck & Ceci, 1999; Ceci & Bruck, 1993, 1995). Early theorists assumed that the misinformation had overwritten or altered the original memory trace (Loftus et al., 1978). An alternative interpretation is that both the original event and misinformation traces are held simultaneously in memory, and reductions in accuracy at test result from misattributing event details to the wrong source.

One account of how source misattribution errors contribute to suggestibility is provided by the Source-Monitoring Framework (Johnson, Hashtroudi, & Lindsay, 1993; Mitchell & Johnson, 2000). According to this interpretation, information about the origins of a memory is not accessed as a separate “source” trace. Instead, source is inferred from integral qualitative characteristics of the memory representation. These include the perceptual, semantic, contextual and affective detail contained within the trace, and the nature of the “cognitive operations” performed at encoding. An evaluation of the quality and magnitude of these characteristics provides diagnostic information about the origins of the memory. Hence, source information is not accessed directly, but is inferred via an attributional judgement process at retrieval (Johnson et al., 1993; Mitchell & Johnson, 2000).

Johnson et al. (1993) proposed that source errors occur because individuals often fail to evaluate these qualitative characteristics effectively. They suggested that source judgements are typically made via an “heuristic process”, where individuals simply rely on assessing the vividness of perceptual detail and the familiarity of a memory. This can result in vital source information being unwittingly ignored. Accurate source decisions are more likely when a controlled “systematic process” is adopted, where individuals use a higher level of deliberation and question the plausibility of the chosen source by considering inconsistencies and other additional knowledge.

Following this rationale, Lindsay and Johnson (1989) hypothesised that postevent misinformation effects may be caused by a failure to adopt the systematic judgement process required for accurate source decisions. They investigated this possibility by manipulating the “judgement process” adopted at retrieval in a three-stage misinformation paradigm. Adults were shown a picture and then a misinformation narrative in which half the target items were changed. At test, participants’ memory for the event was either probed with a traditional yes–no recognition test (“Did you see x in the picture?” yes/no), or with a source-directed test, in which participants indicated whether target items had been experienced in one of four source options (“Did you see x in the picture, text, both, or neither?”). Suggestibility was eliminated when individuals were overtly directed to consider all possible source options at test (see Chambers & Zaragoza, 2001; Zaragoza & Koshmider, 1989; Zaragoza & Lane, 1994 for similar findings). These results suggest that misinformation effects are not based entirely on overwriting of the event trace. Instead, they imply that at least some of the suggestibility effect may be explained by sub-optimal use of source information that is intact in memory, but which is not activated by traditional recognition procedures.

Children as well as adults may benefit from orienting to source at retrieval. Contextual and temporal cues embedded in test questions can facilitate children’s event recall (Pearse, Powell, & Thomson, 2003), and reduce suggestibility (Newcombe & Siegal, 1996, 1997).

Furthermore, children tend to be less suggestible when they are explicitly “warned” about the erroneous misinformation (Holliday & Hayes, 2000, 2002; Lindsay, Gonzales, & Eso, 1995). A possible interpretation is that temporal cues and warnings enhance the quality of consideration of source information at retrieval.

Suggestibility and source errors in young children may also be reduced when the final recognition test is *preceded* by a “source training” phase. For example, Thierry, Spence, and Memon (2000) reported that 3- to 4-year-olds were less suggestible in final recognition test when they had previously completed a source-directed training task (e.g., “Where did Mrs. Science tap a spoon on glass bottles?” live, on video, not at all) rather than a recognition task (e.g., “Did Mrs. Science tap a spoon on glass bottles?” yes or no; see Giles, Gopnik, & Hyman, 2002; Leichtman, Morse, Dixon, & Spiegel, 2000; Thierry & Spence, 2002 for similar findings).

However, only one study to date has measured the *direct* effects of overtly orienting to source, rather than the extent to which performance is influenced by a preceding training session. Welch-Ross (2000) reported that 3- to 6-year-olds were *less* suggestible when responding to recognition (e.g., “Did John wear big bird pyjamas or did John wear Mickey Mouse pyjamas?”) than source-directed questions (e.g., “Did you *see* Sally fall from the jungle-gym or did Kristin *tell you* Sally fell from the jungle-gym?”). These findings imply that source cues may in fact actively hinder children’s resistance to suggestion. There are two possibilities why these findings contradict adult and “transfer of training” findings.

First, Welch-Ross’ (2000) “judgement process” manipulation was within-subject, so children received *both* source directed *and* recognition questions within the same session. Hence, children may have inadvertently used the retrieval strategies acquired from the source-directed task, when questioned with recognition questions. In addition, the switching of question format mid-session may have confused young children.

Second, unlike adult studies (e.g., Lindsay & Johnson, 1989), Welch-Ross (2000) did not provide all source options *simultaneously*. Instead, she employed the type of source-directed task typically reported in children’s eyewitness research, in which children are alerted to source options *sequentially* via question pairs at retrieval question (e.g., Ackil & Zaragoza, 1995; Poole & Lindsay, 1995). In this type of procedure, children are first asked whether they remembering seeing an item in the event. Immediately afterwards a separate question is posed asking the child whether they saw the same item during the misinformation phase (e.g., “Did you see x in the event?” and “Did you hear x in the story?”). This form of source task is presumably employed with children because it is assumed that they cannot cope with the cognitive demands and extra memory load associated with the adult procedure. However, inspecting all sources *simultaneously* may be a crucial factor in achieving *optimal* retrieval of source information. For example, Marsh and Hicks (1998) investigated a variety of source task formats, and reported an attribution bias in favour of the source referred to in the question (seen or generated). Hence, participants were more likely to incorrectly recall that they had “seen” items that they had in fact generated if they were asked the question “Did you *see* x?” (yes/no) than if they were asked to select one of three source options (e.g., “Was the item seen, generated or new?”). It is therefore plausible that independent consideration of each source in the verbal “question pair” method may inadvertently induce a “source in question” bias. Furthermore, other research shows that young children show

problems in attention and may overuse a yes responses (i.e., a “yes bias”) when responding to long lists of yes–no questions (Fritzley & Lee, 2003).

A few studies have successfully employed “simultaneous” source tasks with children, when pictures aid memory of the source options available (Day, Howie, & Markham, 1998; Thierry et al., 2000). In addition, posting-boxes have been employed (albeit for different purposes) in the theory of mind literature to facilitate performance on the false belief task (Mitchell & Lacohee, 1991). Drawing from both ideas, a novel posting-box procedure was devised for the current study. In this task source options were presented simultaneously (both, film only, story only, new) using pictures on four posting-boxes. Cards depicting critical target items were posted into the appropriate box according to source. The procedure aimed to maximise the potential for recovery of source information by presenting source options simultaneously, in a form that is less demanding in terms of memory load than the equivalent procedure used with adults. In addition, the format of the task aimed to be more engaging for young children. Hence, the problems of inattention and “yes bias” that may accompany long lists of yes/no questions would be reduced.

The first aim of the present study was to clarify the *causal* contribution of source-monitoring errors to children’s suggestibility by manipulating the “judgement process” adopted at retrieval. Children viewed an event and listened to a misinformation narrative, before memory was probed at test. Children either considered all possible sources at retrieval (source conditions) or were questioned solely about the event with a recognition procedure (recognition conditions). Suggestibility was compared across source and recognition conditions. The second aim was to investigate whether the *type* of source-directed task influenced the magnitude of suggestibility, and the propensity for “yes bias”. Source cues were either presented simultaneously via a novel posting procedure (source box condition) or were presented sequentially via question pairs (source question condition). Equivalent recognition conditions (recognition box and recognition questions) were constructed to allow direct comparison with each of the two source conditions, resulting in a 2 (judgement process) \times 2 (cue type) design.

Participants were aged 3–4 and 6–7 years, since suggestibility (Ceci & Bruck, 1993), and the likelihood of source-monitoring errors (Roberts, 2002) tends to reduce across this period. It was predicted that 6–7-year-olds would benefit more from source cues than 3–4-year-olds since they hold a more comprehensive grasp of the causal relationship of knowledge and its specific origins (Wimmer, Hogrefe, & Perner, 1988).

1. Method

1.1. Participants

One hundred and sixteen participants (51 males, 65 females) were recruited from two state primary and nursery schools, on the basis of being between 3 and 4 ($M = 49.95$ months, $S.D. = 5.04$, range = 41–59, $n = 60$) or 6–7 years of age ($M = 80.77$ months, $S.D. = 5.39$, range = 72–92, $n = 56$). All participants spoke English as their first language and parental consent was obtained as a condition for inclusion.

Table 1
Age of participants by condition

		<i>n</i>	Mean age (months)	S.D.
3–4 years	Source box	15	50.80	5.00
	Source questions	15	50.20	5.62
	Recognition box	15	50.07	4.99
	Recognition questions	15	48.73	4.79
6–7 years	Source box	14	80.07	4.05
	Source questions	14	81.64	6.78
	Recognition box	14	80.57	5.49
	Recognition questions	14	80.79	5.39

1.2. Design

A 2 (age group: 3–4 versus 6–7 years) \times 2 (judgement process: source versus recognition) \times 2 (cue type: posting-box versus questions) between-participants design was employed to investigate whether source errors contributed to suggestibility. The “judgement process” \times “cue type” manipulation is illustrated in Fig. 1. The design resulted in four experimental conditions for each age group: source box, source questions, recognition box, recognition questions. Table 1 displays the mean ages for each of the experimental conditions. There were two dependent measures for the first set of analyses, which were treated as a repeated-measure variable. The first dependent measure was “misinformation errors”. This was defined as the number of items that were experienced in the story, which were misattributed to the film (range = 0–5). The second dependent measure was “false alarms”. This was defined as the number of non-experienced, new items presented at test, which were misattributed to the film (possible range = 0–5).

A 2 (age group: 3–4 versus 6–7 years) \times 2 (source cue type: box versus questions) between-participants design was also employed to investigate whether a potential “yes bias” was dependent on age group or the type of source cues used at test. The dependent variable here was “yes–yes errors”. This was defined as the total number of times that a child incorrectly responded with “yes” to both questions in a question pair in the source questions condition. The analogous measure in the source box condition was the total number of *erroneous* misattributions to the “film and story” option at test (possible range = 0–15).

1.3. Materials

A three-stage “event–misinformation–test” procedure was employed. The event depicted a theft in a café, involving four characters. It was conveyed on 52 slides with an accompanying taped dialogue, with duration of approximately 8 minutes. The event was devised specifically for the study to ensure that children had no previous knowledge of its contents. Twelve “target items” were conveyed within the event. Target items were nouns acquired, on average, at or before 36 months according to Morrison, Chappell, and Ellis’ (1997) objective Age of Acquisition (AOA) norms. The use of AOA norms aimed to minimise the likelihood of variations in linguistic competency influencing suggestibility (see Ceci &

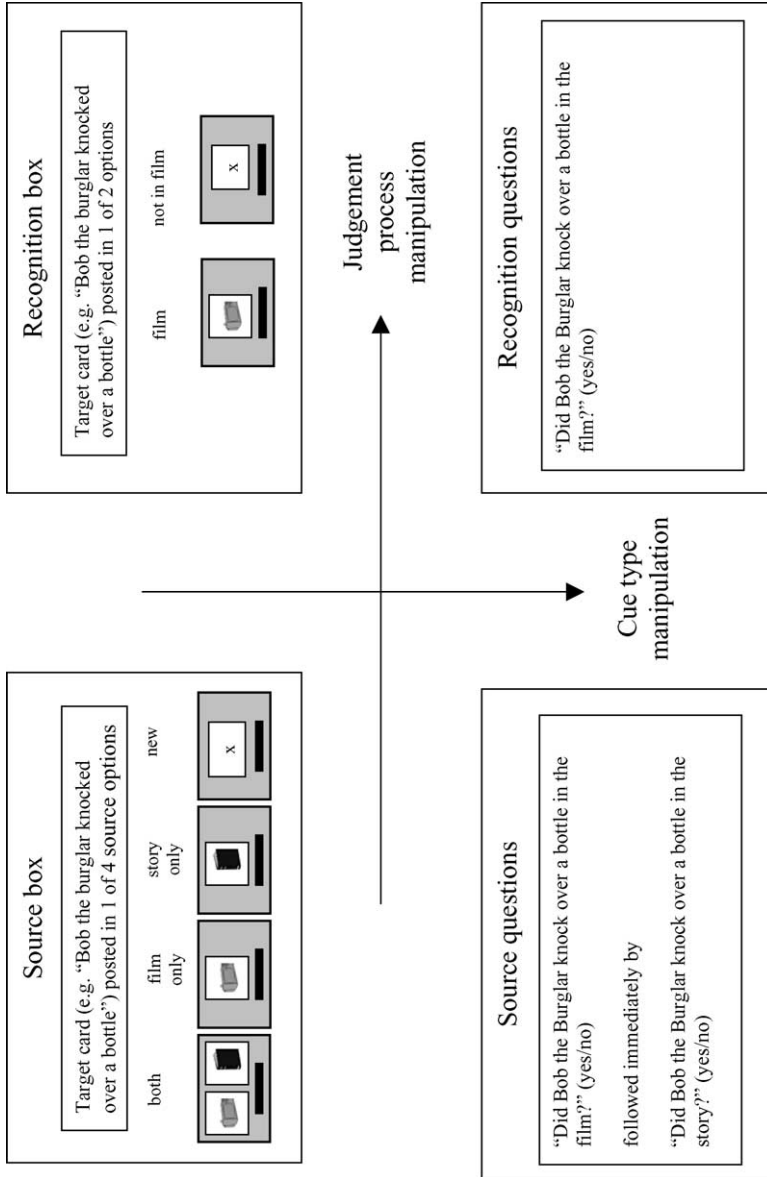


Fig. 1. "Judgement process" and "cue type" manipulations.

Bruck, 1993). In order to avoid an “item type” bias three versions of the event film were constructed to counterbalance target items used in the event phase, and in the misinformation phase and also targets presented as new items in the test phase. This also resulted in three versions of the misinformation narrative. Hence, children within each of the conditions were allocated to one of three film sub-groups. For each version of the film, the 12 target items were presented on two consecutive slides and were referred to in the taped dialogue. The remaining neutral slides were used in all versions of the event. A small pilot study was conducted with 3- to 4-year-old children ($n = 8$) to assess whether children understood the sequence of events depicted in the film. Children viewed the slides and were subsequently tested using the materials described below. These children responded significantly above the level expected by chance, suggesting that even children of pre-school age understood the events depicted.

The misinformation was a narrative depicting a structurally identical sequence as that conveyed in the event phase (see Appendix A). However, half of the critical target items in the narrative were different to those presented in the event. Changed and unchanged targets were evenly distributed throughout the narrative, to avoid confounding source error patterns with temporal primacy or recency effects. The narrative was accompanied by a three-dimensional prop for each of the target items. The use of visual props aimed to avoid modality bias across event and misinformation phases and increased the similarity of these phases, and hence increased the likelihood of subsequent source-monitoring errors (Day et al., 1998; Johnson et al., 1993; Lindsay, Johnson, & Kwon, 1991).

For the test phase, each target item was embedded within a relevant phrase. The full list of phrases is presented in Appendix B. Each phrase was presented individually on a laminated card (110 mm × 110 mm). Twenty-four test cards were used for each film sub-group. Six cards were used for each of the four possible target item types. The four target types were targets experienced in the event and misinformation phases (“film & story” items), those experienced solely in the event or the misinformation phase (“film only” items or “story only” items) and never experienced items (“new” items). Four test cards were employed in the practice phase (1 “film & story”, 1 “film only”, 1 “story only”, 1 “new”, and 20 test cards were used in the test phase (5 “film & story”, 5 “film only”, 5 “story only”, 5 “new”). Hence, the possible range of correct attributions for each item type at test was 0 to 5. The test target items were the same for all four conditions *within* each film sub-group.

Four red posting-boxes (450 mm × 300 mm × 120 mm) were constructed especially for the study. On each box a picture conveyed one of four source options (film & story, film only, story only, new). The event “film” source option was represented as a television and the misinformation “story” was illustrated by a storybook. The “film & story” source option was conveyed by a picture of a television *and* a storybook. A picture of an “x” conveyed the “new” option. The posting-boxes are illustrated in Fig. 1.

1.4. Procedure

Participants watched one version of the event “film” in a group of 6 to 12 children, according to film sub-group. Immediately afterwards, the experimenter read the corresponding misinformation “story” to the group. She presented three-dimensional props, depicting the relevant target item, at appropriate moments of the story. The following day participants

were tested individually. They were asked to confirm whether they remembered seeing the film and hearing the story. The experimenter reaffirmed that the “film” pertained to the slide sequence and the “story” described the narrative with props. The subsequent procedure was then determined by the allocated experimental condition, summarised in Fig. 1. All conditions comprised a training and practise phase with feedback, followed by test phase with no feedback.

1.4.1. *Source box condition*

In the source box condition the four posting-boxes were positioned in front of the child in the order “film & story, film, story, new”, from left to right. For training the experimenter pointed to each box and explained “if you post something in this box, it means that ‘you saw it in both the film & story/film only/story only’” or “you didn’t see it in the film or story”. This explanation was repeated. Subsequently, the child was asked to point to the appropriate box as the experimenter asked “which box means ‘I saw it in both the film and story/film only/story only’/‘I didn’t see it in the film or the story’?”. The experimenter provided feedback after each response and the child pointed to another box if their initial reply was incorrect. Training continued until participants distinguished all four source options without hesitancy. This was often achieved immediately for the older age group, and within two attempts for the 3- to 4-year-olds. Children who did not comprehend the source options after several attempts did not proceed any further. Five children were excluded on this basis, four of whom were male (age range = 42–47 months) and one of which was female (age 80 months). In the practise and test phases, which followed immediately, all test cards were placed face down in front of the child (4 practise, 20 test cards). Cards were selected one by one by the participant and passed to the experimenter, who read out the target phrase printed on it (e.g., “Sara ate a sandwich”).¹ The child then posted the test card in one of the four boxes according to source. The experimenter provided feedback during the practise but not the test phase. Children did not proceed to the test phase until they had posted all practise cards into the appropriate boxes.

1.4.2. *Source questions condition*

Participants in the source questions condition responded to 24 yes–no question pairs, which corresponded to the phrases used in the source box condition (e.g., “Did Sara eat a sandwich in the film?” followed immediately by “Did Sara eat a sandwich in the story?”). The film question was posed before the story question for all pairs and questions were posed in the same order across participants.² In a short training phase, children were informed that the experimenter was going to ask a number of questions about the film and the story and that they were to respond “yes” if they had seen it in that particular medium, or “no” if they had not witnessed the target in that medium. A subsequent practise phase with feedback (4 targets) was followed by a test phase with no feedback from the experimenter (20 targets).

¹ The posting cards depicted a relevant phrase, *not* a picture of the relevant item, and hence contained no visual element. Cards were employed merely to provide a vehicle for carrying out the posting box procedure.

² The order of presentation of source questions was maintained across all participants to reduce the number of cells for subsequent analysis.

1.4.3. Recognition box condition

Children in recognition box condition were probed solely about the event. They followed the same procedure (training, practice and test) as individuals in the source box condition, except only two boxes were provided, representing “seen in the film” and “not seen in the film” (see Fig. 1). Children were asked to post the card (e.g. “Sara ate a sandwich”) in the “film” box, if they remembered seeing the target in the film and in the “not film” box if they did not see it in the film. The two boxes therefore represented the “yes” and “no” responses required in old/new recognition procedures.

1.4.4. Recognition questions condition

In the recognition questions condition the same procedure was followed as in the source questions condition, except children were only asked whether they remembered targets appearing in the film (e.g., “Did Sara eat a sandwich in the film?”). This condition provided a verbal analogy to the recognition box condition, but in this case the participant responded verbally either “yes” or “no” without the use of the posting cards or source boxes.

2. Results

Mean overall correct responses (possible range 0–20) within each condition are displayed in Table 2 to provide a preliminary overview of the data. Data were collapsed across the three film sub-groups, since a one-way ANOVA showed that there were no significant differences between overall correct responses for film 1 ($M = 12.32$, S.D. = 3.53, $n = 41$), film 2 ($M = 13.31$, S.D. = 4.40, $n = 38$), or film 3 ($M = 12.08$, S.D. = 3.75, $n = 37$), ($F(2,113) = 1.07$, $P = .35$).

One-sample t tests revealed that children attributed items to their correct source significantly more often than the frequency expected by chance (25%) in the source box (3–4 years: $t(14) = 4.30$, $P = .001$; 6–7 years: $t(13) = 10.41$, $P < .001$) and source questions conditions (3–4 years: $t(14) = 4.99$, $P < .001$; 6–7 years: $t(13) = 8.41$, $P < .001$). Mean correct responses were also significantly above the 50% expected by chance in both recognition conditions (box: 3–4 years: $t(14) = 3.80$, $P < .01$; 6–7 years: $t(13) = 12.39$, $P < .001$; questions: 3–4 years: $t(14) = 5.81$, $P < .001$; 6–7 years: $t(13) = 11.22$, $P < .001$). Hence, children were not merely responding randomly, suggesting that they understood the purpose of the tasks. This was important to verify, since novel materials were employed here.

Table 2
Overall correct responses (possible range = 0–20)

Judgement process				Cue type, M (S.D.)	
				Box	Questions
Source	3–4 years	($n = 15$)	8.53 (3.18)	7.73 (2.12)	
	6–7 years	($n = 14$)	14.00 (3.23)	12.36 (3.27)	
Recognition	3–4 years	($n = 15$)	12.33 (2.38)	14.06 (2.71)	
	6–7 years	($n = 14$)	16.29 (1.90)	15.79 (1.92)	

2.1. Suggestibility: judgement process and source cue effects

The primary aim of the analysis was to identify the possible contribution of source errors to suggestibility. Although, a variety of types of source confusion are possible, the present analysis focused on two particular types to investigate suggestibility. Hence, two dependent variables were examined. These were “misinformation errors”, defined as the number of story items misattributed to the film (possible range 0–5)³ and “false alarms” defined as the number of new items presented at test, which were misattributed to the film (possible range = 0–5). A significantly higher number of “misinformation errors” than “false alarms” indicates that suggestibility results directly from the incorporation of misinformation rather than simply to errors of false recognition (Ackil & Zaragoza, 1995).

The analysis examined whether orienting children to source information via source cues (source conditions) reduced suggestibility when compared to suggestibility measured under traditional recognition procedures (recognition conditions). It also investigated whether facilitation was dependent on the type of source cue provided at test (box versus questions). A 2 (judgement process: source versus recognition) \times 2 (cue type: box versus questions) \times 2 (age: 3–4 versus 6–7 years) \times 2 (error type: misinformation errors versus false alarms) mixed design ANOVA was employed to investigate these potential effects for the two age groups. Hence, the two dependent measures were entered as a repeated-measures variable (“error type”) in the ANOVA.

As expected there was a highly significant main effect of age group ($F(1,108) = 64.29$, $P < .001$; $\eta^2 = .37$). Three- to four-year-olds were much more likely to misattribute items to the film (misinformation errors: $M = 3.45$, S.D. = 1.28; false alarms: $M = 2.22$, S.D. = 1.58) than 6–7-year-olds (misinformation errors: $M = 2.08$, S.D. = 1.40; false alarms: $M = 0.45$, S.D. = 0.85). However, contrary to our prediction, there were no significant age based interactions (error type \times age group: $F(1,108) = 2.43$, $P = .12$; cue type \times age group: $F(1,108) = 0.85$, $P = .36$). Hence, even though there were absolute differences in the magnitude of source errors between 3–4- and 6–7-year-olds, there was nevertheless a similar pattern of responses across all conditions for both age groups.

However, a significant three-way (error type \times judgement process \times cue type) interaction ($F(1,108) = 4.47$, $P < .05$; $\eta^2 = .04$) demonstrated that the magnitude of suggestibility was dependent on *both* the judgement process *and* the type of source cue provided at retrieval. This interaction is illustrated in Fig. 2 (means provided in Table 3).

Fig. 2 illustrates that false alarms (new item misattributions to the film) remained consistently low, and indeed planned comparisons (Bonferroni adjusted $\alpha = .01$) confirmed that the magnitude of these type of error did not vary across the four conditions (all P 's $> .01$). Hence, any other differences across conditions could not merely be attributed to problems with recognition memory.

In contrast, planned comparisons (Bonferroni adjusted $\alpha = .01$) showed that misinformation errors (story misattributions to the film) did vary according to judgement process *and* cue type. In terms of “judgement process” effects (i.e., the source versus recognition

³ Since attributions to the film pertained to two options at test in the source conditions (i.e., “film & story” and “film only” option), these source option categories were collapsed to form a single “attributed to the film” set. This enabled performance in all four conditions to be compared in a single analysis.

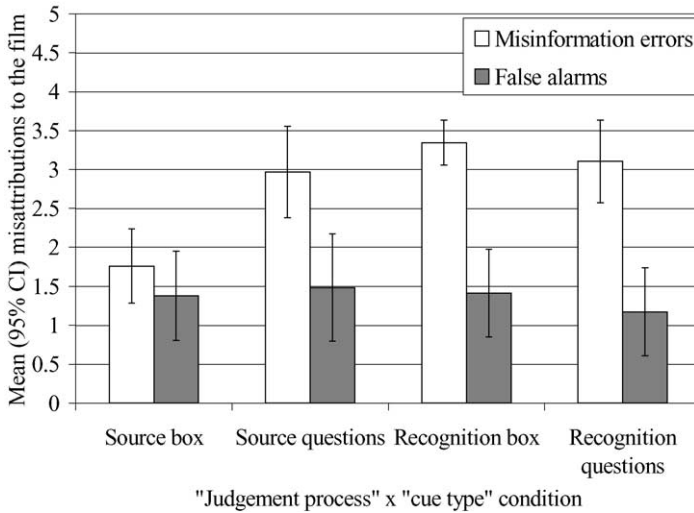


Fig. 2. Suggestibility effects: mean (95% CI) misinformation errors and false alarms in four experimental conditions.

manipulation), planned comparisons showed that misinformation errors in the source box condition were significantly less than those evoked by the recognition box condition ($P < .001$). Although there was an effect in the same direction between the source questions and recognition questions conditions, this difference was non-significant ($P = .71$). Therefore, applying stricter judgement criteria only reduced suggestibility if implemented via posting-box source cues.

With regard to “cue type” effects (i.e., the box versus questions manipulation), planned comparisons showed that misinformation errors were significantly lower for children in the source box than the source questions condition ($P = .001$). However, the number of misinformation errors in both box and question recognition conditions was similarly high ($P = .50$). This implied that differences between performance in the two source conditions were not likely to be based on the use of posting-boxes per se, but on the *simultaneous* presentation of source options. Hence, the posting-box procedure provided a means for simultaneous rather than sequential presentation of source options.

Table 3
Suggestibility effects: misattribution of story and new items to the film

Judgement process	Cue type	<i>n</i>	Error type, <i>M</i> (S.D.)	
			Misinformation errors	False alarms
Source	Box	(<i>n</i> = 29)	1.76 (1.23)	1.38 (1.50)
	Questions	(<i>n</i> = 29)	2.97 (1.55)	1.48 (1.80)
Recognition	Box	(<i>n</i> = 29)	3.34 (1.34)	1.41 (1.47)
	Questions	(<i>n</i> = 29)	3.10 (1.17)	1.17 (1.49)

Finally, post hoc *t* tests (Bonferroni adjusted $\alpha = .01$) were employed to measure the magnitude of the facilitation provided by posting-box source cues, by looking at the *difference* between the number of misinformation errors and false alarms *within* each of the four conditions. Misinformation errors were significantly higher than false alarms in all (all *P*'s < .01) but the source box condition (*P* = .17). This indicates that the suggestibility effect was only reliably attributable to the presentation of misinformation in three of the four conditions (source questions, recognition box, recognition questions). Hence, cues to source presented *simultaneously* (source box condition) effectively reduced suggestibility to a level that could be accounted for merely by problems of recognising false positives. This replicates findings with adults utilising analogous procedures (Lindsay & Johnson, 1989; Zaragoza & Lane, 1994).

In summary the analysis revealed two findings. First, encouraging consideration of source information at retrieval can reduce young children's suggestibility. Second, the effectiveness of reducing the misinformation effect by orienting to source is more substantial when all sources are considered simultaneously (source box condition) rather than sequentially via question pairs (source questions condition). Taken together, the findings imply that children's suggestibility effects can at least be partially accounted for by under-use of source information that is intact in memory, and which may be activated by appropriate strategies at retrieval.

2.2. "Yes bias" effects in source conditions

A further analysis investigated whether source cues presented sequentially via question pairs (source questions condition) induced children to overuse a "yes" response ("yes bias"). This was achieved by examining whether children tended to respond repeatedly with a "yes" response to *both* questions within the question pair. The dependent measure was the number of times that the participant erroneously responded "yes" to both of the questions within the pair in the source questions condition. The analogous dependent measure in the source box condition was the total number of incorrect attributions to the "film and story" option in the posting-box procedure (i.e., the sum of "film only" + "story only" + "new item" misattributions to the "film & story" option; possible range 0–15). These type of error are henceforth referred to as "yes–yes errors".

The possible influence of cue type and age on "yes–yes errors" was assessed with a 2 (source cue type: box versus questions) \times (age: 3–4 versus 6–7 years) between-participants ANOVA. A significant main effect of age ($F(1,54) = 19.91, P < .001; \eta^2 = .27$) demonstrated that 3- to 4-year-olds were more prone to making "yes–yes" errors than 6- to 7-year-olds. In addition, the type of source cues employed influenced the extent of "yes bias" effects. A significant main effect of source cue type ($F(1,54) = 10.76, P < .01; \eta^2 = .17$), qualified by a significant age \times cue type interaction ($F(1,54) = 5.53, P = .02; \eta^2 = .09$) demonstrated that the influence of source cues on "yes bias" effects was dependent on age. The interaction is illustrated in Fig. 3.

Post hoc *t*-tests (Bonferroni adjusted $\alpha = .01$) showed that older children made a similar number of yes–yes errors in both the source box ($M = 1.64, S.D. = 1.39$) and source questions conditions ($M = 2.36, S.D. = 2.31; P = .33$). In contrast, 3–4-year-olds were significantly more likely to make yes–yes errors in the source questions ($M = 7.60, S.D. = 4.87$) than

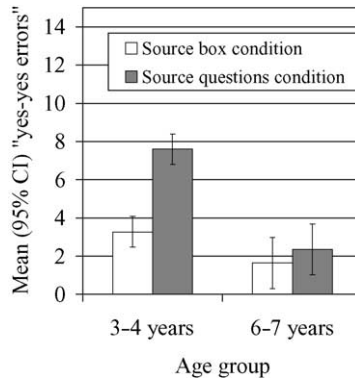


Fig. 3. Yes bias effects: mean (95% CI) "yes-yes errors" across source conditions in 3–4- and 6–7-year-olds.

in the source box condition ($M = 3.26$, $S.D. = 1.62$; $P < .01$). These findings suggest that children were prone to overuse a positive response to source question pairs, particularly at pre-school age. This propensity was reduced when children were alerted to all sources simultaneously with the posting-box procedure (source box condition).

3. Discussion

The purpose of the current research was to investigate the role of source-monitoring errors in children's suggestibility. The first aim was to examine whether source errors contribute to suggestibility by directly manipulating the judgement process at retrieval. The second aim was to investigate the effectiveness of two types of source cue in directing children to retrieve relevant source information. It was hypothesised that the type of source cues typically adapted for use in research with children may inadvertently produce biased responses.

Suggestibility reduced significantly between the ages of 3–4 and 6–7 years, complementing previous research (Ceci & Bruck, 1993). However, the magnitude of the suggestibility effect was also closely associated with the procedures adopted at retrieval. Children who were overtly directed to consider all source options *simultaneously* in the source box condition were significantly less suggestible than those who were probed solely about the original event with a recognition procedure (recognition box condition). This complements findings from experiments manipulating the "judgement process" with adult participants (Lindsay & Johnson, 1989; Zaragoza & Lane, 1994) and research demonstrating that source-monitoring "training" reduces source errors in children (Leichtman et al., 2000; Giles et al., 2002; Thierry & Spence, 2001; Thierry et al., 2000). In line with the predictions of the Source-Monitoring Framework (Johnson et al., 1993), the present findings suggest that children do not adopt the systematic evaluations required for accurate source decisions, unless they are overtly oriented to source at retrieval. Hence, at least some of the suggestibility effect elicited from standard recognition procedures in children may be due to

incomplete use of source information that is intact in memory. This implies that children's suggestibility is not based entirely on over-writing of the event trace (Loftus et al., 1978), and is at least partially influenced by source-monitoring errors.

In addition to these theoretical implications, the findings also have methodological ramifications for future research on children's source memory. Both types of source cue shared the common aim of highlighting source information. However, the novel posting-box version (source box condition) was more effective at reducing suggestibility than the question pair method (source questions condition). Furthermore, source question pairs, which are typically used in children's source-monitoring research, provoked a "yes bias" in the youngest age group. The findings suggest that future research should acknowledge that different types of source cue might influence response biases and overall source-monitoring performance in children.

There are two possible explanations for the observed differences in performance across source box and source questions conditions. The first is that the *modality* of source options influenced the effectiveness of source cues. The pictures representing source options in the source box condition may have reduced the cognitive load associated with memorising multiple source options. Indeed, in a pilot study Thierry et al. (2000) reported that pre-schoolers could not remember verbally presented source options. This led them to use visual aids in their subsequent experiment. Visual source cues may also be more stimulating for the pre-school child, and may help them overcome the potential problem of inattention when responding to long lists of verbal questions (see Fritzley & Lee, 2003). This explanation was supported by the fact that the "yes bias" evident in the source question condition for 3–4-year-olds was eliminated in the source box condition. Problems with inattention and "yes bias" may explain why pre-schoolers in previous research perform so poorly when they are oriented to source with question pairs at test (Poole & Lindsay, 1995).

An alternative explanation for the observed differences in facilitation across source conditions is that the *nature of the presentation* of source options influenced effective orienting to source. In the source box condition, all possible source options were presented *simultaneously* (both, film, story, neither), as in adult research (e.g., Lindsay & Johnson, 1989). In contrast, in the source questions condition, source options were probed sequentially (film, story). The simultaneous presentation of source options may have reduced the risk of a "source in question" bias (Marsh & Hicks, 1998). Although the source questions condition alerted children to the fact that the two sources differed in content, the lack of simultaneous presentation effectively meant that diagnostic information for each source was inspected independently ("film" followed by "story"), increasing the likelihood of source errors. This explanation is supported by the fact that the two types of recognition condition (box versus questions) evoked similar performance within age groups. As such, it is unlikely that the variations in performance observed across the two source conditions could be attributed entirely to the visual versus verbal source options manipulation per se. This is especially true for 6–7-year-olds who did not demonstrate a "yes bias", but nevertheless discriminated sources less successfully in the source questions than in the source box condition.

Further research may wish to tease apart the modality (visual versus verbal) and presentation of source options (simultaneous versus sequential) explanations, which cannot be conclusively disentangled within the present design. In order to do this, two further

conditions are required, in which source options are provided verbally in a simultaneous format and sequentially with the use of source posting-boxes. These conditions were not included in the present study, since the purpose was to compare the effectiveness of a procedure *typically* used to orient children to source, with a *novel* procedure with a the same aim, which was analogous to adult procedures. Indeed, in previous investigation of adults' source memory, participants are alerted to source at test by *reading* a list of source options and circling their choice (Lindsay & Johnson, 1989). Hence, the posting-box procedure is in fact a closer analogy to the methods used with adults, since in both cases source options are presented visually. Furthermore, it is not really clear how a truly simultaneous, verbal presentation of source options could be achieved. Even though the experimenter may list the four source options verbally (both, film, story, new), the nature of presentation is still sequential, in that all options are not provided at exactly the same moment in time.

Another point to note is that, contrary to our prediction, *both* 6–7- and 3–4-year-olds' suggestibility benefited to the same degree from orienting to source at retrieval. Hence, even pre-school children used the source prompts effectively. It seemed unlikely that children of 3–4 years would benefit from instructions to consider source, due their limited ability to make causal links between knowledge states and perceptual origins (O'Neill, Astington, & Flavell, 1992; Wimmer et al., 1988). Why then did children of this age group benefit from orientation to source in the present study?

One possibility is that the source task clarified the meaning of the questions posed in the recognition conditions for the younger age group. They may have perceived the recognition question to mean "respond positively if an item was seen before in *any* context" (see Newcombe & Siegal's, 1996, 1997 interpretation). However, in the recognition box condition the meaning of the question was made more explicit by pictures, and yet children performed just as poorly as those in the recognition questions condition.

The second possibility is that young children can benefit from deliberate strategies to monitor source information, but only when *age-appropriate* strategies are employed. Hence, in the current research an age-appropriate analogy to adult source-directed task (the source box condition) allowed children to inspect sources simultaneously. This optimised the retrieval of source information, and also reduced the likelihood of a "yes bias". Indeed, in the theory of mind literature, performance on false belief tasks can be enhanced when questions are made more explicit (Freeman & Lacohee, 1995; Freeman, Lacohee, & Coulton, 1995) and temporal markers are included (Wellman, Cross, & Watson, 2001). Therefore, it is not uncommon for pre-school children's performance to be facilitated by *age-appropriate aids* in other developmental tasks. Further research may clarify if this facilitation is in some way similar across domains.

Finally, although both age groups benefited from orienting to source, there were large absolute differences in suggestibility between the 3–4- and 6–7-year-olds. This was demonstrated by a significant main effect of age, even when source information was fully exploited in the source box condition. Therefore, a fuller understanding of the developmental mechanisms underlying age differences in the ability to retrieve source information is still required. This would be best achieved by adopting methods that are developmentally appropriate, and which optimise retrieval of intact source information by ensuring that source options are considered simultaneously.

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Appendix A. Misinformation narrative (target items)

I am going to tell you a story about a girl called Sara. Sara had just finished doing her shopping, but she had so many bags to carry that she dropped her *bread/ball/keys*. She picked it/them up and carried on her way. Suddenly it started to rain so Sara *put up her umbrella/put her hat on/went under a tree* to try to keep dry. She looked around and saw a café, and decided to go and get something to eat. Bob the Burglar followed her inside. Once in the café, Sara put her shopping down *by a window/on a chair/on a table*. Then she noticed that her *glasses/boots/jumper* were/was all wet from the rain so she took them/it off to dry them/it. Sara looked around for a waitress and ordered some food. She also asked to borrow *a pencil/a telephone/some scissors* whilst she waited. Soon Sara's food arrived. It was a *sandwich/some cake/a banana*. She started to eat it; it was yummy. At that moment, the waitress called out "I forgot to give you a *knife/a fork/a spoon*". Sara replied "Don't worry, I'll come and get it", and she went up to the counter. Now, when Sara wasn't looking, Bob the Burglar took some of Sara's shopping. He ran towards the door, but on the way he knocked a *bottle/some flowers/a candle* onto the floor. Sara shouted "Hey, come back. That man has stolen my shopping." She chased him out of the café and Bob the Burglar started to run, but then he saw a policeman, and dropped the box. Sara picked up the box and took out a toy *frog/rabbit/lion*. "Thank goodness" she said, "my toy *frog/rabbit/lion* is safe and sound". Meanwhile, the policeman chased Bob the Burglar and he tried to hide behind a *book/some balloons/his hands*, but the policeman saw him. Sara ran over and said "this man tried to steal my shopping". "I'm not surprised about that" said the policeman. "This is the famous Bob the Burglar". "But how did you know," said Bob the Burglar. "Because you always wear a t shirt with a picture of a *fish/butterfly/star* on it," answered the policeman. "Come on you, we're off to the jail". "Thank goodness for the policeman" said Sara, and she went home in her *car/on her bicycle/on the bus*.

Appendix B. Target nouns embedded in appropriate phrase

Sara dropped her *bread/ball/keys*

Sara *put her hat on/put her umbrella up/went under a tree* when it started to rain

Sara put her shopping by the *window/on a chair/on the table* when she first came into the café

Sara took her *glasses/boots/jumper* off to dry them
 Sara asked the waitress for a *pencil/a telephone/some scissors*
 Sara ate a *sandwich/a cake/a banana*
 The waitress gave Sara a *knife/fork/spoon*
 Bob the Burglar knocked a *bottle/some flowers/a candle* onto the floor
 There was a toy *frog/rabbit/lion* in the box
 Bob the Burglar hid behind a *book/some balloons/his hands*
 Bob the Burglar had a *fish/butterfly/star* on his t shirt
 Sara went home *on the bus/on a bicycle/in a car*
 N.B. target nouns dictated by film sub-group

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