Age-related Differences in the Free-recall Accounts of Child, Adolescent, and Adult Witnesses

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Summary: Many researchers have examined the factors that affect children’s ability to provide eyewitness evidence, leading to significant reform in policy and practice. In stark contrast, there has been virtually no eyewitness research conducted with adolescents, even though adolescents are still undergoing developmental changes that are likely to affect eyewitness performance. We compared the eyewitness performance of children, adolescents, and adults by showing them a brief film clip depicting a simulated crime and using cognitive interview instructions to elicit free-recall accounts. Adolescents provided more information than children, but less information than adults. Accuracy did not differ with age. These data suggest that, like children, adolescents could benefit from specialised interview techniques that help them provide more complete accounts. Across all three age groups, individual differences in cognitive functioning contributed to variation in eyewitness performance, and eliciting a second free-recall account increased the amount of information reported. Copyright © 2013 John Wiley & Sons, Ltd.

Eyewitness testimony is one of the most critical forms of evidence in criminal investigations (Engelhardt, 1999; Fisher & Schreiber, 2007). Inaccurate or incomplete testimony can result in wasted police time, failure to solve a case, wrongful conviction, or victims remaining in unsafe situations (McMurtrie, 2007; Milne & Bull, 1999). Given the high social and financial costs of these outcomes, an important research goal is to understand how various factors influence witnesses’ ability to recall and recount events.

One of the most studied variables in the eyewitness testimony literature is age. In particular, although a full and accurate description of an event that may have been sudden, unexpected, and stressful is likely to be challenging for any witness, it is particularly difficult for children. The ability to encode, retain, and retrieve memories for events emerges during the preschool years and continues to improve across childhood (Baker-Ward & Ornstein, 2002; Fivush, 2002; Pipe, Thierry, & Lamb, 2007). The development of language is also protracted (Saywitz, 2002). Consequently, relative to adults, even though adolescents are still undergoing developmental changes that are likely to affect eyewitness performance.

We compared the eyewitness performance of children, adolescents, and adults by showing them a brief film clip depicting a simulated crime and using cognitive interview instructions to elicit free-recall accounts. Adolescents provided more information than children, but less information than adults. Accuracy did not differ with age. These data suggest that, like children, adolescents could benefit from specialised interview techniques that help them provide more complete accounts. Across all three age groups, individual differences in cognitive functioning contributed to variation in eyewitness performance, and eliciting a second free-recall account increased the amount of information reported. Copyright © 2013 John Wiley & Sons, Ltd.

Although the difference between children’s and adults’ accounts is well established, we know almost nothing about what happens in between. Although adolescents have received substantially less attention than children, they deserve special consideration for at least two reasons. First, the functional maturation of the human brain continues throughout adolescence and extends into the early 20s (Giedd et al., 1999; Hudspeth & Pribram, 1990; Paus, 2005; Sowell, Thompson, Holmes, Jernigan, & Toga, 1999). Significant changes occur between childhood, adolescence, and adulthood across a number of brain regions, including the prefrontal cortex (Giedd et al., 1999; Sowell et al., 1999), leading to more efficient functioning within and between brain regions and enhanced cognitive processing (Paus, 2005; Sowell et al., 1999). Consequently, many of the complex cognitive skills required in legal contexts might pose particular problems for both children and adolescents. For example, given that the frontal lobes play an important role in working memory, executive functioning, and response inhibition (Paus, 2005; Smith & Jonides, 1999), young witnesses might have more difficulty than adults inhibiting conflicting or irrelevant information when providing reports.

The second reason adolescents deserve special consideration is that adolescence represents a unique stage in social development. Adolescents are more likely than children or adults to change their behaviour to fit in with others (Costanzo & Shaw, 1966; Santor, Messervey, & Kusumakar, 2000). For example, adolescents are more likely than adults to comply with authority figures in legal contexts (Grisso et al., 2003; Gudjonsson, 2003). These data suggest that adolescents might be particularly vulnerable to the influence of any demand characteristics of the interview situation.

Consistent with these predictions, adolescents, like children, are typically less accurate or more suggestible than adults when tested in paradigms designed to measure suggestibility or misinformation effects (Gudjonsson & Singh, 1984; Loftus, Levidow, & Duensing, 1992; McGuire, London, & Wright, 2011; Richardson, Gudjonsson, & Kelly, 1995; Singh & Gudjonsson, 1992; but see Redlich, Silverman, & Steiner, 2003). But how do adolescents perform relative to other age groups when questioned using the open-ended techniques that
are appropriate for use during investigative interviews? Open-ended questions have been used in only three eyewitness memory studies that included adolescent participants (Chapman & Perry, 1995; Eisen et al., 2007; Memon, Wark, Holley, Bull, & Koehnken, 1997). In two of these, adolescents’ performance was compared with that of children (as cited earlier), but researchers have yet to compare adolescents’ performance with that of older witnesses. We address this issue in the present experiment.

We also examine the extent to which free-recall reports might differ as a function of individual difference variables other than age. Although several researchers have investigated how cognitive variables might contribute to eyewitness performance, most of this research has been conducted with children, and much of it has focused on suggestibility (see Bruck & Melnyk, 2004; Clarke-Stewart, Malloy, & Alhusen, 2004; Lee, 2004, for reviews). However, a few researchers have examined the extent to which scores on standardized memory, language, and intelligence tests might predict eyewitness performance under neutral interview conditions.

Given that event recall depends on memory for the target event, it seems likely that individual differences in general memory skills would play a role in eyewitness performance. In the few studies where researchers have tested this hypothesis, they have found positive relations. For example, Eisen, Qin, Goodman, and Davis (2002) found that maltreated children’s digit span and memory for sentences were negatively related to the number of errors made when recalling a medical examination (see also Eisen et al., 2007).

Language underlies witnesses’ ability to understand interviewers’ questions and to express what they remember. It also plays an important role in the encoding, storage, and retrieval of event memories (Hayne & Jack, 2011). However, aside from verbal intelligence, tests of language have not demonstrated a consistent relation with eyewitness performance. For example, some researchers have found no relation between children’s event recall and their vocabulary scores (Greenhout, Ornstein, Gordon, & Baker-Ward, 1999; Gross & Hayne, 1999), whereas others have found positive relations (Gordon et al., 1993; Salmon, Roncolato, & Gleitzman, 2003; see also Brown & Pipe, 2003). There is some evidence that the relation between language and eyewitness recall strengthens with age across childhood (Gordon et al., 1993).

General intellectual functioning might contribute to eyewitness memory through, for example, the organisation of event representations or the use of memory strategies to aid retrieval (Brown & Pipe, 2003; Geddie, Fradin, & Beer, 2000). Indeed, children’s scores on intelligence tests correlate positively with the amount of information recalled about classroom events (Brown & Pipe, 2003; Geddie et al., 2000). Verbal intelligence tends to be more closely related to children’s eyewitness performance than non-verbal intelligence (Brown & Pipe, 2003; Henry & Gudjonsson, 2007), although both measures are positively related (e.g. Eisen et al., 2002; Elischberger & Roebers, 2001; Roebers & Schneider, 2001). There is some evidence that, as for language, the relation between eyewitness recall and intelligence (both verbal and non-verbal) increases with age across childhood (Elischberger & Roebers, 2001; Roebers & Schneider, 2001).

It therefore appears that children’s general memory, linguistic, and intellectual abilities all contribute to their eyewitness performance to some extent. For both theoretical and applied reasons, it is important to know whether the role of these variables is consistent across the lifespan. From a theoretical perspective, this will tell us whether the reasons for individual variation in the quality of older witnesses’ reports are the same as the reasons for individual variation in the quality of children’s reports. From an applied perspective, knowing the extent to which these cognitive variables contribute to eyewitness performance will be helpful for experts who are required to evaluate witnesses’ reports (Geddie et al., 2000).

Interviewers obviously cannot manipulate a witness’s age or cognitive skills. There are, however, a number of other variables that influence eyewitness performance and are under the interviewer’s control. Perhaps the most influential of these is questioning style. As such, a large amount of research attention has been devoted to developing interview techniques that maximise the volume and accuracy of witnesses’ reports (e.g. Aschermann, Mantwill, & Koehnken, 1991; Larsson, Granhag, & Spjut, 2003; Lipton, 1977; Roberts & Higham, 2002; for reviews, see Fisher & Schreiber, 2007; Milne & Bull, 1999). Free-recall prompts (such as ‘Please tell me everything that happened that morning’) have been identified as particularly useful, with information obtained during free recall generally highly accurate (e.g. Lipton, 1977) and forensically relevant (e.g. Roberts & Higham, 2002).

The main drawback to free-recall accounts is that they are often relatively brief. In order to elicit additional information, investigators often use increasingly specific questions. Unfortunately, when asking specific questions, investigators often introduce new—and potentially inaccurate—details (Milne & Bull, 1999). For example, investigators might ask leading questions (e.g. ‘Was he wearing a blue hat?’) or forced-choice questions (e.g. ‘Was the hat blue or black?’). It is well established that, relative to free-recall prompts, these types of questions impact negatively on accuracy (e.g. Aschermann et al., 1991; Larsson et al., 2003; Lipton, 1977; see Milne & Bull, 1999, for a review).

A crucial step in reducing the need for specific questioning is to develop techniques that maximise the amount of information that witnesses provide during free recall. The cognitive interview (CI), which is recommended by scientists and widely used by police, includes a number of instructions designed to achieve this (Fisher & Schreiber, 2007; Milne & Bull, 1999). Chiefly, witnesses are asked to report everything they can remember, even seemingly minor details, and to mentally reinstate the context in which the event took place. Used together, these instructions significantly increase the amount of information reported by both children and adults, with no effect on accuracy (Milne & Bull, 2002).

In its full version, the CI also includes a number of mnemonics that are variations on the typical free-narrative technique (e.g. recalling the event in reverse chronological order or describing the event from a different point of view). However, researchers have voiced concern that some witnesses might find these latter techniques confusing (Memon, 2006; Saywitz, Geiselman, & Bornstein, 1992) and that evidence obtained using the
‘change perspective’ mnemonic could be deemed speculation or hearsay (Boon & Noon, 1994). Furthermore, two studies have shown that simply asking participants to ‘try again’ was just as effective at eliciting additional correct information as using these special mnemonics (Boon & Noon, 1994; Milne & Bull, 2002).

The reminiscence literature offers further evidence that simply asking witnesses to provide a second free-recall account might effectively increase the amount of information reported (see La Rooy, Pipe, & Murray, 2005, for a review). Reminiscence is the tendency for the cumulative number of unique details reported to increase across multiple retrieval attempts. Both adults (e.g. Scrivner & Safer, 1988) and children (e.g. Bluck, Levine, & Laulhere, 1999; La Rooy et al., 2005; Peterson, Moores, & White, 2001; Salmon & Pipe, 2000) have shown reminiscence for witnessed or personally experienced events.

The implications of these results for applied settings are unclear, however, as participants did not receive CI instructions prior to the first retrieval attempt. Given that the CI instructions were specifically designed to maximise the amount of information that is reported, they might create a ceiling effect such that subsequent retrieval attempts will fail to elicit additional details. Even in the Boon and Noon (1994) and Milne and Bull (2002) experiments, in which CI mnemonics were used, participants were not given both the ‘report everything’ and ‘context reinstatement’ instructions prior to the first retrieval attempt, both of which are standard features of the CI (Fisher & Schreiber, 2007; Milne & Bull, 1999) and which have been shown in tandem to be crucial to its success (Milne & Bull, 2002). It remains to be seen how effective a second free-recall attempt will be when these standard instructions are given prior to the first attempt. One of the goals of the present experiment was to answer this question.

In light of the research discussed above, we had three main aims in conducting the present experiment. The first was to provide the first empirical evaluation of adolescents’ free-recall accounts relative to those of both children and adults. Consistent with New Zealand’s legal definitions of a child, young person, and adult (Children, Young Persons, and Their Families Act, 1989), we recruited children aged 9–11 years and adolescents aged 14–16 years. Given that brain maturation extends into early adulthood (Giedd et al., 1999; Hudspeth & Pribram, 1990; Sowell et al., 1999) and older adults exhibit a decline in eyewitness performance (Moulin, Thompson, Wright, & Conway, 2007), we restricted the age of our adult participants to 25–60 years. Whereas the adult samples in many memory studies comprise college students, who may differ systematically from the general population (Loftus et al., 1992), we recruited all participants from the wider community. Our second aim was to examine the extent to which children’s, adolescents’, and adults’ performance on standardised cognitive tests are related to their eyewitness performance. Our final aim was to clarify previous research findings (Boon & Noon, 1994; Milne & Bull, 2002) by establishing whether a second free-recall attempt is successful at eliciting additional details when the standard report everything and context reinstatement instructions are given prior to the first attempt.

Participants individually viewed a brief film clip depicting a simulated crime. After a 45-minute delay, during which the interviewer administered standardised cognitive tests, participants were asked to provide two free-recall accounts about what they had witnessed. The interviews were then transcribed and coded, allowing us to systematically assess the type, quantity, and accuracy of the information that participants reported.

METHOD

Participants

Participants were recruited via a newspaper advertisement, invitations distributed to local schools, a research participant database, and word of mouth. The final sample comprised 48 children aged 9–11 years (M = 10.6, SD = 0.9; 24 boys), 48 adolescents aged 14–16 years (M = 15.4, SD = 0.8; 24 boys), and 48 adults aged 25–60 years (M = 42.8, SD = 9.3; 24 men). An additional five participants were excluded because of insufficient fluency in English (one adult and one child) or experimenter error (two adults and one adolescent). All participants, and a parent/guardian of each child and adolescent participant, gave written informed consent.

Across the three age groups, 86% of participants identified as NZ European, 6% as NZ Maori, 9% as Asian or Indian, and 9% as other ethnicities (percentages do not sum to 100 because some participants reported multiple ethnicities). Child and adolescent participants provided their parents’ occupations, and adult participants provided their own and, if applicable, their partner’s occupation. On the basis of the Elley-Irving (2003) socio-economic index, in which scores range from 1 (e.g. lawyer, university professor) to 6 (e.g. cook or cleaner), the average household occupation level across the sample was 2.7 (SE = 0.11); scores did not differ as a function of the age group, F(2, 131) = 1.98, p > .10.

Film clips

In order to increase the internal and external validity of our findings (Wells & Windschitl, 1999), we used three different film clips as the target events. The clips were shown on a 24-in. computer monitor, with participants seated approximately 1.5 m from the screen. The film clips were created by the New Zealand Police for use in their interview training workshops. The use of these clips ensured that our target events were representative of events that are often the focus of investigative interviews.

The first film clip (54 seconds) shows a man walking on a suburban footpath, looking over a fence, looking in a letterbox, and entering a property. The second (31 seconds) shows two people walking into a shop and, a few seconds later, running out of the shop and around the corner out of sight. The third clip (14 seconds) shows a young woman shoplifting in a convenience store.

Memory interview

The interview was conducted using a standardised script, based on the standard CI techniques used by the New Zealand Police. Each session was conducted by one of two trained female interviewers. At the beginning of the memory
interview, participants were instructed to take their time, to concentrate hard, and to report everything they could recall. They were told to make sure they only reported the information they could actually recall, and not to guess. Finally, participants were asked to reinstate the context of the event by thinking about what they had seen, heard, thought, and felt when watching the clip.

While participants described what they remembered, the interviewer used minimal encouragers (e.g. ‘M-hm’), but did not interrupt. Once the participant stopped giving information, the interviewer prompted once, ‘Is there anything else you can remember?’

Next, the interviewer asked the participant to talk her through the event again. The interviewer explained that this did not mean she thought the participant had got anything wrong the first time; it was just in case he or she could remember any more. The participant was reminded not to guess or to try to fill in any gaps in his or her memory. Once the participant began to give information, the interview proceeded as for the first recall phase.

Procedure

Participants were tested individually. Sessions were balanced such that each interviewer saw half of the participants from each age group and half of each gender within each age group. After consent procedures were completed, the participant was shown one of the three film clips. Clips were randomly assigned, with the restriction that each was viewed equally often by participants from each combination of age group, gender, and interviewer. Before showing the clip, the interviewer asked the participant to watch and listen carefully and to try to imagine he or she was actually there, seeing it happen.

After viewing the clip, the participant was administered the two-subtest form of the Wechsler Abbreviated Scale of Intelligence (WASI), which provides an acceptable general summary of cognitive ability (Wechsler, 1999). It comprises one test of verbal intelligence (vocabulary) and one test of non-verbal intelligence (matrix reasoning). The interviewer also administered the four subtests of the Wide Range Assessment of Memory and Learning (WRAML; Sheslow & Adams, 2003) that contribute to the screening index (story memory, design memory, verbal learning, and picture memory). Both the WASI and the WRAML were able to be administered across all three of our age groups. To keep the session length reasonable for participants, rather than administering an additional test of language, we used scores on the WASI vocabulary subtest as a measure of language ability.

The participant was then interviewed about the film clip using the interview protocol described earlier. The delay between the film clip and the interview was approximately 45 minutes. Upon completion of the interview, participants were thanked and given $15.

Coding

All interviews were audio-recorded and transcribed verbatim. Any identifying information was removed from the transcripts prior to coding. A coding scheme was developed to quantify the amount, type, and accuracy of the information that participants reported. First, each new relevant detail participants reported was assigned to one of the five categories described in the following. Repetitions and off-topic utterances were ignored. Any word or group of words that gave embellishment to the main idea (e.g. adjectives and adverbs) scored a further code of the same type. In the following examples, each separately underlined word or phrase received unique credit for that particular information type:

Person: Information describing a person’s physical appearance, including his or her clothing (e.g. ‘she had brown hair’ or ‘he was wearing a brown striped hoodie’)

Behaviour: Information describing the behaviour, actions, or manner of the people in the clip (e.g. ‘he looked into a letterbox’ or ‘the girl looked annoyed’)

Surroundings: Information describing physical surroundings and objects (e.g. ‘he looked into a letterbox’ or ‘the girl took a packet of noodles from the shelf’)

Time: Information describing the sequence of events (e.g. ‘then’, ‘while’, or ‘first’), the duration of something (e.g. ‘They were in the shop for about 10 seconds’), or the time of day (e.g. ‘It must have been the middle of the day because the sun was very bright’)

Sound: Information describing any sounds (e.g. ‘the girl shouted “Sam” quite loudly’ or ‘I could hear birds chirping’)

Next, each detail was further coded as correct, possible, or incorrect. The possible code covered subjective or evaluative statements (e.g. ‘It looked like a nice neighborhood’). This category also included reasonable speculation about things that were not shown in the clip but could have been correct (e.g. ‘the shopkeeper might have been out the back’).

Thirty randomly selected transcripts (10 from each age group) were coded independently by two coders. Agreement between coders was good; Pearson correlations ranged from $r=0.89$ to $r=0.98$ for the five information-type codes and from $r=0.91$ to $r=0.99$ for the three accuracy codes (all $p<.001$). Disagreements were resolved through discussion; one coder coded the remaining transcripts.

RESULTS

Prior to analysis, we adjusted for outliers by replacing any values that were $\geq 3 \ SD$ from the mean with the next-highest value plus 1 (Tabachnick & Fidell, 2007). Across all variables analysed, we replaced 7 child, 9 adolescent, and 11 adult data points. For analyses of variance (ANOVAs), where the homogeneity-of-variance assumption was violated, we report Welch’s $F$-ratio and Tamhane’s post-hoc comparisons. Elsewhere, Tukey’s post-hoc test was used. Unless stated otherwise, alpha = .05 throughout.

Preliminary analyses showed no main effects of gender, and gender did not enter into any significant interactions, so we collapsed across gender for subsequent analyses. Given the wide age range of our adult participants, we tested for correlations between age and our eyewitness measures within this group. None were significant ($p > .10$). There were effects of film clip on the volume of participants’ reports, $F(2, 141) = 13.37$, and the proportion of information that
was correct, possible, and incorrect, $F(2, 141) = 3.72, 11.10$, and 5.70, respectively. The interactions with age were non-significant ($p > .05$). Because film clip was a nominal variable, it was not possible to include it as a covariate (Bruce, Kemp, & Snelgar, 2009). Given our thorough counterbalancing of film clip, however, we are confident that the variation in performance due to film clip will not have affected our other results.

**Amount and type of information reported**

We included only correct details in these analyses. Table 1 shows the mean number of correct details reported as a function of age group, recall phase, and information type. Because details about sound were rare, we omitted this category from analyses. We subjected these data to a 3 (age: children, adolescents, and adults) × 5 (information type: person, behaviour, surroundings, and time) multivariate ANOVA, with repeated measures across information type. The dependent variables were the numbers of unique details reported during the first and second recall phases. The main effects of age, $F(4, 280) = 17.43$, Wilks’ lambda = 0.64, $\eta^2_p = 0.20$, and information type, $F(6, 136) = 96.38$, Wilks’ lambda = 0.19, $\eta^2_p = 0.81$, and their interaction, $F(12, 272) = 7.83$, Wilks’ lambda = 0.55, $\eta^2_p = 0.26$, were all significant for the combined dependent variable amount recalled.

Next, we analysed the amount recalled during the two individual recall phases, using a Bonferroni-adjusted alpha level of .025. Mauchly’s test showed that for both recall phases, the assumption of sphericity had been violated for age on the amount of information that was reported about people, whereas the proportion of possibly correct information and the proportion of incorrect information both increased during the second recall phase, whereas the proportion of possibly correct information and the proportion of incorrect information both increased (Table 2). Because participants did not always report details for each information type, we were unable to examine accuracy as a function of this variable.

**Accuracy**

Recall that each detail reported was categorised as correct, possible, or incorrect. For each participant, these data were converted to proportions by dividing the total number of details falling into each category by the total number of details reported, separately for each recall phase. We analysed these proportions using a 3 (age: children, adolescents, and adults) × 2 (recall phase: first and second) ANOVA with repeated measures across recall phase. There were no significant effects of age or interactions. There were, however, significant effects of recall phase on the proportion of information that was correct, $F(1, 141) = 55.80$, $\eta^2_p = 0.28$, possible, $F(1, 141) = 9.89$, $\eta^2_p = 0.07$, and incorrect $F(1, 141) = 48.27$, $\eta^2_p = 0.26$. Relative to the first recall phase, the proportion of correct information decreased during the second recall phase, whereas the proportion of possibly correct information and the proportion of incorrect information both increased (Table 2). Because participants did not always report details for each information type, we were unable to examine accuracy as a function of this variable.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Full sample</th>
<th>People</th>
<th>5.06 (0.38)</th>
<th>7.25 (0.09)</th>
<th>12.92 (0.79)</th>
<th>8.41 (0.46)</th>
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<tbody>
<tr>
<td></td>
<td>Behaviour</td>
<td>5.52 (0.40)</td>
<td>7.00 (0.45)</td>
<td>9.35 (0.65)</td>
<td>7.29 (0.32)</td>
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<td></td>
<td>Surroundings</td>
<td>5.88 (0.40)</td>
<td>11.69 (1.00)</td>
<td>14.29 (1.15)</td>
<td>10.62 (0.60)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>1.98 (0.28)</td>
<td>2.52 (0.24)</td>
<td>2.40 (0.24)</td>
<td>2.30 (0.15)</td>
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<td></td>
<td>Sound</td>
<td>0.38 (0.08)</td>
<td>0.44 (0.10)</td>
<td>0.44 (0.13)</td>
<td>0.42 (0.06)</td>
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</tr>
<tr>
<td></td>
<td>Total</td>
<td>18.92 (1.06)</td>
<td>28.69 (1.79)</td>
<td>38.96 (1.94)</td>
<td>28.85 (1.16)</td>
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<table>
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<th>Adults</th>
<th>Full sample</th>
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<td>1.10 (0.25)</td>
<td>1.81 (0.23)</td>
<td>1.31 (0.13)</td>
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<tr>
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<td>3.17 (0.43)</td>
<td>3.42 (0.37)</td>
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<td>Time</td>
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<td>0.90 (0.17)</td>
<td>1.06 (0.18)</td>
<td>0.94 (0.10)</td>
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<tr>
<td>Sound</td>
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<td>0.10 (0.04)</td>
<td>0.17 (0.07)</td>
<td>0.10 (0.03)</td>
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<tr>
<td>Total</td>
<td>6.06 (0.64)</td>
<td>6.94 (0.77)</td>
<td>9.60 (0.83)</td>
<td>7.53 (0.45)</td>
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</table>
Individual difference measures

On the basis of the WASI and WRAML subtests, we were able to obtain six standardised scores for each participant: WASI vocabulary T score (verbal intelligence), WASI matrix reasoning T score (non-verbal intelligence), WASI Full-2 score (general intelligence), WRAML verbal memory index (verbal memory), WRAML visual memory index (visual memory), and WRAML screening memory index (general memory). We used linear regression to examine whether these six individual difference measures predicted two dependent measures: the number of correct details reported in our eyewitness paradigm and, separately, the proportion of correct information. Entering all six predictor variables into the regression analyses simultaneously resulted in unacceptable levels of multicollinearity among predictors (tolerance = 0.001–0.012). To avoid multicollinearity and to maintain a good ratio of participants to predictor variables, we conducted a separate analysis for each individual difference measure. Because film clip affected both dependent variables, we controlled for film clip in the models using a set of two dummy predictors. We also examined whether the relations between our individual difference measures and eyewitness performance varied with age by including two dummy variables representing the three age groups and terms for their interaction with the nominated individual difference measure. We used Bonferroni–Holm-adjusted alpha levels when interpreting the results of these analyses.

All of the 12 models were significant (Table 3). In each case, the nominated individual difference measure and the dummy variables for clip were the only significant predictors, with the exceptions that verbal intelligence, verbal memory, and visual memory scores were not significant predictors of proportion correct. In all cases, the association between the individual difference measure and the eyewitness memory measure was in a positive direction. None of the interactions with age were significant (ps > .10).

DISCUSSION

Age-related differences in recall

Children and adolescents provided less information about the films than adults but were no less accurate. These data are consistent with existing literature on the effects of age.
on free recall in both eyewitness and autobiographical memory paradigms. Typically, the amount of information that individuals report increases with age in childhood and between childhood and adulthood, although accuracy remains high across age groups (e.g. Marin et al., 1979; Oates & Shrimpton, 1991; Sutherland & Hayne, 2001; Tustin & Hayne, 2010). Although our findings are highly consistent with past research, they make a unique contribution by allowing us to evaluate adolescents’ performance relative to that of both younger and older witnesses. The amount of information reported by adolescents in response to free-recall prompts was intermediate between the amounts reported by children and adults, suggesting that eyewitness memory improves gradually across this developmental window.

Most of the information that participants reported described the people in the film clips, their behaviour, and the surrounding objects and scenery. These were also the categories in which age differences emerged. Children reported less information than adults across all three of these categories. Adolescents reported less than adults about people and behaviour. These are the categories of information that are likely to be vital in eyewitness situations; it is therefore important for interviewers and researchers to consider how we can maximise the amount of information that young witnesses provide about these aspects of events. Across all three age groups, few details were reported about time or sound. This could have been due to the nature of our target events. It is possible that age differences would have emerged had there been more scope for describing these aspects of the events.

What factors might be responsible for the age differences we observed in the volume of information recalled? From a social/motivational perspective, older participants might have been more sensitive to a perceived requirement to ‘perform well’ in the laboratory or might have felt more at ease with the adult interviewer than their younger counterparts. Alternatively, cognitive or linguistic factors could have played the major role. For example, older participants might have used more effective encoding or retrieval strategies than younger participants or been better able to communicate their recollections (Bjorklund & Douglas, 1997; Lamb et al., 2007; Saywitz, 2002).

**Individual differences**

Our analyses indicated that all six of our individual difference variables were positively related to the amount of correct information participants reported and that non-verbal intelligence, general intelligence, and general memory were positively related to the proportion correct. The failure of the interaction terms to make a significant contribution to the regression models indicates that the relations between the individual difference variables and the eyewitness recall variables did not differ meaningfully across our three age groups. Past research indicates that the relations between eyewitness memory performance and scores on tests of language and intelligence increase with age in childhood (Elishberger & Roebers, 2001; Gordon et al., 1993; Roebers & Schneider, 2001). If this trend continues beyond childhood, it was not strong enough to be detected in our analyses.

Prior research with children has typically shown that scores on verbal intelligence tests play a more important role in predicting eyewitness performance than scores on tests of non-verbal intelligence. As Table 3 shows, we found no evidence to support this conclusion.

One reason researchers have examined the relations between children’s eyewitness performance and individual differences in cognitive functioning is to inform professionals who might be asked to evaluate a witness’s evidence in a legal setting (Gedde et al., 2000). Our results suggest that, across all of the individual difference variables we measured, standardised test scores may be just as predictive for older witnesses as they are for children.

**Utility of second free recall**

In order to elicit as much information as possible under free-recall conditions, we asked participants to provide a second free-recall account. How successful was this strategy? Participants of all ages volunteered some new information during this phase, with children, adolescents, and adults reporting approximately 6, 7, and 10 correct new details on average, respectively. As these means indicate, eliciting a second free-recall account did nothing to decrease the age-related differences in the overall amount of information reported; as in the first free-recall phase, the amount of new information reported increased with age.

These data suggest that even when witnesses are provided with both the context reinstatement and report everything instructions from the outset, they might not report all available information during their first attempt. Our results add to existing evidence that simply asking witnesses to try again can increase the amount of information obtained under free-recall conditions.

An important caveat to this conclusion is that the new information might come at the cost of accuracy. Across all three of our age groups, participants’ accuracy decreased between the first and second recall phases. This aspect of our data is consistent with past research. Whether the subsequent account is given within the same interview (Boon & Noon, 1994; La Rooy et al., 2005, Experiment 2), 24 hours after the first (La Rooy et al., 2005, Experiment 1), or over 6 months later (La Rooy et al., 2005, Experiment 3; Peterson et al., 2001; Salmon & Pipe, 2000), the error rate (as a proportion of new information reported) is typically at least double that of the original account (although see Bluck et al., 1999). This trend of decreasing accuracy suggests that asking participants to provide a second free-recall account might have an effect comparable with that of asking more specific questions. Researchers generally find that as the line of questioning becomes more specific, the accuracy of witnesses’ reports decreases (e.g. Aschermann et al., 1991; Larsson et al., 2003; Lipton, 1977; see Milne & Bull, 1999, for review). Given that details that witnesses have less confidence in are also less likely to be accurate (Roberts & Higham, 2002), one possible explanation for this trend of decreasing accuracy is that when interviewers encourage witnesses to provide more specific or simply more information, the witnesses might begin to report details that they had initially refrained from mentioning because they were
less sure of them. Supplementary analyses revealed a small but significant trend consistent with this interpretation. Participants indicated uncertainty (e.g. ‘I think...’) more frequently during the second recall phase relative to the first, suggesting that they had less confidence in the new information that they provided.

Limitations and future directions

Like all laboratory experiments, our experiment has some limitations in terms of its ecological validity. First, we asked participants to watch carefully as we showed them a brief filmed event in a quiet laboratory setting, and we interviewed them after a 45-minute delay. Actual witnesses would view live events with no prior warning, might have their view obstructed or their attention diverted, and would be interviewed after a delay that could range from a few minutes to a week or more, during which they might be exposed to post-event information from a range of sources. The task of remembering and describing what happened might therefore be considerably more difficult for an actual witness than it was for our participants. Another difference is that witnesses to an actual transgression might be more or less willing to provide information depending on factors such as their role in the situation, whether they know the perpetrator (or suspect), and whether they fear recrimination. These issues might be particularly relevant for adolescent witnesses, who tend to offend in groups (Steinberg, 2004). Finally, our interviewers asked only free-recall questions; investigators are likely to ask many different types of questions, including more specific open-ended or closed questions (Evans & Webb, 1993; Fisher, Geiselman, & Raymond, 1987). Accuracy tends to suffer as questions become more specific, particularly for younger witnesses.

With these issues in mind, the present results are likely to represent a ‘best-case scenario’ of eyewitness performance. Further laboratory and field research is required to assess the relative effect that the aforementioned factors have on the eyewitness performance of children, adolescents, and adults. In our own laboratory, we are currently investigating age-related differences in eyewitness reports elicited under less than ideal interview conditions.

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