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The effect of cross-examination on the accuracy of adult eyewitness testimony.

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Abstract

Cross-examination permits styles of questioning that increase eyewitness error (e.g. leading questions). Under cross-examination children change many of their initially accurate answers (Zajac & Hayne, 2003; 2006). The effect of cross-examination on accuracy of adult eyewitness testimony was investigated. Twenty-two student witnesses watched a video of a staged theft, either in pairs, or individually. Paired witnesses discussed the video with their co-witnesses, but did not know they had seen slightly different versions. Participants in the co-witness condition demonstrated memory conformity and recalled less accurately than witnesses in the control condition. After approximately four weeks all participants were cross-examined by a trainee barrister. Following cross-examination there was no difference in accuracy between the two experimental groups. Witnesses in both conditions made many changes to their previous reports by altering both initially correct and incorrect answers. The results demonstrate negative effects of cross-examination on the accuracy of adult eyewitness testimony.

Keywords: cross-examination; eyewitness; suggestibility; memory; interviewing

The effect of cross-examination on the accuracy of adult eyewitness testimony.

A substantial body of research has demonstrated that eyewitness memory can be highly malleable. Eyewitness memory can be distorted by suggestion from information acquired after the relevant event was witnessed (Loftus & Hoffman, 1989; Wright & Loftus, 1998), by the style of questioning that a witness encounters (Loftus & Palmer, 1974; Loftus & Zamni, 1975) or by repeated questioning (Odinot, Walters & Lavender, 2009). Eyewitnesses have been shown to be influenced by misleading information acquired through questioning (Loftus, Miller & Burns, 1978) or discussion with a co-witness (Gabbert, Memon & Allen, 2003). The cognitive interview was developed to avoid memory distortion and elicit accurate information from witnesses. An important basis of the cognitive interview is to avoid leading questions and minimise use of closed questions (see Holliday, Brainerd, Reyna & Humphries, 2009 for a recent review). Both adults and children may show memory distortion, but children and other vulnerable witnesses are likely to be especially susceptible (Holliday *et al.*, 2009). For this reason special provision is made for children to give testimony in court in a number of jurisdictions.

In contrast to the copious amounts of research on investigative interviewing there has been relatively little research on the effect of cross-examination in court on the reliability of eyewitness testimony. John Henry Wigmore is often cited as having described cross-examination as “the greatest legal engine ever invented for the discovery of truth”¹. Yet the styles of questioning commonly used in cross-examination include question formats that can limit the completeness and accuracy of

¹ 5 J. Wigmore, Evidence §1367 (J. Chadbourn rev. 1974).

the answer; including leading questions, use of negatives, closed questions, either/or questions, yes/no questions, and multiple questions (Kebbell, Deprez & Wagstaff, 2003; Kebbell, Hatton & Johnson, 2004; Perry, McAuliff, Tam, Claycomb, Dostal & Flanagan, 1995; Zajac, Gross & Hayne, 2003). Texts on cross-examination advocate use of leading questions, and techniques to undermine the credibility of a witness.

For example Moses (2001) gives the following advice to barristers:

“Leading is the way you direct the jury's focus to you rather than the witness. As to form, the most leading form of a leading question is a declarative statement, e. g., "The car was red." asked with an interrogative inflection of voice. When you start a question with a personal pronoun, e.g., you, she, he, or a noun, e.g., "the car", you usually are on your way to a leading question. As a general rule, you will seek agreement, a concession, from the witness. Much of your cross-examination can be prepared by forming a set of leading questions that will elicit a string of "yes" answers from the opposition witness. Planning your core leading questions in advance of trial will help train you to form extemporaneous leading questions when the need arises.”

Moses (2001) explains further: “As a general rule, you don't want to invite the witness to explain. This means that you generally don't ask the witness "Why?" or "How?" or "Can you explain that?" or "Tell me more." or "Would you describe ...?" These open-ended questions give the witness free rein. If you want to let the opposition's witness wiggle off the hook, just ask him to "explain." The witness' explanation will usually hurt your case. Thus, you ask leading questions.”

There are several fundamental differences between an investigative interview, and cross-examination. Most research assumes that the interview is with a compliant

witness who is trying to recall as accurately as possible. In a typical research design, misleading information is introduced in a small proportion of questions in a post-event questionnaire or interview. In contrast, cross-examination is likely to involve active persuasion and an attempt to undermine the witness' confidence. Witnesses are likely to face direct challenges to the accuracy of their report, and have an alternative account put to them. Furthermore, cross-examination might be expected to be detrimental to a witness's testimony due to factors which we know increase witnesses' suggestibility, such as a long delay between witnessing the event and cross-examination (Read, Connolly, Toglia, Ross & Lindsay, 2007) and the perceived high status and authority of the cross-examiner (Roper & Shewan, 2002).

Zajac, Gross and Hayne (2003) examined court transcripts of cross-examination of complainants of sexual abuse aged 5 to 13 years. Barristers used many complex, confusing, leading and closed questions. The children exhibited a strong tendency to comply with leading questions and rarely requested clarification of complex or grammatically incorrect questions. Over 75% of children altered at least one aspect of their evidence and several completely retracted their allegations. A difficulty with interpreting these data is that the ground truth of the allegations is unknown. For this reason archival research must be combined with research using an experimental approach.

In an experimental study by Zajac and Hayne (2003), 5-6 year-old children visited a police station. Half were exposed to misleading information after the event. Six weeks later the children were interviewed and after a further eight months were cross-examined. The children made many changes to their original responses, and were as likely to change an initially correct response as they were to change an initially incorrect response. The effect of the cross-examination was to decrease the

accuracy of the children's testimony, even when they had not been exposed to misleading information. In a similar study Zajac and Hayne (2006) reported that 9 – 10 year-old children changed fewer accurate than inaccurate answers, although they still changed 40% of correct answers under cross-examination.

The research by Zajac and colleagues showed that cross-examination reduced the accuracy of children's testimony. The question arises of whether the effect is due to the vulnerability of children's testimony or whether cross-examination would adversely affect the accuracy of adult eyewitness testimony. The aim of the present study was to examine this issue using an ecologically valid scenario. Student participant witnesses watched a video. A co-witness paradigm (Gabbert *et al*, 2003) was employed to expose some of the witnesses to misleading information. Discussion with a co-witness can provide a powerful influence on testimony (Patterson & Kemp, 2006), and a plausible source of misleading information for the adult participants. After 4 weeks delay each witness was cross-examined by a trainee barrister. The barristers were instructed that it would be favourable to their client if each witness changed their testimony on four critical points, which differed between two versions of the video. The barristers did not know there were two versions of the video but were informed whether the witness had the opportunity to discuss the event with a co-witness. It was predicted that if they encountered misleading information from their co-witness, witnesses would incorporate some of this misleading information into their testimony of their own memory. The main objective was to test whether cross-examination affected the accuracy of testimony of adult witnesses. If the adult witnesses had not encountered misleading information it was predicted that they may be less likely to change their testimony under cross-examination than participants in the co-witness condition because the alternative account provided by the barrister

would be novel and they would not have a plausible attribution for assuming that they were mistaken.

The design of the materials included an opportunity to test whether under cross-examination witnesses are more likely to acquiesce by making an omission error (i.e. agreeing that they did not see something that in fact they did see) or a commission error (i.e. to erroneously acquiesce by agreeing they saw something that they did not actually see). Research on memory conformity from co-witness discussion has shown that a co-witness who reported something a witness did not see can be more influential than a co-witness who reported not noticing a detail that the witness did see (Gabbert, Memon & Wright, 2006). The materials also permitted a test of whether under cross-examination witnesses are more likely to acquiesce to a suggestion concerning a peripheral detail than to a detail about the central action of the event. Eyewitnesses are more likely to be misled by leading questions about a peripheral detail than a central event (e.g. Coxon & Valentine, 1997; Wright & Stroud, 1998).

Method

Participants

Thirty students participated for course credits. Eight participants failed to complete the cross-examination stage and were excluded from the analyses. Complete data sets were obtained from 22 participants (18 female, 4 male), aged 18-44 ($M = 22.86$, $SD = 6.80$). Participants were randomly assigned to individual ($n = 11$) or co-witness ($n = 11$) conditions. Within the individual condition, five participants viewed perspective A (view from the room) of the video, six participants viewed perspective

B (view from the door), and within the co-witness condition, six participants viewed perspective A of the video, five participants viewed perspective B.

Design

The study employed a 2 x 2 x 2 mixed design. *View* (version A vs. version B) and *Experimental condition* (control vs. co-witness discussion) were between-participant factors, and *time of recall* (statement vs. cross-examination) was a repeated measure.

Materials

Participants watched a video of a simulated crime event, which was used by Gabbert *et al.* (2003). The video lasted approximately 90 seconds. It showed a girl entering a room to return a borrowed book, and was filmed from two different perspectives to simulate a real event witnessed from different angles. All actions and events could be seen from both perspectives, except for four critical details. Two details could only be seen from perspective A: The girl threw a note into a bin on her way out of the room, and the title of the book that she was carrying was visible. Two other details could only be seen from perspective B: The girl checked the time on her watch, and took a £10 note out of a wallet she found in the office and put it into her pocket. One detail visible in each version concerned the girl's actions which were central to the event (throwing a note in the bin and stealing money) and one question concerned a peripheral detail (wearing jewellery and the title of the book).

Procedure

Participant-witnesses were asked to watch the video clip. Half viewed the video from perspective A (view from the room) and half from perspective B (view from the door). Participants in the co-witness condition viewed different versions of

the video simultaneously in pairs, and were led to believe that they were viewing the same video clip as their co-witness. They viewed the video on different screens opposite each other so that they were unable to see the screen that their partner was watching.

After the video, witnesses were told to imagine that they had just seen a suspected crime and were waiting for the police to arrive. All witnesses completed a questionnaire, on the pretext of rehearsing their memory whilst waiting for the police. Witnesses in the control condition completed the questionnaire individually. Participants in the co-witness condition completed the same questionnaire with their co-witness, and were asked to discuss the event together and provide the most accurate collaborative answer in the questionnaire. The questionnaire was the same as that used by Gabbert *et al.* (2003). It contained a free-recall question asking witnesses to recall all they could about the sequence of events and actions from the video, followed by eight specific questions (e.g. “Was the girl left or right handed?”), followed by an additional final question asking participants whether or not they could provide any evidence of the girl’s guilt (or innocence) from what they had witnessed in the video.

All participants then completed an unrelated filler task for 30 minutes before completing another recall questionnaire individually. Participants were asked to imagine that the police had now arrived and that they should complete the questionnaire as accurately as possible as if they were real witnesses providing information about what they had seen personally. This questionnaire, which we term the witness “statement”, asked for a free-recall account of the video, followed by a further eight questions. Four of these questions referred to the four critical details. The other four questions were about unrelated (neutral) details. Two of the critical

questions probed for information only available from the perspective A video: The title of the book, and the girl screwing up a note and throwing it in the bin. Two questions probed for information that was only available from the perspective B video: Any jewellery the girl was wearing, and whether she put the money into her pocket. Confidence in the answer to each question was measured using a 7-point confidence rating.

After a delay of approximately 4 weeks (*mean* = 25 days) witnesses returned for the cross-examination stage. Three trainee-barristers (2 males, 1 female) on the Bar Vocational Course at the College of Law, London, independently cross-examined a subset of participants each at Goldsmiths College. An audio recording of each cross-examination was made. The experimenter was present but remained silent and impartial.

For each witness, the barrister was given a copy of their free-recall witness statement made at the end of the first experimental session, the witness' answer to each of the four critical questions, and as appropriate the co-witness's answer. Thus the barristers saw the information that the witnesses gave after discussion in the co-witness condition. The barristers were instructed that it would be beneficial to their client's interest if the witness changed their answer to the alternative (from the different perspective video). They were told what the desired response was, and that the witness may have discussed the video with a co-witness. They were not told that there were two different versions of the crime video. The barristers were asked to use the same techniques that they would use in court to elicit the desired response from the witness. Each witness was given the opportunity to read over their witness statement ten minutes prior to their cross-examination interview.

At the start of the cross-examination the barrister invited the witness to give a free-recall account of what they had witnessed in the video. The only prompt used by the barrister at this part of the interview was “can you tell me anything else?” This simulated evidence-in-chief, which would normally be elicited by the barrister of the opposing side (prosecution or defence, depending which side had called the witness). When the witness ceased to provide further information, the cross-examination began. Witnesses were questioned on the four specific (critical) questions. When the cross-examination was finished, the participants were asked if they were suspicious as to the purpose or manipulations involved in the study at any point. None had suspected that two different versions of the video were used in the co-witness condition. They were fully debriefed. The procedure was approved by the Goldsmiths Psychology Department Ethical Committee, and conformed to the British Psychological Society ethical code of practice.

Results

To maintain the ecological validity of the cross-examination the barristers were free to use any strategy they might use in court. A quantitative analysis of the memory performance is presented followed by a qualitative description of questioning strategy.

Co-witness influence

Seventy-three percent of participants in the co-witness condition incorporated at least one item that could only have been acquired from their co-witness into their statement and responses to critical questions made at the end of the initial experimental session. In comparison, none of the witnesses in the control condition incorporated these details into their statement. There was a significant association between experimental condition and the number of unseen critical items reported (χ^2

(1) = 12.57, $p < .001$, $\phi = .76$). Witnesses were asked to indicate their confidence in each answer on a 7-point scale. Mean confidence data are reported in Table 1. A 2x2 mixed ANOVA with type of response (correct vs. incorrect) to all questions (critical and neutral) as a repeated measure and experimental condition as a between-participant factor, revealed that confidence of correct answers (mean = 5.36) was greater than confidence of incorrect answers (mean = 4.08), $F(1, 18) = 13.33$, $p < .005$, $\eta^2 = .43$. There was no main effect of condition, $F(1, 18) = .64$, $p = .43$, $\eta^2 = .03$, nor was there a type of response x condition interaction for confidence, $F(1, 18) = .002$, $p = .96$, $\eta^2 = .00$. Mean confidence of ten participants in the co-witness condition in their correct answers to critical questions alone (mean = 5.15) was higher than to their incorrect answers to critical questions alone (mean = 4.50). This difference was not statistically significant. Data from one participant in the co-witness condition were excluded as they did not give any incorrect answers. Only four participants in the individual condition gave any incorrect responses to critical questions, therefore data from this condition was not included in this comparison.

Insert Table 1.

Effect of cross-examination

Under cross-examination the majority (73%) of witnesses changed an answer from their statement on at least one of the critical questions by fully acquiescing to the barrister that an alternative answer was correct. The number of changes made by individual witnesses (maximum = 4) was distributed as follows; 36% changed one answer, 23% changed two answers, 14% changed three answers, but none changed all four answers. Sometimes a witness will accept the possibility that they are mistaken and that the account provided might be true, without fully acquiescing. If this response is counted as a change of testimony, 84% of witnesses changed their

testimony; 4 % changed one answer, 32% changed two answers, 36% changed three answers, and 14% changed all four answers.

To analyse the effects of cross-examination and experimental condition, witnesses were given two points for each of the four critical questions they answered correctly in their statement. If a participant had failed to mention an item (e.g. the girl was wearing a watch) in response to critical question in their statement questionnaire (e.g. 'describe any jewellery the girl was wearing') but they had mentioned the detail in their free-recall, their answer to the specific question was coded as correct. If during cross-examination the witness completely acquiesced to the barrister and accepted that the alternative account put to them was correct, two points were added to their statement score if the change was towards accuracy, or deducted if the change was away from a formerly accurate response. If the witness accepted that their recollection might be wrong and that the alternative proposed by the barrister was possibly correct, one point was added or subtracted as appropriate. This coding system was used by Zajac and Hayne (2003). The data are illustrated in Figure 1 panel A.

The number of accurate responses was subjected to a 2 x 2 x 2 mixed ANOVA. Time of recall (statement vs. cross-examination) was a repeated measure. Experimental condition and perspective of the video viewed were between-participant factors. The data met the assumption of sphericity (Mauchly's $W = 1$). The effect of the time of recall had a large effect size, $F(1, 18) = 16.50, p < .001, \eta^2 = .48$. The statement accuracy score of 6.3 fell to 4.7 after cross-examination. The effect of experimental condition was mid-way between a small and a medium effect size, although it just failed to reach a conventional level of statistical significance, $F(1, 18) = 4.01, p = .061, \eta^2 = .18$. Recall was more accurate by participants in the individual

condition than in the co-witness condition (5.95 vs. 5.05). The interaction between time of recall and experimental condition had a large effect size, $F(1,18) = 7.95$, $p < .05$, $\eta^2 = .31$. Within the co-witness condition accuracy decreased from 5.3 to 4.8; in the individual condition it decreased from 7.3 to 4.7. Statement recall was more accurate amongst participants who viewed the video alone compared to those who had an opportunity to talk to a co-witness. This difference between experimental conditions was eliminated after cross-examination. Therefore, cross-examination reduced the accuracy of participants in the individual condition, who had a high level of accuracy in their statement, but had no effect on the accuracy of witnesses who had been exposed to misleading information. There was no effect of perspective viewed, $F(1,18) = .58$, $p = .46$, $\eta^2 = .03$, nor was there a time x view interaction, $F(1,18) = .91$, $p = .35$, $\eta^2 = .05$, or time x condition x view interaction, $F(1,18) = .36$, $p = .56$, $\eta^2 = .02$.

A 2 x 2 x 2 mixed ANOVA of the data on changes made under cross-examination with view (Version A vs. Version B) and experimental condition as between-participant factors and the visibility of details (seen vs. unseen) as a within-participant factor yielded no significant effects (all F ratios < 1 , $\eta^2 = .026$). Therefore there was no evidence that testimony on unseen details was more susceptible to cross-examination (net change in accuracy -.96) than testimony on seen details (net change in accuracy -0.59). A similar analysis that compared changes in accuracy from cross examination on questions about peripheral details (the title of the book and the jewellery worn, net change in accuracy -1.00) and central action (throwing a note in the bin and stealing the money; net change in accuracy -.55) also showed no effects (all F ratios < 1 , $\eta^2 = .029$).

Bearing in mind the theft scenario shown in the video, it could be argued that a witness who admitted the possibility of error and accepted that an alternative account

was possible, may be making a realistic meta-memory judgement rather than necessarily making an error. To address this issue accuracy scores after cross-examination were re-calculated by only making changes (by 2 points) when the witness showed full acquiescence to the barrister's alternative account. No change to their statement score was made if the witness only acknowledged the possibility that the version suggested by the barrister may be correct. As the perspective of the video viewed had no effect in the first analysis, data were collapsed across versions for subsequent analyses. These data met the assumption of sphericity (Mauchly's $W = 1$) and are illustrated in Figure 1 panel B. A mixed ANOVA showed that the time of recall had a large effect size, $F(1, 20) = 9.76, p < .01, \eta^2 = .33$. The statement accuracy score of 6.3 fell to 5.3 after cross-examination overall. The effect of experimental condition had a medium effect size, $F(1, 20) = 7.40, p < .05, \eta^2 = .27$. Recall was more accurate by participants in the individual condition than in the co-witness condition (6.4 vs. 5.1). The interaction between time of recall and experimental condition had a small-to-medium effect size but just failed to reach statistical significance, $F(1, 20) = 3.95, p = .06, \eta^2 = .16$. Within the co-witness condition accuracy decreased from 5.3 to 4.9; in the individual condition it decreased from 7.3 to 5.6. Use of the revised coding system led to some changes in the pattern of statistical significance, however there remained a large effect of cross-examination of reducing the accuracy of testimony. The main difference is that the participants in the individual condition scored better after cross-examination under the revised scoring system, suggesting that witnesses who viewed the video alone were proportionately more likely to admit the possibility of error without full acquiescence.

If cross-examination is effective it should induce witnesses to change more formerly inaccurate answers than formerly accurate answers. In order to examine

whether this is the case the proportion of correct answers changed and the proportion of incorrect answers changed were compared as a function of experimental condition. A 2 x 2 mixed ANOVA was conducted with the initial accuracy of answer (correct vs. incorrect) as a repeated measure and experimental condition (individual vs. co-witness) as a between-participant factor. There were no significant effects. The largest effect size was the interaction between experimental condition and initial accuracy, $F(1,20) = 2.76, p = .11, \eta^2 = .16$. There was a trend for witnesses in the individual condition to change a greater proportion of accurate than of inaccurate answers (.46 vs. .27), whereas the trend for witnesses in the co-witness condition was to change fewer accurate than inaccurate answers (.37 vs. .48).

Finally, we consider the question of whether participants in the individual condition are any more or less likely than the participants in the co-witness condition to change their responses to the critical questions as a result of the cross examination regardless of the accuracy of the change. The mean number of critical questions to which witnesses made a full acquiescence under cross-examination did not differ between the individual and the co-witness conditions (mean = 1.36 [s.d.= 1.03] vs. 1.09 [s.d. = 1.04] respectively), $t(20) < 1$. Similarly the mean number of critical questions to which witnesses made any change under cross-examination did not differ between the individual and the co-witness conditions (mean = 2.36 [s.d.= 1.03] vs. 2.27 [s.d. = 1.42] respectively, $t(20) < 1$).

Strategies and questioning style

When first asked about a topic the witness invariably repeated the answer they had given previously. This is unsurprising because the witness had just read their statement. The barristers invariably followed the same strategy to cross-examine each witness. First the barrister feigned surprise by the answer (e.g. “Really? You didn’t

see the title at all?”). This question may have been repeated or probed several times. Next the barrister would develop this theme. “The title of the book was clearly visible, correct?” or “Your co-witness was very clear in recalling the title. I think she is correct.” If the witness did not acquiesce, the barrister would deploy an additional argument. “You saw the jewellery the girl was wearing, why did you not see the title of the book?” Next the barrister may offer the desired answer. “If I tell you the name of the book, would that help? Does ‘*Memory Disorders*’ ring a bell?” Finally, if the witness still had not acquiesced, the barrister would suggest that his or her own version of events is plausible and the witness simply fails to remember it.

Most questions asked were leading questions. Many were statements with which the witness was invited to agree by tagging “correct?” or “yes?” to the end. Other types of questions asked included closed questions (e.g. “Is she right-handed?”); and questions containing double negatives were asked (e.g. “So you can’t say she didn’t take the money?”). Negative feedback was frequently used (e.g. “I don’t think any crime was visible. I think you assumed she took it.”). Examples of answers in each of the categories (no change, partial acquiescence and full acquiescence) are given in Appendix 1.

Discussion

Some witnesses who watched a video had the opportunity to discuss the event with a co-witness who, unknown to the witnesses, had seen a video that differed on four critical details. All witnesses then answered questions about what they had seen personally. The experimental manipulation was successful in evoking memory conformity errors. Almost three-quarters of witness included at least one detail which they could only have acquired from their co-witness. The observation that none of the witnesses who viewed the video alone, and did not talk to a co-witness, included any

of the critical details from the alternative version of the video in their account, provides strong support for influence from the co-witness as the source of these memory errors. These results provide further evidence of co-witnesses as potentially powerful sources of suggestion on eyewitness testimony. The data replicate effects previously reported in the literature of memory conformity (Gabbert et al, 2003; Patterson & Kemp, 2006)

Approximately four weeks after viewing the video all witnesses were cross-examined by a barrister on their answers to each of the critical details that differed in the two versions of the video. Each witness had the opportunity to read through their statement. After being invited to describe what they saw in their own words, each witness was cross-examined as a hostile witness by a barrister, who attempted to elicit the alternative answer from the witness. The barristers were very successful: Almost three-quarters of witness changed at least one answer, fully accepting that the alternative version proposed by the barrister was true, and more than a third of all witnesses changed more than one answer under cross examination. As many as 84% of witnesses accepted at least once that they may be mistaken, and 68% made this concession on two or three occasions.

The experiment found no evidence that witnesses were more likely to make commission errors (report something they didn't see) or omission errors (fail to report something they did see) under cross-examination, nor were they more likely to make errors on peripheral than on central details. However, the analyses relied on only two questions of each type. In future research more powerful experimental designs may be able to increase understanding of the effect of cross-examination by teasing apart effects of this nature.

The results showed that after a delay of just 4 weeks eyewitness testimony can be remarkably fragile. Cross-examination is extremely effective in manipulating witnesses' testimony. Eyewitness testimony did not become more accurate as a result of cross-examination, as has been assumed by some legal professionals (Stone, 1988). Witnesses were as likely to change a correct answer to an inaccurate one as they were to change an inaccurate answer to an accurate one. It has previously been demonstrated that children make many changes to their testimony in response to cross-examination, and young children are as likely to change initially correct as initially incorrect answers (Zajac & Hayne, 2003; 2006). The older children (9-10 year-olds) studied by Zajac and Hayne (2006) changed fewer correct than incorrect answers.

The present report shows that young adults are highly likely to change their answers under cross-examination. In fact, young adults who had not been exposed to misleading information showed a substantial decrease in their accuracy of their testimony as a result of cross-examination. These witnesses reported more accurate memories in their statement, and therefore were expected to have been more resistant to suggestion in cross-examination. Even under conditions that favour accurate eyewitness memory, cross-examination reduced the accuracy of testimony. Witnesses who had been exposed to misleading information showed no difference in the number of correct and incorrect answers they changed. However, these witnesses gave more incorrect answers in their statement, and changed many of their answers (both formerly correct and incorrect) under cross-examination. Statistically they had more opportunity to change incorrect answers than did the witnesses who were not exposed to misleading information. The difference in the effect of cross-examination on the testimony of witnesses exposed to misleading information and those who were not,

may be attributable to the low level of accuracy in the statement prior to cross-examination of 'misled' witnesses (i.e. a 'floor' effect for the witnesses in the co-witness condition). A similar result was reported by Zajac and Hayne (2003) and Zajac and Hayne (2006).

From a psychological perspective it is unsurprising that cross-examination has a negative effect on accuracy of testimony. The barristers in the present study made extensive use of social pressure (e.g. negative feedback by feigned surprise that a witness did not see some aspect, pointing out that their co-witness saw it) and leading questions. Both factors have been shown to reduce the accuracy of eyewitness testimony (e.g. Patterson & Kemp, 2006; Schooler & Loftus, 1986). The testimony given under cross-examination might reflect a memory distortion as a result of suggestion from misleading information, or it might result from compliance to social pressure. Future research should include a follow-up after cross-examination, when witnesses are again asked to give their own free recall and answer specific questions. If the change in testimony resulted from memory distortion the changes made during cross-examination should persist because the witness has changed their belief of what they remember. In the alternative, if the change in testimony was a result of compliance to social pressure, the witnesses' answer should revert to their initial answers in a follow-up because the social pressure of cross-examination has now been removed.

It has been postulated that cross-examination cannot mislead an honest witness (e.g. Stone, 1988). Earlier research has challenged this belief for vulnerable witnesses, including children and witnesses with learning difficulties (Kebbell *et al.*, 2004; Zajac & Hayne, 2003, 2006, Zajac *et al.*, 2003). The data reported here show that adult witnesses are misled by cross-examination. The effect of cross-examination was

particularly marked for witnesses who had not previously encountered misleading information, who changed more correct answers than incorrect answers from their statement. Even witnesses who were exposed to misleading information from a co-witness prior to cross-examination, were as likely to change correct answers from their statement as they were to change incorrect answers.

The evidence reported here shows that cross-examination can impair the accuracy of adult eyewitness testimony, and that honest witnesses can be misled by cross-examination. Limitations of the present study should be carefully considered before generalising the findings to the courtroom. Participants testified about a video event. Witnesses may be less likely to be misled if they participated in the events about which they were cross-examined. Evidence from child witnesses shows that participation is no safeguard against the malign effects of cross-examination (Zajac et al., 2003, Zajac & Hayne, 2003, 2006), but this issue remains to be investigated with adult witnesses. The testimony of participants in the study reported here had no real-world consequences. It is possible that witnesses may be less susceptible to coercive tactics under circumstances where their testimony is potentially highly consequential.

Trainee barristers participated in this research as a means to enhance the ecological validity of the cross-examination. In future research, ecological validity could be further enhanced if the direct examination was carried out by a different person, so that the barrister did not conduct the direct examination before switching to a cross-examination role. In court, counsel for the side that called the witness is entitled to re-examine a witness about new issues that arose during cross-examination. Contradiction of evidence-in-chief during cross-examination is an example of such an issue. Re-examination could be incorporated into an experiment designed to test whether the witness' recollection has been changed by the cross-examination or if the

witness merely complied with the social pressure but continues to hold their original interpretation of events.

It could be argued that the most important application of cross-examination is to distinguish honest from dishonest witnesses. This issue was not addressed in the present study. The effectiveness of cross-examination in exposing witnesses who deliberately attempt to deceive should be the subject of future research.

A co-witness paradigm was used in the research reported because it was thought that adult witnesses may be less likely to change their testimony if there was no potential source of misleading information. The results showed that exposure to misleading information was not necessary for witness testimony to be affected by cross-examination. In the event, it was found that the accuracy of witnesses who were not exposed to misleading information showed a greater negative impact from cross-examination. The same result was found with child witnesses by Zajac and Hayne (2003, 2006). These data suggest that future studies of cross-examination would not need to incorporate a strategy for presenting post-event misleading information prior to cross-examination.

REFERENCES

- Coxon, P. & Valentine, T. (1997). The effects of age of eyewitnesses on the accuracy and suggestibility of their testimony. *Applied Cognitive Psychology*, 11, 415-430
- Gabbert, F., Memon, A., & Allan, K. (2003). Memory conformity: can eyewitnesses influence each other's memories for an event? *Applied Cognitive Psychology*, 17, 533-543.
- Gabbert, F., Memon, A. & Wright, D. B. (2006). Memory Conformity: Disentangling the steps toward influence during a discussion. *Psychonomic Bulletin & Review*, 13, 480-485.
- Holliday, R. E., Brainerd, C. J., Reyna, V. E. & Humphries, J. E. (2009). The cognitive interview: Research and Practice across the Lifespan. In: Bull, R., Valentine, T. & Williamson, T. (eds.) *Handbook of psychology of investigative interviewing: Current developments and future directions*. Chichester: Wiley-Blackwell (pp. 137-160).
- Kebbell, M. R., Deprez, S., & Wagstaff, G. F. (2003). The direct and cross-examination of complainants and defendants in rape trials: a quantitative analysis of question type. *Psychology, Crime & Law*, 9, 49-59.
- Kebbell, M. R., Hatton, C., & Johnson, S. D. (2004). Witnesses with intellectual disabilities in court: what questions are asked and what influence do they have? *Legal and Criminological Psychology*, 9, 23-35.
- Loftus, E. F. & Hoffman, H. G. (1989). Misinformation and memory: The creation of new memories. *Journal of Experimental Psychology: General*, 1, 100-104.

Loftus, E. F., Miller, D.G. & Burns, H.J. (1978). Semantic integration of verbal information into a visual memory. *Journal of Experimental Psychology: Human Learning & Memory*, 4, 19-31.

Loftus, E. F. & Palmer, J. C. (1974). Reconstructions of automobile destruction: An example of the interaction between language and memory. *Journal of Verbal Learning and Verbal Behavior*, 13, 585-589.

Loftus, E. & Zanni, G. (1975). Eyewitness testimony: The influence of wording of a question. *Bulletin of the Psychonomic Society*, 5, 86-88.

Moses, R. (2001). Cross-examination in criminal cases.

<http://criminaldefense.homestead.com/Cross.html> [2/12/2009]

Odinot, G., Wolters, G. & Lavender, T. (2009). Repeated partial eyewitness questioning causes confidence inflation but not retrieval –induced forgetting. *Applied Cognitive Psychology*, 23, 90-97.

Patterson, H. M. and Kemp, R. I. (2006). Comparing methods of encountering post-event information: The power of co-witness discussion. *Applied Cognitive Psychology*, 20, 1-17.

Perry, N. W., McAuliff, B. D., Tam, P., Claycomb, L., Dostal, C., & Flanagan, C. (1995). When lawyers question children. Is justice served? *Law and Human Behavior*, 19, 609-629.

Read, J. D., Connolly, D. A., Toglia, M. P., Ross, D. F., & Lindsay, R. C. L. (2007). The effects of delay on long-term memory for witnessed events. In *The handbook of eyewitness psychology, Vol I: Memory for events*. (pp. 117-155).

Mahwah, NJ US: Lawrence Erlbaum Associates Publishers.

Roper, R., & Shewan, D. (2002). Compliance and eyewitness testimony: Do eyewitnesses comply with misleading 'expert pressure' during investigative interviewing? *Legal and Criminological Psychology, 7*, 155-163.

Schooler, J. W. & Loftus, E. F. (1986). Individual differences and experimentation: Complementary approaches to interrogative suggestibility. *Social Behaviour, 1*, 105-112.

Stone, A. A. (1988). Psychiatry and the law. In: Nicholi, A. M. *The new Harvard guide to psychiatry* (pp. 797-827). Cambridge, MA, England: Belknap Press.

Wright, D. B., & Loftus, E. F. (1998). How misinformation alters memories. *Journal of Experimental Child Psychology, 71*, 155-164.

Wright, D. B. & Stroud, J. (1998). Memory quality and misinformation for peripheral and central objects. *Legal and Criminological Psychology, 3*, 273-286.

Zajac, R., Gross, J., & Hayne, H. (2003). Asked and answered: questioning children in the courtroom. *Psychiatry, Psychology and Law, 10*, 199-209.

Zajac, R. & Hayne, H. (2003). I don't think that's what really happened: The effect of cross-examination on the accuracy of children's reports. *Journal of Experimental Psychology, Applied, 9*, 187-195.

Zajac, R. & Hayne, H. (2006). The negative effect of cross-examination style on questioning on children's accuracy: Older children are not immune. *Applied Cognitive Psychology, 20*, 3-16.

Acknowledgement.

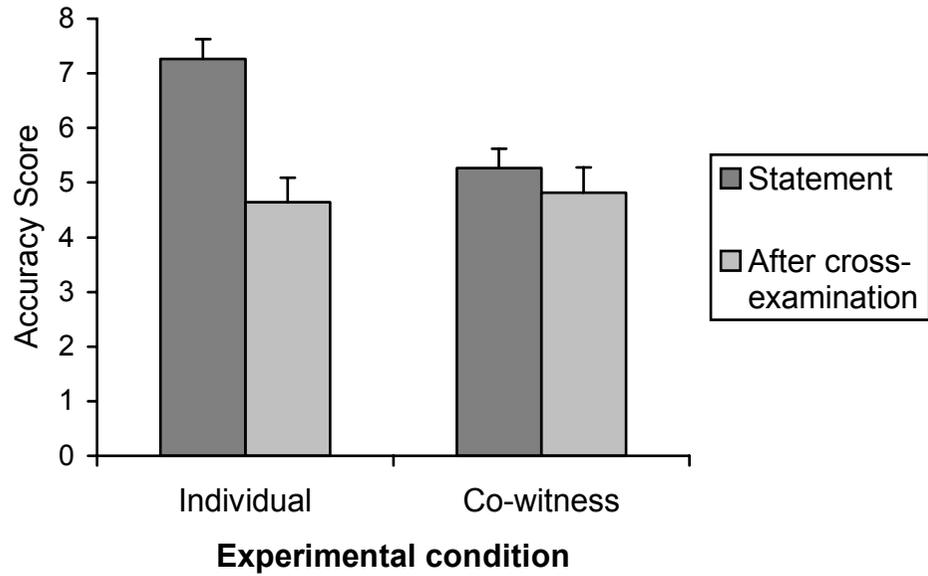
We thank Dr Fiona Gabbert for kindly providing the video material and questionnaire.

	Correct answers	Incorrect answers	Critical questions only	
			Correct answers	Incorrect answers
Individual witnesses	5.25 (.66)	3.95 (1.36)	5.17 (.80)	-
Co-witnesses	5.46 (.58)	4.20 (1.25)	5.15 (1.07)	4.50 (1.71)
Total	5.36 (.61)	4.08 (1.27)	-	-

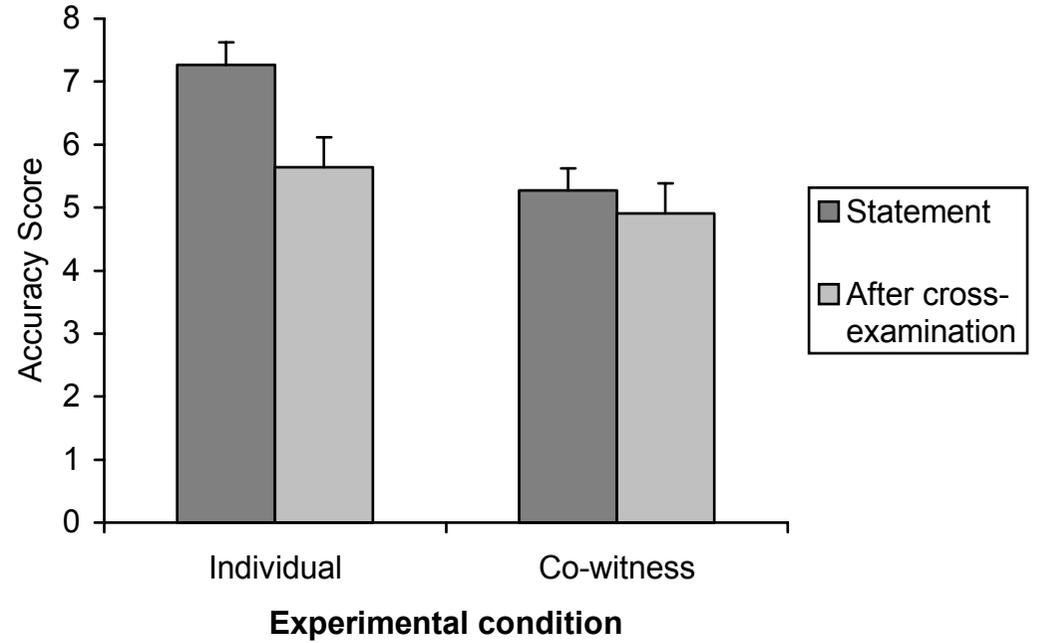
Table 1: Mean confidence and standard deviation (in parentheses) of answers as a function of accuracy and experimental condition. Note: Mean confidence for incorrect answers of participants in the individual condition are not included because only four participants gave any incorrect answers to the critical questions.

Figure captions.

Figure 1. Accuracy scores (maximum = 8) as a function of experimental condition (individual viewing vs. co-witness) before and after cross-examination. Error bars are standard error of the mean.



Panel A



Panel B

Appendix 1. Examples of witnesses' degree of change to testimony.

1. Witness does not acquiesce to suggestion.

Barrister: When the girl took out the book, you couldn't see the title?

Witness: Yes, I could

Barrister: At what stage could you see the title?

Witness: When the girl put the book on the table

Barrister: You're a student here, aren't you?

Witness: Yes

Barrister: And you come across quite a lot of text books, don't you?

Witness: Yes

Barrister: And you recognise quite a lot of them?

Witness: Yes

Barrister: And "Memory Disorders" is quite a common subject for a psychology text book. You would come across this sort of title quite a lot. I think you are mistaken.

Witness: No, it was definitely called "Memory Disorders" in the video

Barrister: Is it possible that you might be mistaken, it was several weeks ago?

Witness: No, I am definitely not mistaken.

2. Witness accepts that the suggestion is possible

Barrister: The girl knew the money was in the drawer?

Witness: Yes.

Barrister: So why would she have gone back to the draw unless it was to take the money out?

Witness: I don't know.

- Barrister: It's possible she took the money from the wallet at the time?
- Witness: I didn't actually see her take the money out.
- Barrister: Whilst her back was to you. How long was this for?
- Witness: Somewhere between 15 and 30 seconds.
- Barrister: The drawer was open during this time, correct?
- Witness: Yes.
- Barrister: It's quite possible then that she took the money and put it in her pocket during this time, correct?
- Witness: No. I didn't see this.
- Barrister: But her back was to you?
- Witness: Yes.
- Barrister: So it is possible she did take the money out?
- Witness: Well, it's possible but it would have been something very small.
- Barrister: Would it be fair to say that if she took something it would have been quickly then, yes?
- Witness: Possibly.
- Barrister: If she was somebody who was good at stealing, she would have got away with it, yes?
- Witness: Yes
- Barrister: So you can't say she's not guilty then?
- Witness: No
- Barrister: So it's possible she took the money quickly and you are mistaken?
- Witness: It's possible.
- Barrister: It's possible that you can't remember exactly what happened and she might have taken the money?

Witness: It's possible, yes.

3. Witness acquiesces with suggestion.

Barrister: But what about the crumpled note that she put in the bin?

Witness: I'm not sure I saw that happen

Barrister: But you saw her write the note?

Witness: Yes

Barrister: And then you saw her screw it up, to avoid anyone catching her?

Witness: Um, yes, I think I did see her screw it up actually

Barrister: Your co-witness didn't comment on her throwing it in the bin either did she? She has probably influenced you, yes?

Witness: Yes that's possible

Barrister: Which is why you failed to mention her throwing the note away earlier?

Witness: I think so

Barrister: So you did, in fact, yourself see the girl throw the note in the bin didn't you?

Witness: Yes, because she didn't want to get caught; I saw her throw the note away