APPLIED COGNITIVE PSYCHOLOGY
Appl. Cognit. Psychol. **15**: 659–671 (2001)
DOI: 10.1002/acp.739

Simultaneous and Sequential Lineups: Decision Processes of Accurate and Inaccurate Eyewitnesses

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SUMMARY

The cognitive processes and decision-making strategies of eyewitnesses were tested for their predictive qualities in determining the accuracy of identifications from lineups. The sequential lineup presentation was compared with the traditionally employed simultaneous lineup under culprit (target) present and culprit absent conditions. Consistent with previous research the sequential presentation resulted in an equivalent number of correct identifications compared to the simultaneous lineup but reduced false identification rates. Although sequential lineups were found to be associated with the use of absolute strategies, those shown a simultaneous lineup reported the use of both relative and absolute strategies. Accurate identifications and rejections were found to be associated with the use of absolute strategies, irrespective of lineup presentation or presence of target. Also accurate identifications, at least with a sequential lineup, were generally made faster than inaccurate identifications. These results are compared to previous studies with respect to the effect that mode of processing (relative versus absolute judgements) has on a witness's decision making and identification accuracy. Copyright © 2001 John Wiley & Sons, Ltd.

Despite the fact that eyewitness testimony is one of the most persuasive factors for jurors when deciding the guilt or innocence of a suspect, it is also a potentially fallible factor (e.g. Huff, 1987; Rattner, 1988). In 1998, Wells *et al.* reported on 40 cases in the United States involving men who were wrongfully convicted of sexual assaults, and who were later exonerated by DNA evidence. Ninety per cent of these false convictions involved eyewitness identification in which one or more eyewitness incorrectly identified the person. Though psychologists have been able to recommend procedures that have been found to reduce the level of such false identifications (e.g. Lindsay, 1999; Wells *et al.*, 1998), they remain a significant concern (e.g. Pozzulo and Lindsay, 1998; Searcy *et al.*, 1999). Therefore research is still needed to determine why false identifications occur. One suggestion is that the nature of identification procedures adopted may actually bias eyewitness accuracy through their influence on the decision strategies utilized by the witness.

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Received 16 November 1999
Revised 15 May 2000
Accepted 30 May 2000

SIMULTANEOUS VERSUS SEQUENTIAL LINEUPS

The most commonly used lineup procedure in the United States (Wogalter *et al.*, 1993) and Western Europe (McKenzie and Dunk, 1999) is the simultaneous lineup, where the suspect and other lineup members are all in view at the same time, either in person (e.g. UK) or via photospreads (e.g. USA). Accordingly, the witness can directly compare one face with another. Research has, however, indicated that the use of the simultaneous lineup results in a high number of false identifications, which arise because of the use of a relative judgement strategy (Lindsay *et al.*, 1991; Lindsay and Wells, 1985; Wells, 1984). Here, the eyewitness 'selects the member of the lineup who most resembles the eyewitness's memory of the culprit relative to the other members of the lineup' (Wells and Seelau, 1995, p. 768). When the perpetrator is in the lineup, a relative judgement strategy should be an effective and acceptable strategy; the actual perpetrator ought to be the one who most resembles the eyewitness's memory of the perpetrator relative to others in the lineup. However, when the actual perpetrator is missing from the lineup, a relative judgement strategy could lead to an innocent suspect or foil being chosen and possibly charged.

Although not widely used in real-world identification tasks, research has shown that the sequential mode of presentation, where suspects and foils are presented one at a time, may produce better results. Compared to simultaneous lineups, sequential presentation does not significantly influence the rate of correct identifications but does significantly lower the rate of false identifications, particularly in target absent conditions (e.g. Cutler and Penrod, 1988; Lindsay *et al.*, 1991; Lindsay and Wells, 1985). This decrease in the levels of false identification is thought to be due to the sequential lineup promoting the use of an absolute decision strategy. In the case of lineup identifications, absolute judgements follow where the eyewitness compares each lineup member to their memory of the perpetrator and uses some criterion threshold in order to decide whether the person is, or is not, the actual culprit. This decision process normally happens very rapidly.

WITNESSES REPORTING OF RELATIVE AND ABSOLUTE DECISION STRATEGY USAGE

The relative/absolute distinction in decision making was investigated by Lindsay *et al.* (1991), who compared simultaneous and sequential lineups in which the target was either absent (TA) or present (TP). They asked participants to note on a 7-point scale whether they had used a relative or absolute judgement process when making their identification decision. The results suggested that participants given a sequential lineup relied on 'absolute' judgements significantly more often than those given a simultaneous lineup. Target presence/absence in the lineup did not significantly influence this pattern of decision making strategies.

Similary, Dunning and Stern (1994) suggested that decision-making processes may actually be useful in determining accuracy of identification. Using data collected from questionnaires that specifically asked participants about their decision-making processes, Dunning and Stern found that accurate witnesses were much more likely to endorse a greater number of automatic recognition responses than inaccurate witnesses. For example, participants often reported that the face they had chosen had 'popped-out' at them, or that they 'just recognized the target' but could not explain why. Inaccurate

witnesses, however, often reported using explicit, deliberative procedures, often involving a process of elimination. In this sense, decision-making strategy may be a valuable postdictor of identification accuracy. Unfortunately, in all their studies, Dunning and Stern only used simultaneous lineups. Consequently, it is not clear what decision-making processes would be reported by participants presented with a sequential lineup. In addition, it remains to be seen whether these processes would be indicative of an accurate decision.

DECISION TIMES AND POSTDECISION CONFIDENCE AS ASSESSMENT VARIABLES

While some studies have obtained information regarding the use of absolute and relative decision making strategies from indirect self-report data (e.g. Lindsay *et al.*, 1991), others have used more direct measures such as decision times (e.g. Sporer, 1993). Sporer (1993) found that witnesses who correctly chose the target in a sequential lineup did so significantly quicker than those who falsely identified a lineup foil. However for lineup rejections, decision speed was unaffected by the accuracy of the witness. On the basis of these results, Sporer suggested that decision time could be used as an indicator of accuracy, but only for those witnesses who have chosen someone from the lineup (Sporer, 1994). He also suggested that such findings provided some support for the relative/absolute distinction of decision-making strategies in lineup decisions. Those witnesses who made a correct identification apparently recognized the culprit in the lineup very quickly and automatically, suggesting that they used an absolute judgement strategy. On the other hand, those who falsely identified an innocent foil took much longer, which suggested the use of a relative strategy, comparing each lineup member with the others before reaching their decision (Sporer, 1993).

Since Sporer's study, the hypothesis that the speed of the decision reflects the utilized decision process has gone unchallenged. Therefore, one of the aims of the present study was to test the relationship between decision time, lineup presentation mode and identification accuracy systematically.

As well as decision times, Sporer (1993) also investigated the confidence of the witnesses decision. While many studies have shown that confidence is generally unrelated to accuracy (e.g. Bothwell *et al.*, 1987; Smith *et al.*, 1989), Sporer (1993) found that correct choosers were more confident than those who had incorrectly chosen an innocent suspect or foil. Non-choosers were also found to be more confident than those who had incorrectly rejected a TP lineup. The present study will also investigate the confidence–accuracy relationship of choosers and non-choosers.

PROFILE OF ACCURATE AND INACCURATE WITNESSES

The aim of the present research was to examine the underlying cognitive processes that might help discriminate accurate from inaccurate witnesses. Both simultaneous and sequential lineups were investigated and the presence/absence of the target in the lineup was manipulated. It was predicted that the sequential lineup would result in fewer false identifications, particularly when the target was absent from the lineup, while maintaining

an equivalent number of correct identifications to a simultaneous lineup (see Lindsay *et al.*, 1991; Lindsay and Wells, 1985). In addition, based on the findings of Dunning and Stern (1994) and Sporer (1993) it is predicted that witnesses making accurate positive identifications will: (a) report that their decisions were a product of automatic recognition (i.e. an absolute decision-making strategy), (b) reach their decisions more quickly than inaccurate witnesses and (c) will be more confident in their decisions. In contrast inaccurate witness identifications will be associated with a relative decision-making strategy (i.e. witnesses will report using an elimination process) and longer response latencies.

METHOD

Participants

Seventy-two participants (26 males and 46 females) took part in the study. These were drawn from an undergraduate population, and from psychology students at a local sixth form college.[1] The participants ranged in age from 16 to 40 years, with a mean age of 18.8 years. All faces used in the lineups were unfamiliar to the participants.

Design

A 2×2 between-subjects design was employed, where the factors were lineup presentation mode (simultaneous or sequential) and presence of target in the lineup (present or absent). Participants were randomly allocated to one of the four experimental conditions. A number of dependent measures were recorded:

Accuracy of identification
In Target Present (TP) lineups, the participant could make a correct identification (hit), an incorrect identification of a distractor (a false positive identification), or decide that the target was absent from the lineup (an incorrect rejection of the lineup). In Target Absent (TA) lineups, the participants could either correctly reject the lineup, or make an incorrect false positive identification of a distractor.

Decision times
For simultaneous lineups, decision time was defined as the time taken between the lineup being uncovered to the time that the participant verbally identified an individual, or rejected the lineup. A mean decision time was calculated from the total time taken divided by the number of photographs (6) in the lineup. For the sequential lineup, the time taken for each photograph shown was measured, by stopwatch, from the time that each photograph was uncovered, to the time that the participant verbally gave their decision as to whether or not the photograph shown was that of the target. For sequential non-choosers, a mean rejection time was calculated by dividing the sum of the decision times for the individual faces by the number of faces in the lineup (6).

[1]Analysis was conducted on the decision accuracy of the two groups in order to ascertain whether there was any significant difference in their identification performance. No significant differences were found $\chi^2(1, N = 72) = 1.98$, ns.

Materials

Stimulus event

All participants were shown a video of 60 seconds in length, which depicted a man acting suspiciously in a car park. The man was seen trying the doors of each car in order to see if any were unlocked. The film showed the target from both close range and at a distance, and he was the only person visible throughout the film.

Lineup presentation

Participants were presented with one of four experimental lineup presentations, each consisting of six 8×10 inch coloured photographs consisting of a head and shoulders frontal shot of young males. All photographs were taken using identical background, lighting and distance, and in each the subject wore a white laboratory coat so as to avoid any clothing bias. In the TP condition, as well as the actual target, there were 5 distractors, who had been ranked by independent raters as being visually similar to the target. In the TA condition, the target was replaced by an additional distractor who had been ranked as having the highest similarity of all distractors to the target. In the simultaneous lineup presentation, the six photographs were displayed upon a piece of black card in an array of 3 rows by 2 columns.

Cognitive processes questionnaires

Data regarding the cognitive processes utilised by the participant during the identification procedure were collected via a self-report questionnaire. Two different questionnaires were given depending on whether or not the participant had made a positive choice from the lineup. The questions and their responses were based on those used by Dunning and Stern (1994) and were pilot tested prior to starting the study, with minor modifications made to improve clarity.

Choosers questionnaire

The first question asked the participant how they would best describe their decision-making strategy. The first two responses were indicative of an absolute recognition strategy ('I just recognized him, I cannot explain why', and 'His face just ''popped out'' at me'). The next two responses were indicative of a relative strategy ('I compared the photographs to each other in order to narrow the choices', and 'I first eliminated the ones definitely not him, then chose among the rest'). The remaining responses focused on other aspects of the identification process (e.g. 'I matched the image in my head to the picture in front of me' and 'I based the judgement on specific facial features'). Participants were then asked to indicate their level of confidence that they had correctly chosen the target person, using a 7-point scale (1 being not very confident and 7 being 100% confident). Finally they were asked to describe in their own words, the strategies they used while carrying out the identification task.

Non-choosers questionnaire

The first question ascertained the type of decision process used by those who rejected the lineup. Non-choosers were given the choice of selecting an absolute decision strategy (i.e. 'I tried to match each photograph to my memory of the target person's face, without referring to the other photos shown'), a relative decision strategy (i.e. 'I compared each face shown with the others and arrived at my decision by a process of elimination'), or

neither. They were then asked to indicate their level of confidence that the target was not in the lineup. Finally participants were asked to describe in their own words, the strategies they used while carrying out the identification task.

Procedure

All participants were tested individually and were told that they would be required to watch a short video and complete a questionnaire. They were then asked to watch the stimulus video. After a 15-minute delay, participants were given one of the four lineup procedures. In the simultaneous procedure, participants simply viewed the array of six photographs and gave a verbal decision by reporting either the number of their chosen face or that the culprit was believed absent from the array. The decision time was measured as the elapsed time between the uncovering of the lineup photographs in the simultaneous condition and the participant's decision.

In the sequential lineup condition participants were shown each photograph one at a time. The faces were separated by pieces of card to ensure that, as one photograph was being turned over, the next would not be in view. No clues were given as to how many photographs would be shown, and extra pieces of card were inserted after the last photograph so as to mislead the participant in this respect. This was considered important, as participants may have felt the need to choose someone if they thought that they were nearing the end of the set. For each photograph the participant was required to state whether or not the photograph was of the person in the video, and they were informed that they could not re-examine any photographs. If the participant decided that a photograph matched the target, the procedure was terminated and any remaining photographs were not shown. Hence decision times were recorded for each of the photographs that were actually shown to the participant.

In both types of lineup, the position of the photograph of the target or his replacement was rotated so as to appear in each of the six possible positions, and all participants received unbiased instructions giving them an option to either choose a lineup member or to reject the lineup.

Once the identification task had been completed, participants completed the cognitive processes questionnaire appropriate to their response. The participants were not informed of the accuracy of their identification decision or debriefed about the study until after they had completed this questionnaire.

RESULTS AND DISCUSSION

Identification accuracy

Table 1 shows the percentages and absolute frequencies of accurate and inaccurate decisions in TP and TA lineups as a function of lineup presentation. Overall more correct decisions were made (56.9%) than incorrect decisions (43.1%). An equal number of total correct and incorrect decisions were made by those shown a simultaneous lineup, while the sequential lineup resulted in more correct decisions (63.9%) than incorrect decisions (36.1%). Comparing lineup performance separately for TA and TP conditions, 55.5% of correct identifications (hits) were made in TP lineups. The overall rate of correct rejections of TA lineups was 58.4%.

Table 1. Identification accuracy in simultaneous and sequential lineups as a function of target presence

	Lineup presentation mode			
	Simultaneous		Sequential	
Target	Correct decision	Incorrect decision	Correct decision	Incorrect decision
Present				
%	61.1	38.9	50.0	50.0
Absolute frequency	11	7	9	9
Absent				
%	38.9	61.1	77.8	22.2
Absolute frequency	7	11	14	4
Totals				
%	50.0	50.0	63.9	36.1
Absolute frequency	18	18	23	13

Logit loglinear analysis, using accuracy as the dependent variable, indicated that there were no significant main effects of lineup presentation type ($\chi^2(1) = 1.42$, $p > 0.05$), or of target presence ($\chi^2(1) = 0.06$, $p > 0.05$). However, a significant interaction between lineup presentation and target presence was found ($\chi^2(1) = 4.80$, $p < 0.05$). Separate analysis of Target Absent lineup identification accuracy showed a significant effect of lineup presentation ($\chi^2(1,\ N = 36) = 5.6,\ p < 0.05$), as expected. More correct rejections were found with a sequential lineup (77.8%) compared to a simultaneous lineup (38.9%). Separate analysis of Target Present lineups found no significant difference in accuracy as a function of lineup presentation modes ($\chi^2(1, N = 36) = 1.22$, ns).

In summary these findings show that identification accuracy was moderated by the interaction of lineup presentation and target presence. When the target was present, the simultaneous lineup resulted in slightly more correct identifications than the sequential lineup. However, when the target was absent, compared to the sequential lineup, the simultaneous lineup produced a significantly higher number of false identifications. These findings are consistent with those found in previous studies (i.e. Cutler and Penrod, 1988; Lindsay and Wells, 1985; Sporer, 1993).

The main aim of this study, however, was to determine whether accurate and inaccurate witnesses could be identified by the decision processes and strategies utilised during the identification task. In particular, it was felt to be important to investigate whether the superiority in accuracy rates associated with the sequential lineup was driven by the use of absolute strategies, as the eyewitness literature has suggested.

Lineup presentation type and decision strategy

Participants could report using absolute strategies, relative strategies, a mixture of the two, or neither. Table 2 shows the proportions and frequencies of absolute and relative strategies endorsed as a function of lineup presentation type and decision accuracy. For ease of analysis, the association between lineup presentation type and decision strategies were analysed separately for the use of relative and absolute strategies.

Table 2. Proportion (*N*) of participants endorsing absolute and relative decision strategies as a function of lineup presentation type and accuracy

	Decision strategy			
	Absolute endorsed?		Relative endorsed?	
Lineup presentation	Yes	No	Yes	No
Simultaneous ($n = 36$)				
Accurate	36.1% (13)	13.9% (5)	22.2% (8)	27.8% (10)
Inaccurate	22.2% (8)	27.8% (10)	27.8% (10)	22.2% (8)
Total	58.3% (21)	41.7% (15)	50.0% (18)	50.0% (18)
Sequential ($n = 36$)				
Accurate	47.2% (17)	16.65% (6)	0% (0)	63.9% (23)
Inaccurate	19.5% (7)	16.65% (6)	2.8% (1)	33.3% (12)
Total	66.7% (24)	33.3% (12)	2.8% (1)	97.2% (35)
Totals ($N = 72$)				
Accurate	41.7% (30)	15.3% (11)	11.1% (8)	45.9% (33)
Inaccurate	20.8% (15)	22.2% (16)	15.3% (11)	27.7% (20)
Total	62.5% (45)	37.5% (27)	26.4% (19)	73.6% (53)

Relative strategies

Overall, 26.4% of all participants reported using relative decision strategies, the majority of which were associated with being shown a simultaneous lineup. In fact, of those witnesses shown a sequential lineup, only one witness reported the use of a relative strategy. A highly significant association between lineup presentation type and the use of relative strategies was found, ($\chi^2(1, N = 72) = 20.66$, $p < 0.001$), with significantly more witnesses reporting the use of relative strategies when shown a simultaneous lineup than when shown a sequential lineup. Regarding the accuracy of the decision of those endorsing the use of a relative strategy, 11.1% were found to be accurate and 15.3% were found to have produced inaccurate decisions. Logit loglinear analysis, using accuracy as the dependent variable, found there to be no significant main effects of either relative strategy ($\chi^2(1) = 1.08$, $p > 0.05$), or of lineup presentation type ($\chi^2(1) = 0.2$, $p > 0.05$), and no significant interaction of relative decision strategies with lineup presentation on accuracy ($\chi^2(1) = 1.45$, $p > 0.05$). Therefore, although earlier analysis had shown that simultaneous lineups were significantly associated with the use of relative strategies, it would appear that the use of these strategies had little impact upon the accuracy of the identification.

Absolute strategies

Although more witnesses reported using an absolute strategy when shown a sequential lineup (66.7%) compared to a simultaneous lineup (58.3%), no signification relationship was found for lineup presentation type and absolute strategies ($\chi^2(1, N = 72) = 0.53$, $p > 0.05$). Participants were just as likely to report the use of an absolute strategy when shown a simultaneous lineup as they were if shown a sequential lineup.

Although it was no surprise to find that the sequential lineup encouraged the use of an absolute decision strategy, it was surprising to find that the simultaneous lineup elicited absolute, as well as relative, decision-making strategies. In some cases, participants endorsed using both strategies. For example, one participant reported 'I remembered

features from the video and applied it [sic] to the line up faces in front of me. The one I chose matched the features I remembered and I then compared it to the faces that were in the line up to check it was definitely the one or if there were other possibilities.' With the use of an absolute strategy unexpectedly not being influenced by lineup type, there would be no rationale for expecting the influence of lineup type on accuracy to be moderated or driven by the decision-making style. Consequently no further analysis was pertained. Instead the present results would suggest that superiority in accuracy rates associated with the sequential lineups might not have been due solely to the use of absolute strategies *per se*.

Effect of target presence on decision strategies reported

As with lineup presentation type, the relationship between target presence and decision strategies were analysed separately for relative and absolute strategies. Table 3 shows the proportions and frequencies of absolute and relative decision strategies endorsed as a function of the presence of target in the lineup and decision accuracy.

Relative strategies

Fewer witnesses endorsed the use of a relative strategy when the target was absent from the lineup (19.4%) than when the target was present (33.3%). However, no significant relationship was found between the presence of the target in the lineup and the use of relative decision strategies ($\chi^2(1, N = 72) = 1.79, p > 0.05$). Therefore it was unlikely that any differences in accuracy across TA and TP lineups could be moderated by decision style.

Absolute strategies

Seventy-five per cent of those shown a target absent lineup endorsed the use of an absolute strategy, compared to 50% of those shown a target present lineup. This relationship was found to be significant ($\chi^2(1, N = 72) = 4.8, p < 0.05$). Logit loglinear analysis was then conducted, using accuracy as the dependent variable, to examine the effects of target presence and absolute decision strategies on identification accuracy. A significant main effect of absolute strategy on accuracy was found ($\chi^2(1) = 4.69, p < 0.05$). The main effect of target presence ($\chi^2(1) = 0.12, p > 0.05$), and the interaction of absolute strategy and

Table 3. Proportion (*N*) of absolute and relative decision strategies endorsed as a function of presence of target and accuracy of decision

	Decision strategy			
	Absolute endorsed?		Relative endorsed?	
Lineup presentation	Yes	No	Yes	No
Target present ($n = 36$)				
Accurate	30.6% (11)	25.0% (9)	16.65% (6)	38.9% (14)
Inaccurate	19.4% (7)	25.0% (9)	16.65% (6)	27.8% (10)
Total	50.0% (18)	50.0% (18)	33.3% (12)	66.7% (24)
Target absent ($n = 36$)				
Accurate	52.8% (19)	5.6% (2)	5.6% (2)	52.8% (19)
Inaccurate	22.2% (8)	19.4% (7)	13.8% (5)	27.8% (10)
Total	75.0% (27)	25.0% (9)	19.4% (7)	80.6% (29)

target presence ($\chi^2(1) = 2.31$, $p > 0.05$) were not found to be significant. Those witnesses who reported using an absolute decision strategy were more likely to be accurate, irrespective of whether the target was present or absent in the lineup.

Combined with the earlier findings regarding decision strategy and lineup type, these findings suggest that it is the use of absolute decision strategies that influences whether a witness is accurate in his or her decision, irrespective of the lineup presentation type used and whether the target is present or absent from the lineup. As the sequential lineup was not found to be significantly associated with the use of absolute strategies, it would appear that the use of an absolute strategy is not an automatic by-product of the witness being shown a sequential lineup. Witnesses are just as likely to make an accurate decision when shown a simultaneous lineup, but only as long as they use an absolute strategy. However, it is important to note that these results should be treated with caution. It could be argued that people are not generally aware of their own thought processes, and that self-report data may merely reflect people's best guesses rather than a true reflection of cognitive strategy (e.g. Nisbett and Wilson, 1977). In this sense, Sporer's (1993) analysis of the more direct measure of response time is valuable.

Decision times

Due to the nature of the two lineup presentation procedures, the decision times for simultaneous and sequential lineups were analysed separately. Table 4 shows the mean decision times obtained by accurate and inaccurate choosers and non-choosers for both lineup types.

Simultaneous decision times

Consistent with predictions, accurate choices were found to be made faster ($M = 4.69$ s) than inaccurate choices ($M = 5.25$ s), and accurate rejections of the lineup were made faster ($M = 4.68$ s) than inaccurate rejections ($M = 6.33$ s). As neither absolute ($r(36) = -0.008$, $p > 0.05$) or relative ($r(36) = -0.094$, $p > 0.05$) decision strategies were found to be significantly associated with average decision times, decision strategies

Table 4. Mean decision times and confidence levels (with standard deviations) for choosers and non-choosers in simultaneous and sequential lineups

	Lineup presentation mode			
	Simultaneous		Sequential	
Variable	Correct decision	Incorrect decision	Correct decision	Incorrect decision
Choosers				
Mean decision time(s)	4.69 (1.48)	5.25 (3.83)	3.82 (2.87)	16.45 (13.17)
Confidence	5.18 (0.87)	5.43 (0.76)	5.67 (1.50)	4.17 (1.33)
N	11	14	9	6
Non-choosers				
Mean decision time(s)	4.68 (2.08)	6.33 (4.05)	3.87 (2.13)	3.95 (1.78)
Confidence	4.57 (1.72)	5.00 (1.41)	4.36 (1.69)	3.14 (1.77)
N	7	4	14	7

Note: The possible range of confidence scores was from 1 (not very confident) to 7 (100% confident).

were not included as covariates in the statistical analysis of decision times. The log-transformed mean decision times were analysed by means of a 2(accuracy) × 2(choice) ANOVA. No significant main effects or interaction of accuracy and choice were found (all F's < 1). Analysis of decision times by means of a 2(accuracy) × 2(target presence) ANOVA also failed to find any significant main effects or interaction (all F's < 1). Accurate decisions, whether choices or rejections, were made with the same speed as inaccurate decisions.

Sequential decision times

As a result of individual times being collected for each face shown in a sequential lineup, a more detailed analysis was undertaken for sequential decision times. As above, neither the use of absolute or relative strategies was found to have a significant association with any of the decision times under analysis. Therefore the two decision strategies were not included as covariates in the statistical analysis of decision times.

Choosers

With respect to those participants who made a choice from a sequential lineup, Table 4 shows that accurate choices were made much faster ($M = 3.82$ s) than inaccurate choices ($M = 16.45$ s). Due to the large standard deviation associated with the time for incorrect choosers, analysis was conducted using a log-transformed selection time. The difference in selection times for accurate and inaccurate choosers was found to be significant, ($t(13) = -2.43$, $p < 0.05$). Accurate selections of the target were made significantly faster than inaccurate choices of a foil. The decision times of accurate choosers were further analysed to determine whether there was any difference between the time taken to select the target and the time taken to reject the foils. Although witnesses were quicker to select the target ($M = 0.33$ s) than to reject the foils ($M = 0.41$ s), this difference was not found to be significant ($z = -0.42$, $p > 0.05$). In contrast, inaccurate choosers showed that the time taken to select a foil ($M = 1.06$ s) was significantly slower than the time taken to reject the target ($M = 0.69$ s) ($z = -2.02$, $p < 0.05$).

Non-choosers

Table 4 also shows the mean decision times of accurate and inaccurate rejections. Accurate rejections were made slightly faster ($M = 3.87$ s) than inaccurate rejections ($M = 3.95$ s). However, analysis of the log-transformed mean rejection times found there to be no significant difference across accuracy ($t(19) = 0.188$, $p > 0.05$). Further analysis was conducted for the inaccurate rejectors to ascertain whether there was any difference between the time they took to incorrectly reject the target and the time taken to reject the foils in the lineup. The time taken to incorrectly reject the target ($M = 0.86$ s) was found to be significantly slower than the time taken to reject the foils ($M = 0.43$ s) ($z = -2.19$, $p < 0.05$), suggesting that the participants may have been hesitating before finally deciding to reject the target.

Sporer (1994) suggested that decision times might be a reliable indicator of accuracy for those making positive choices from a lineup. Although this was not found to be true for those participants shown a simultaneous lineup, the results of the decision times for sequential lineups certainly appeared to support Sporer's findings. Accurate selection of the target was made significantly faster than an inaccurate selection of a foil. However, it could be argued that decision times are not a reliable measure. The time person A takes to

make an accurate identification may be quicker than the time they take to make a false identification, but person A's accurate identification response time may be much slower than person B's. In this sense the individual variation associated with decision times may minimise their utility as a possible indicator of witness accuracy.

Post-decision confidence

Table 4 also shows the mean confidence scores that each participant gave following their identification decision, where a high score indicated a high perceived confidence. On average, those who made a choice from the lineup tended to report more confidence in their decision ($M = 5.23$) than those who did not make a choice ($M = 4.22$). As for the accuracy of the decision, correct choosers tended to be marginally more confident ($M = 5.4$) than incorrect choosers ($M = 5.05$). Those nonchoosers who correctly rejected the lineup also were more confident in their decision ($M = 4.43$) than incorrect non-choosers ($M = 3.82$). However, correlational analysis showed that overall participants' level of confidence was not related to their accuracy, ($r(72) = -0.11$, $p > 0.05$). This supported previous research findings (e.g. Bothwell *et al.*, 1987; Fruzzeti *et al.*, 1992) and suggested that confidence was not a reliable predictor of accuracy in this context (cf. Sporer *et al.*, 1995).

SUMMARY AND CONCLUSIONS

With the exception of Dunning and Stern's (1994) study, the principal evidence in support of the distinction between absolute/relative decision making was based solely on the speed with which the decision was made. The faster decision times normally found with a sequential lineup were thought to be the result of the procedure promoting the use of an absolute decision-making strategy. The findings from this study suggest that those shown a simultaneous lineup are just as likely to report using absolute decision strategies as those shown a sequential lineup. However, with respect to the accuracy of the decision, the use of an absolute decision strategy certainly appears to influence the accuracy of the witness's identification decision.

Obviously further studies are required in order to ascertain whether this is a robust effect. However, preliminary evidence would suggest that it may be worth while to inform the witness at the start of the identification procedure, not only that the target may or may not be present in the lineup, but also that the use of an absolute decision strategy may help them arrive at an accurate decision.

ACKNOWLEDGEMENTS

The authors wish to thank Elizabeth Brimacombe for the materials used in the present experiment and Professor Jim Stevenson for his statistical advice.

REFERENCES

Bothwell RK, Deffenbacher KA, Brigham JC. 1987. Correlation of eyewitness accuracy and confidence: Optimality hypothesis revisited. *Journal of Applied Psychology* **72**: 691–695.

Brandon R, and Davies C. 1973. *Wrongful Imprisonment*. Allen and Unwin: London.
Cutler BL, Penrod SD. 1988. Improving the reliability of eyewitness identifications: Lineup construction and presentation. *Journal of Applied Psychology* **73**: 281–290.
Dunning D, Stern LB. 1994. Distinguishing accurate from inaccurate identifications via inquiries about decision processes. *Journal of Personality and Social Psychology* **67**: 818–835.
Fruzzeti AE, Toland K, Teller SA, Loftus EF. 1992. Memory and eyewitness testimony. In *Aspects of Memory; Vol. 1. The Practical Aspects*, Gruneberg MM, Morris PE (eds). Routledge. London; 18–50.
Huff CR. 1987. Wrongful conviction: Social tolerance of injustice. *Research in Social Problems and Public Policy* **4**: 99–115.
Lindsay RCL. 1999. Selling the sequential lineup. *Applied Cognitive Psychology* **13**: 219–225.
Lindsay RCL, Lea JA, Fulford JA. 1991. Sequential lineup presentation: Technique matters. *Journal of Applied Psychology* **76**: 741–745.
Lindsay RCL, Lea JA, Nosworthy GJ, Fulford JA, Hector J, LeVan V, Seabrook C. 1991. Biased lineups: Sequential presentation reduces the problem. *Journal of Applied Psychology* **76**: 796–802.
Lindsay RCL, Wells GL. 1985. Improving eyewitness identifications from lineups: Simultaneous versus sequential lineup presentation. *Journal of Applied Psychology* **70**: 556–564.
McKenzie I, Dunk P. 1999. Identification parades: Psychological and practical realities. In *Analysing Witness Testimony: A Guide for Legal Practitioners and Other Professionals*, Heaton-Armstrong A, Shepherd E, Wolchover D (eds). Blackstone Press Ltd: London; 178–193.
Nisbett RE, Wilson TD. 1977. Telling more than we can know: Verbal reports on mental processes. *Psychological Review* **84**: 231–259.
Pozzulo JD, Lindsay RCL. 1998. Identification accuracy of children versus adults: A meta-analysis. *Law and Human Behavior* **22**(5): 549–570.
Rattner A. 1988. Convicted but innocent: Wrongful conviction and the criminal justice system. *Law and Human Behavior* **12**: 283–293.
Searcy JH, Bartlett JC, Memon A. 1999. Age differences in accuracy and choosing in eyewitness identification and face recognition. *Memory and Cognition* **27**: 538–552.
Smith VL, Kassin SM, Ellsworth PC. 1989. Eyewitness accuracy and confidence: Within- versus between-subject correlations. *Journal of Applied Psychology* **74**: 356–359.
Sporer SL. 1993. Eyewitness identification accuracy, confidence and decision times in simultaneous and sequential lineups. *Journal of Applied Psychology* **78**: 22–33.
Sporer SL. 1994. Decision times and eyewitness identification accuracy in simultaneous and sequential lineups. In *Adult Eyewitness Testimony: Current Trends and Developments*, Ross DF, Read JD, Toglia MP (eds). Cambridge University Press: New York; 300–327.
Sporer SL, Penrod S, Read JD, Cutler B. 1995. Choosing, confidence and accuracy: A meta-analysis of the confidence–accuracy relations in eyewitness identification studies. *Psychological Bulletin* **118**: 315–327.
Wells GL. 1984. The psychology of lineup identification. *Journal of Applied Social Psychology* **14**: 89–103.
Wells GL, Seelau EP. 1995. Eyewitness identification: Psychological research and legal policy on lineups. *Psychology, Public Policy and Law* **4**: 765–791.
Wells GL, Small M, Penrod S, Malpass RS, Fulero, SM, Brimacombe CAE. 1998 Eyewitness identification procedures: Recommendations for lineups and photospreads. *Law and Human Behaviour* **22**: 603–647.
Wogalter MS, Malpass RS, Berger MA. 1993. How police officers construct lineups: A national survey. *Proceedings of the Human Factors and Ergonomics Society*, September. Human Factors and Ergonomics Society: Santa Monica, CA; 640–644.

