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The Target-to-Foils Shift in Simultaneous and Sequential Lineups

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A theoretical cornerstone in eyewitness identification research is the proposition that witnesses, in making decisions from standard simultaneous lineups, make relative judgments. The present research considers two sources of support for this proposal. An experiment by G. L. Wells (1993) showed that if the target is removed from a lineup, witnesses shift their responses to pick foils, rather than rejecting the lineups, a result we will term a target-to-foils shift. *Additional empirical support is provided by results from sequential lineups which typically show higher accuracy than simultaneous lineups, presumably because of a decrease in the use of relative judgments in making identification decisions. The combination of these two lines of research suggests that the target-to-foils shift should be reduced in sequential lineups relative to simultaneous lineups. Results of two experiments showed an overall advantage for sequential lineups, but also showed a target-to-foils shift equal in size for simultaneous and sequential lineups. Additional analyses indicated that the target-to-foils shift in sequential lineups was moderated in part by an order effect and was produced with (Experiment 2) or without (Experiment 1) a shift in decision criterion. This complex pattern of results suggests that more work is needed to understand the processes which underlie decisions in simultaneous and sequential lineups.*

KEY WORDS: eyewitness memory; identification.

INTRODUCTION

One of the fundamental goals for research in eyewitness identification has been to understand the decision processes that underlie identification decisions. Much experimental evidence has been offered to support the proposal, initially made by Wells (1984), that witnesses, in the course of making identification decisions from lineups, use a comparative or relative judgment strategy. Such judgment strategies are contrasted with absolute judgment strategies that do not involve comparisons between lineup members.

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The evidence supporting this distinction between relative and absolute decision strategies comes from a variety of sources and we will not review all the evidence here, but will focus on two particularly compelling demonstrations—one based on a comparison between sequential and simultaneous lineups (Lindsay & Wells, 1985; Steblay, Dysart, Fulero, & Lindsay, 2001 for a review), and the other based on a comparison between target-present (TP) and target-removed (TR) lineups (Wells, 1993).

The Target-Present, Target-Removed Lineup Paradigm

A compelling demonstration supporting the hypothesis that witnesses use relative decision strategies in making identifications comes from Wells (1993). In the target-present (TP) condition, witnesses to a staged crime were shown a six-person lineup containing the target plus five foils. In the target-removed (TR) condition, the target was not presented, creating a five-person lineup consisting of the five foils only. The comparison of TP and TR lineups raises the question: What would witnesses do if the target person were not in the lineup? The correct response, of course, would be a none-of-the-above response, that is, to reject the lineup.

Wells' results showed that 54% of witnesses correctly identified the target in the TP condition, and 21% incorrectly rejected the lineup. Presumably the witnesses who would have identified the target when he was in the lineup should recognize when he is not in the lineup and should reject the TR lineup. This reasoning predicts a 75% (54 + 21%) rejection rate in the TR lineup. The results however, deviated considerably from that prediction. Specifically, of the 54 witnesses who presumably would have identified the target had he been in the lineup, 43 picked one of the other filler photographs, and only 11 gave the correct no-identification (no-ID) response. We will refer to this result as a *target-to-foils shift*. This shift was driven primarily by the next-best lineup alternative: most of the foil identifications in the TR lineup went to the foil photograph that appeared to be the next-best match. Wells (1993) and many others (Dunning & Stern, 1994; Lindsay, Pozzulo, Craig, Lee, & Corber, 1997; Wells, Small, Penrod, Malpass, Fulero, & Brimacombe, 1998; Wrightsman, Greene, Nietzel, & Fortune, 2002) have viewed the target-to-foils shift as strong and compelling evidence for witnesses' use of relative judgments in making identification decisions.

Simultaneous and Sequential Lineup Presentation

Additional evidence for the absolute–relative distinction comes from a comparison between simultaneous and sequential lineups. In the simultaneous lineup all of the lineup alternatives are presented at the same time, whereas in the sequential lineup the alternatives are presented one-at-a-time, and each alternative requires a yes–no decision from the witness.

The typical pattern of results shows a decrease in correct identification of the target in target present lineups, and a somewhat larger decrease in the false identification rate, particularly for innocent suspects in target-absent lineups (see Steblay et al., 2001, for a meta-analytic review). A well-accepted explanation of the differences between simultaneous and sequential lineups proposes that the results arise from a different balance of relative and absolute decision processes. Specifically, relative decisions should come into play less in sequential lineups than in simultaneous lineups (Kneller, Memon, & Stevanage, 2001; Lindsay & Wells, 1985). An example illustrates the proposed difference. In a simultaneous lineup, alternative #3 may be the most similar to the witness's memory of the perpetrator, and may be identified because he is the best match, and because there are clearly no other alternatives to consider other than those shown in the lineup. In the sequential lineup, however, #3 may be the best match *so far*, but the witness may choose to not identify him based on the possibility of an even better match yet to be presented.

THE PRESENT EXPERIMENTS

The combination of the results—those comparing TP to TR lineups, and those comparing simultaneous and sequential lineups—leads to a clear prediction: If the target-to-foils shift is the product of relative decision processes, and if relative decision processes play less of a role in sequential lineups, then sequential lineups should show a smaller target-to-foils shift when TP and TR lineups are compared.

Statistical Assessment of the Target-to-Foils Shift

A fundamental question needs to be addressed before going further: How does one assess the target-to-foils shift? In the original Wells demonstrations, no statistical test was presented, perhaps because the effect was so large as to be virtually self-evident. However, it is important to statistically quantify the shift for at least two reasons: (1) in some cases the magnitude of the shift may not be so large as to be self-evident, and (2) the degree of shift in the simultaneous lineup condition must be compared to that of the sequential lineup condition, and in order to make this comparison one first needs to quantify the size of the shift.

There are a number of ways in which the shift can be evaluated, and of these we propose the following: The target-to-foils shift is a deviation from a clearly specified expectation, specifically that the foil identification rate in the TR lineup should be equal to that for the TP lineup, and the correct identifications from the TP lineup should shift to a no-ID response. The deviations between data and expectation can be evaluated as a chi-square with 1 degree of freedom.

In the Wells study, there were 68 foil identifications and 32 no-ID responses in the TR lineup. The expected frequencies, had all the correct identifications from the TP lineup shifted to correct rejections in the TR lineup, would have been 25 foil and 75 no-ID responses, producing a $\chi^2 = 98.613, p < .001$.

The statistical comparison of simultaneous and sequential lineups in the present experiments asks whether the magnitude of deviation between observed and expected outcomes is different for simultaneous and sequential lineups. To address this question we compute two chi-square statistics, one with one degrees of freedom, which considers simultaneous and sequential lineups separately, and another with 1 degree of freedom which collapses over (ignores) lineup type. The difference between these two chi-square statistics is a chi square with 1 degree of freedom, which provides an estimate of the contribution of lineup type.

Next-Best Alternative, Order, and Position Effects

In the Wells (1993) experiment, there was a clear next-best alternative in the lineup. This alternative was identified by 13% of witnesses in the TP lineup, with the nearest competitor being identified by only 3% of witnesses. This next-best alternative was the alternative most frequently identified (39%) in the TR lineup. Although there is no a priori reason to assume that a clear next-best alternative is a necessary condition of the target-to-foils shift, in following Wells' methodology we also designated a clear next-best alternative.

Although order effects have not been demonstrated in sequential lineups (Lindsay & Wells, 1985; Sporer, 1993), the identification responses in the present experiments may depend on the ordering of the next-best alternative with respect to the target. Specifically, if the next-best alternative precedes the target, the correct identification rate for the target may be reduced because witnesses who identify the next-best alternative have effectively "spent" their pick prior to the presentation of the target. Thus, the experiments reported here counterbalanced the ordering of the target and the next-best alternative.

For simultaneous lineups, there is no temporal order of presentation; however, the relative positions of the lineup members may nonetheless have some effect. Half of the witnesses were presented the lineup with the target in position 2 and the next-best alternative in position 4, whereas the other half were shown the lineup with those positions reversed. To equate simultaneous and sequential lineups in a way that positions would have equivalent meaning, the simultaneous lineups were presented in a single row, rather than in the standard 3×2 configuration.

The analysis of presentation order allows for a direct test of what we will term the *constant criterion hypothesis*, which posits that the criterion for making an identification response remains constant over the sequential presentation of the lineup. The alternative hypothesis is that witnesses adjust or shift their decision criterion over the course of the lineup. Although the issue is clearest for the sequential lineup in which the positions indicate sequential order, the issue can also be examined by looking at position effects (rather than order effects) in simultaneous lineups.

The analysis of the constant criterion hypothesis for sequential lineups will be carried out as follows:

First, if the criterion is held constant then the likelihood of a positive identification of a given alternative should also be constant for all witnesses who are presented with that alternative. Consider the two cases in which alternative A appears in position 2 versus position 4. The unconditional identification rate may be lower for A presented in position 4 than for A presented in position 2. However, this may arise because fewer people have the opportunity to identify alternative A in position 4 because they have already identified some other alternative. The test of the constant criterion hypothesis is based not on the identification rates but rather on the conditional identification rates, considering only those witnesses who have the opportunity to make an identification because they have not already made an identification.

The second test of the constant criterion hypothesis is even more straightforward. If the criterion is held constant across variations in order, then the no-ID rate should also be constant. To illustrate, consider a lineup with six alternatives, each of whom bears some degree of match to the witness's memory of the target. These matches may take on values m_1, m_2, m_3, m_4, m_5, and m_6. If one of them is above the witness's decision criterion C, the witness will make an identification, and a no-ID response will be given only if all of the matches are below criterion. It is clear that if all six matches are below criterion, the order in which they are presented does not matter. Thus, the no-ID rates must be invariant across variations in order (sequential lineups) and position (simultaneous lineups) if the criterion is invariant with respect to order and position. We should note that the criterion analysis based on no-ID rates holds for comparisons for which the lineup members are held constant, but not for comparisons where the lineup alternatives (or lineup size) vary.

Although the focus of these analyses is on sequential lineups, the same logic can be applied to the simultaneous lineups. However, the simultaneous lineups cannot analyze the same conditional identification rates because those depend on the order of presentation. However, similar analyses can be performed on the unconditional identification rates and also for the no-ID rates.

EXPERIMENT 1

Participants

One hundred and ninety-two people participated in partial fulfillment of an introductory psychology course requirement.

Materials and Procedure

The participant-witnesses watched a videotape that began rather harmlessly with a discussion between two graduate students but then ended with one of those graduate students walking to her car and being carjacked. The video was shot from the perspective of a witness walking several steps behind the victim. Immediately after watching the video, participants completed a very brief (approximately 10 min) personality questionnaire, and then were asked to give a description of the thief and indicate their confidence that they would be able to identify the thief later (on a scale of 1–6). Witnesses were then presented with one of two lineups, a TP lineup consisting of the photograph of the carjacker and five foils, or a TR lineup that contained only the five foils.

The lineups were presented either simultaneously or sequentially. In the simultaneous case, the photographs were presented on a computer screen in a single row of either six (TP) or five (TR) photographs. For the sequential lineup, the photographs were shown one-at-a-time, with the witness giving a yes or no response for each one. Witnesses were not informed as to the number of photographs they would see and were not allowed to go backwards in the sequence. Following Lindsay and Wells (1985), all lineup photographs were shown, even if the witness had already made an identification. For both simultaneous and sequential lineups if witnesses gave multiple-identification responses, they were asked to choose between their selections.

All photographs used in the experiment came from a pool of booking photos selected by detectives and police officers from the San Bernardino County Sheriff's Department. The photographs selected for this study were rated for similarity to the target by two separate groups of raters ($N = 54$, Tunnicliff & Clark, 2000; $N = 60$, Clark & Tunnicliff). The photographs used in Experiment 1 were selected because they had moderate similarity ratings (roughly 3.3 on a 5-point scale, and 2.0 on a 4-point scale). The determination of the next-best lineup member (hereafter referred to as NB) was based on data from Clark and Tunnicliff (2001) which showed a forced-choice identification rate of .31 for the next-best designate and a range of .03 to .19 for the other four foils. Our purpose in this selection strategy was to use photographs with fairly well-known similarity characteristics and to have a clear next-best alternative in the lineup.

With the target and NB photographs alternated in positions 2 and 4 for half of the witnesses and 4 and 2 for the other half, and the remaining four foil photographs were rotated across four positions (1, 3, 5, and 6 in TP lineups and 1, 3, and 5 in TR lineups) to create eight different assignments of photos to positions for each of the four lineup conditions. Equal numbers of participants were assigned to these different stimulus orderings ($n = 6$) for a total of 48 participants in each cell of the 2×2 design.

A number of safeguards were used in order to minimize any experimenter bias effects. Two experimenters conducted each experimental session. The first experimenter started the videotape (but never watched it), administered the personality questionnaire, and collected description and pre-identification confidence data. A second experimenter administered the lineup. A computer was used to present the lineup instructions (including a statement that the actual perpetrator may not be in the lineup), the lineup photographs, and a postidentification confidence question (again, on a 1–6 scale). The two-experimenter procedure and the computer presentation were used to minimize experimenter influence in witnesses' descriptions and preidentification confidence, and to minimize experimenter influence in the presentation of lineup instructions, the presentation of the lineup photographs, and the collection of identification responses and postidentification confidence responses.

Neither of the experimenters ever watched the carjacking video, did not know the identity of the carjacker, and were unlikely to learn the identity of the carjacker through interactions with witnesses, given that those interactions were extremely limited. These double-blind procedures are consistent with researchers' recommendations for law enforcement (Wells et al., 1998), and were motivated by empirical studies showing experimenter influence in eyewitness identification experiments (Garrioch & Brimacombe, 2001; Phillips, McAuliff, Kovera, & Cutler, 1999).

Results and Discussion

This section is organized as follows: (1) As a preliminary to the main analyses, we discuss the resolution of multiple identifications, followed by (2) the basic identification data (including position and order effects), followed by (3) the analysis of the target-to-foils shift (including position and order effects), followed by (4) criterion analyses. The prospective and retrospective confidence analyses, although not irrelevant, add very little to the discussion, and thus they are not presented in the main text, but in an Appendix.

A preliminary data analysis issue concerns the handling of multiple-identification responses. Of the 96 witnesses shown sequential lineups, 22 made multiple identifications (15 TP, 7 TR), whereas witnesses shown simultaneous lineups made two multiple identifications. In the simultaneous lineups there is no clear temporal ordering of the multiple identifications. Thus, there are two options for dealing with multiple identifications in simultaneous lineups—either exclude them from the analysis or ask witnesses to choose between their multiple identifications. Because multiple identifications were rare in simultaneous lineups (.021 of all witnesses), they contribute virtually nothing to the overall pattern of results, and thus the different options for dealing with them do not change the simultaneous lineup results. We resolved the two simultaneous multiple-identification responses by asking the witnesses to choose between their two identifications.

In sequential lineups, multiple identifications can be resolved either by counting only the first identification or by having witnesses choose between their multiple identifications. The results reported below used the first-response rule, which in real-world application seems critical to the sequential procedure. Nonetheless, the results were also analyzed with the choose-between rule. Witnesses asked to choose between their multiple identifications chose poorly, and were no better than chance when choosing between the target and foil multiple identifications. Moreover, the overall pattern of results did not differ as a function of different means of sorting out multiple identifications.[3]

Basic Identification Data: Simultaneous Versus Sequential Lineups

The identification results for TP and TR lineups, with sequential and simultaneous presentation, are shown in Table 1. Each witness's response was classified as one of the following: identification of the target, identification of a foil, a don't know response, or a reject response. As is typical, don't know responses were somewhat rare, and thus the don't know and reject responses were combined into a single no-ID response for subsequent analyses.

[3]We analyzed the sequential data in two additional ways: by having witnesses choose between their multiple identifications, and by simply excluding witnesses who made multiple identifications. Neither of these alternatives changed the pattern of results. Had the multiple identifications in sequential lineups been analyzed by asking participants to choose between their identifications rather than taking their first identification, the change would have been negligible—one additional target identification and one less foil identification in the TP lineups, with no change in the TR lineups. Excluding multiple-identification witnesses from the analysis changed the response proportions slightly, did not change the pattern of results, but showed larger chi-square values, indicating that the size of the target-to-foils shift was increased by excluding multiple identifications.

Table 1. Response Probabilities for Target-Present and Target Removed, Simultaneous, and Sequential Lineups in Experiment 1

	Simultaneous		Sequential	
	Target present	Target removed	Target present	Target removed
Suspect	.250	—	.458	—
Foil	.542	.729	.396	.708
Next-best	.250	.417	.189	.333
No pick	.208	.271	.146	.292
Don't know	.104	.104	.000	.000
Reject	.104	.167	.146	.292

The first point to note is that sequential lineups produced better performance than simultaneous lineups, with a higher rate of correct rejections in TR lineups (.292 vs. .167) and a higher rate of correct identifications in TP lineups (.458 vs. .250). The increase in correct rejections, although short of statistical significance, $\chi^2(1) = 2.123$, $p > .10$, is consistent with the pattern typically shown in simultaneous-sequential lineup comparisons. This advantage is reduced considerably if don't know responses are combined with rejections into a no-ID response ($\chi^2 < 1$). The sequential advantage for correct identifications, $\chi^2(1) = 4.554$, $p < .05$), however, is unusual (see Culter & Penrod, 1988; Lindsay et al., 1991, Parker & Ryan, 1993). Combining correct identifications and correct nonidentifications, the advantage for sequential lineups was marginally reliable, $\chi^2(1) = 2.907$, $p < .10$.

Order and Position Effects

The simultaneous lineup results were not affected by the position of the next-best or target alternatives. There were no differences in correct identification rate, identification of NB, or correct rejection rates, based on the positions of NB and target. In contrast order effects were found in the sequential lineups, and the results are given separately for NB in position 2 and NB in position 4 in Table 2.

The correct identification rate was much higher in TP lineups when NB was in position 4 than when NB was in position 2, $\chi^2(1) = 5.371$, $p < .05$. By contrast the identification of the NB was higher when it preceded the target, and the combination of these effects for NB and target was statistically reliable, $\chi^2(1) = 5.448$, $p < .02$. Correct rejection rates did not differ in sequential lineups as a function of the position of NB, $\chi^2(1) = 1.613$, $p > .10$. From these order effects, it is also clear that the sequential advantage occurred only when NB was presented in position 4, and only for correct identifications, $\chi^2(1) = 9.600$, $p < .01$.

Table 2. Response Probabilities for Sequential Lineups, Next-Best in Position 2 or 4, in Experiment 1

	Next-best in Position 2		Next-best in Position 4	
	Target present	Target removed	Target present	Target removed
Suspect	.292	—	.625	—
Foil	.583	.625	.208	.792
Next-best	.292	.417	.083	.250
Reject	.125	.375	.167	.208

The explanation of this order effect is straightforward: When the next-best alternative was in position 2, many witnesses who were shown sequential lineups identified him, and hence did not have an opportunity to identify the target. The opportunity to make an ID was essentially "used up" before the target was presented. In contrast, when NB was presented in position 4 most witnesses (.625) had already identified the target in position 2, making NB something of a nonfactor.

Evaluation of the Target-to-Foils Shift

The relevant data for evaluating the target-to-foils shift are shown in Fig. 1. Each panel of the figure shows the foil and no-ID response rates for TP and TR lineups. The expected values for the foil and no-ID response rates are not shown (for clarity). However, the expected patterns would in each case show a flat zero-increase for foil identifications, and a very steep increase in no-ID responses for the TR relative to the TP lineup. The figure shows three main findings: (1) There was overall a large target-to-foils shift, (2) the magnitude of the shift did not differ for simultaneous and sequential lineups, and (3) the shift in sequential lineups depended in large part on the ordering of the next-best and the target. The shift was produced only when the next-best alternative was in position 4 (and the target in position 2), with virtually no shift at all when the next-best was in position 2. The statistical analyses supporting these conclusions are as follows:

The target-to-foils shift was evaluated, first ignoring the simultaneous-sequential distinction. The deviation from the expected values was quite large, $\chi^2(1) = 24.094$, indicating a large shift. A second analysis, taking lineup type into consideration produced a $\chi^2(2)$ only slightly larger, 26.398, indicating no difference

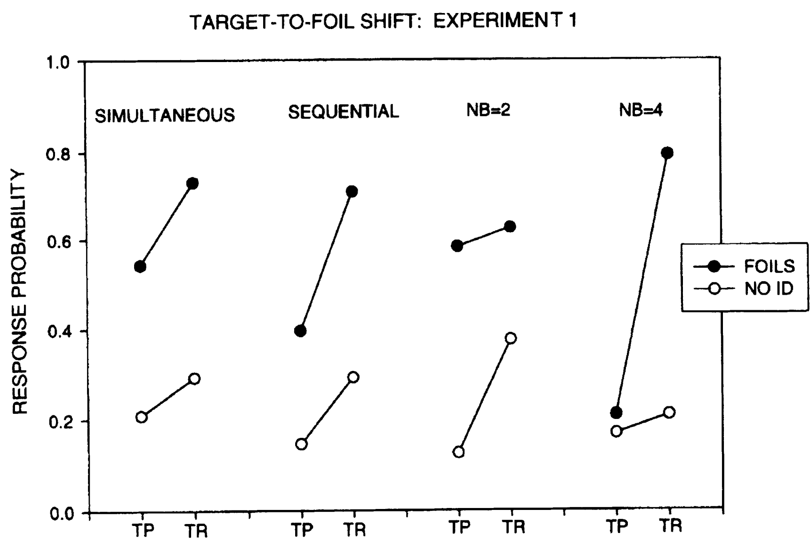

Fig. 1. Target-to-foils shift for simultaneous and sequential lineups with NB in position 2 and NB in position 4. For each case, data are shown for foil and no-ID response rates for both target-present (TP) and target-removed (TR) lineups.

in the magnitude of the target-to-foils shift in simultaneous and sequential lineups, $\chi^2(1) = 2.304, p > .10$.

Order and Position Effects in the Target-to-Foils Shift

Now we address whether the position (simultaneous lineups) and/or order (sequential lineups) of the next-best and target played a role in determining the magnitude of the target-to-foils shift.

First, for the simultaneous lineups, there was no effect of position. Collapsing over position produced a $\chi^2(1)$ of 6.797, $p < .01$ (indicating a significant shift), which was increased only slightly by adding next-best position to the analysis, $\chi^2(2) = 6.952$. The difference (6.952–6.797 = 0.155), which measures the effect of position in producing the shift, was clearly miniscule.

The order effect for sequential lineups is given in similar fashion. Collapsing over order produced a $\chi^2(1) = 19.601$. By adding order to the analysis, the $\chi^2(2)$ was increased dramatically to 49.687. The difference, $\chi^2(1) = 30.086, p < .001$, indicated a large role for the ordering of next-best and the target in producing the target-to-foils shift in sequential lineups.

Again, the explanation of the order effects is straightforward. Consider first the sequential TP lineups. When next-best was presented in position 2, the proportion of witnesses identifying him was .292; thus, it appears that for many witnesses the match of next-best to memory was above criterion. Contrast these results with those obtained when the target was presented in position 2 prior to the next-best alternative. Most witnesses (.625) identified the target, a few identified a foil (.208), and only a very few identified the next-best alternative (.083). The identification rates for foils and for NB were low because most witnesses had already made an identification prior to seeing NB. Thus, when the target was removed, and NB was in position 4, there was a large shift toward picking a foil, driven in large part by the .250 identification rate for NB. With the target removed, witnesses had the opportunity to observe NB prior to having identified another lineup member, an opportunity they did not have in the TP lineups. The lack of a target-to-foils shift for the NB = 2 lineups is also a product of the order effect.

Tests of the Constant-Criterion Hypothesis

We now address the question as to whether the position or ordering of NB and target had an effect on criterion placement, for either simultaneous (position) or sequential (order) lineups. The analyses proceed somewhat differently for simultaneous and sequential lineups.

For sequential lineups, the relevant comparisons are for target identifications in TP lineups, NB identifications in TR lineups, and reject rates for both TP and TR lineups, in all cases comparing response probabilities when NB was in position 2 versus NB in position 4. None of these comparisons showed any effect of position for simultaneous lineups (all $\chi^2 < 1$).

The analyses proceed somewhat differently for sequential lineups. First, the no-ID rates are compared as they were for simultaneous lineups. These showed no difference as a function of NB order for TP ($\chi^2(1) = .070$) or TR lineups, $\chi^2(1) = .137$).

The other analyses examine the conditional identification rates for the target in TP lineups and the NB in TR lineups, considering only those witnesses who had not already made an identification. The probabilities of identifying next-best, considering only those witnesses who had not already made an identification, were nearly dead-equal for NB in position 2 (10/24 = .417) and NB in position 4 (6/14 = .429). Likewise for targets, the conditional identification rates in TP lineups did not differ for NB in position 2 (15/23 = .652) versus position 4 (7/12 = .583), $\chi^2(1) < 1$.

These analyses were all consistent with a constant-criterion assumption, and inconsistent with a shifting criterion. This is most relevant for the sequential lineups. One explanation of the target-to-foils shift for sequential lineups proposes that the shift occurs because over the course of the lineup, witnesses lower their decision criterion. The present analyses rule out that explanation.

Summary

Experiment 1 showed a large target-to-foils shift for both simultaneous and sequential lineups. Moreover, the size of the shift, measured in terms of the deviation from expectations for foil and no-ID rates, did not differ for simultaneous and sequential lineups.

There were no effects due to the positions of the target or next-best alternative in simultaneous lineups. In sharp contrast, the ordering of target and NB played a large role in sequential lineups. Specifically, the target was identified often and the NB rarely when the target was presented before the NB, and target and NB were identified with equal probability when NB preceded the target. These order effects were the basis of three additional findings: The target-to-foils shift was shown only when NB was in position 4 with no shift when NB was in position 2. Second, there was a large advantage of sequential lineups over simultaneous lineups, restricted primarily to those lineups in which the target preceded the next-best alternative (i.e., NB = 4). Third, it is important to note that the order effects were not produced by a shift in decision criterion. All three tests of criterion shift were consistent, showing no evidence for a criterion shift in sequential lineups.

This last result has important implications regarding the target-to-foils shift in sequential lineups. Obviously, witnesses do not know a priori that the target is removed in a TR lineup; they can only discover this as the lineup is sequentially presented. Thus, if the target-to-foils shift were the result of a criterion shift, it would have to be a shift that occurs over the course of the lineup. The finding that the criterion did not shift over the course of the lineup therefore suggests that the target-to-foils shift was not produced by a downward shift in criterion for TR lineups.

One limitation of Experiment 1 is that the results were obtained using a lineup in which the next-best alternative was a very strong competitor to the target, thus raising a question of generalizability. Are these results specific to the similarity relations of the lineup members used in Experiment 1, or will the results generalize to the case where the next-best alternative is a less strong competitor? This question was addressed in Experiment 2, by using a different set of lineup stimuli which included a next-best alternative that was not as similar to the target as was the case in Experiment 1.

EXPERIMENT 2

Participants

One hundred and ninety-two people participated in partial fulfillment of an introductory psychology course requirement.

Materials and Procedure

The participant-witnesses in Experiment 2 watched the same videotaped staged crime that was used in Experiment 1. All procedures in Experiment 2 were identical to those in Experiment 1 with the exception of lineup composition.

The lineups in Experiment 1 were constructed such that one filler photograph was designated as the next-best alternative (NB), based on results from previous studies (Clark & Tunnicliff, 2001; Tunnicliff & Clark, 2000). The NB alternative in Experiment 1 was highly similar to the suspect. The additional fillers chosen in Experiment 1 were moderately similar to the suspect. To better assess the influence of similarity on decision processes in simultaneous and sequential lineups, Experiment 2 used a moderately similar NB alternative to the suspect and additional fillers that were moderate-to-low in similarity to the suspect. The fillers were selected from the same pool as Experiment 1, but with a few changes. Most importantly, the very competitive next-best alternative from Experiment 1 was removed from both TP and TR lineups. The new next-best alternative was a weaker competitor to the target (based on previous studies). Two other foils were changed as well so as to be less competitive with the new next-best alternative.

Again, in the TP lineups the target and NB were presented in positions 2 and 4 for half of the lineups and in positions 4 and 2 for the other half. Likewise, for the TR lineups, NB was shown in position 2 or position 4. With the two critical photographs held in positions 2 and 4, the remaining four foil photographs were rotated across positions 1, 3, 5 and 6 in the TP lineups and positions 1, 3, and 5 in the TR lineups to create eight different assignments of photos to positions for each of the four lineup conditions. Witnesses were again assigned to conditions in equal numbers for a total of 48 participants per cell of the 2×2 design.

The same safeguards were used in Experiment 2 as in Experiment 1 to minimize any experimenter bias effects.

Results and Discussion

This section is organized in the same way as for Experiment 1, considering (1) multiple identifications, followed by (2) the basic identification data, followed by the analysis of the target-to-foils shift, and (4) the criterion analyses. Confidence data are again given in the Appendix.

Again, a preliminary data analysis issue concerns the handling of multiple-identification responses. Witnesses shown sequential lineups made 12 multiple identifications (7 TP, 5 TR), and witnesses shown simultaneous lineups made only

Table 3. Experiment 2 Response Probabilities for Target-Present and Target-Removed, Simultaneous, and Sequential Lineups

	Simultaneous		Sequential	
	Target present	Target removed	Target present	Target removed
Suspect	.417	—	.479	—
Foil	.438	.667	.333	.646
Next-best	.208	.313	.208	.375
No pick	.146	.333	.188	.354
Don't know	.042	.042	.000	.000
Reject	.104	.292	.188	.354

one multiple identification. In the simultaneous lineups there is no clear temporal ordering of the multiple identifications, and thus the one multiple identification was resolved as a forced-choice.

In the sequential lineups, multiple identifications were resolved as they were in Experiment 1, by counting only the first identification a witness made rather than having them chose between their multiple identifications. The results reported below use the first-response rule, which in real world application seems critical to the sequential procedure. Nonetheless, witnesses were asked to choose between their multiple identifications and similar to the results of Experiment 1, these witnesses tended to choose poorly (two-thirds choosing a foil).[4]

Basic Identification Data: Simultaneous Versus Sequential Lineups

The identification results for TP and TR lineups, with simultaneous and sequential presentation are shown in Table 3. Each witness's response was classified as one of the following: identification of the target, identification of a foil, a don't know response, or a reject response. As is typical, don't know responses were somewhat rare, and thus don't know and reject responses were combined into a single no-ID response for subsequent analyses.

As in Experiment 1, sequential lineups produced slightly better performance than simultaneous lineups, with a slightly higher rate of correct rejections in TR lineups (.354 vs. .292) and a slightly higher rate of correct identifications in TP lineups (.479 vs. .417). These two small, nonsignificant increases in correct responses (both $\chi^2 < 1$) did not, when combined, add up to a statistically significant advantage for sequential lineups ($\chi^2 < 1$).

[4]Multiple identifications were again re-analyzed by having witnesses choose between multiple identifications, and by excluding multiple identification witnesses from the analyses. Had the multiple identifications in sequential lineups been analyzed by asking subjects to choose between their identifications, the results would have changed only slightly, with three additional target and three less foil identifications in TP lineups, and no change in the TR lineups. This would have increased the target identification rate to .5417 and decreased the foil identification rate to .2708. The lowering of the foil identification rate would have lowered the expected value used to compute the target-to-foils shift, resulting in larger chi-square values, but no changes in the statistical analyses. Excluding the multiple-identification witnesses also had little effect, did not change the pattern of results, and also produced large chi-square values, giving a larger estimate of the size of the target-to-foils shift.

Table 4. Experiment 2 Response Probabilities for Sequential Lineups, Next-Best in Position 2 or 4

	Next-best in Position 2		Next-best in Position 4	
	Target present	Target removed	Target present	Target removed
Suspect	.292	—	.667	—
Foil	.500	.500	.167	.792
Next-best	.292	.292	.125	.458
Reject	.208	.500	.167	.208

Order and Position Effects

As was the case for Experiment 1, the positions of the target and NB had no effect in simultaneous lineups (chi-square values for NB, target, and reject rates all < 1), but produced large effects for sequential lineups. The sequential lineup data are presented separately for each ordering in Table 4.

For sequential lineups, the correct identification rate in TP lineups was much higher when the target preceded NB (.667) than when the target followed NB (.292), $\chi^2(1) = 6.762, p < .01$. Likewise, the identification rate for NB was lower when NB followed the target. The combination of these results for target and NB was also statistically reliable, $\chi^2(1) = 4.467, p < .05$. The incorrect rejection rates in TP lineups did not vary with position, $\chi^2 < 1$, however, the position of NB did produce higher correct rejection rates for NB $= 2$ than for NB $= 4$, $\chi^2(1) = 4.463$, $p < .05$. From these order effects, a sequential advantage again emerges, exactly as it did in Experiment 1, again for correct target identifications, only when NB was in position 4, $\chi^2(1) = 4.00, p < .05$.

The explanation of the sequential lineup order effect is again straightforward: When NB appeared in position 2, many witnesses selected him and therefore did not have the opportunity to select the target in position 4. Conversely, when NB appeared in position 4, most witnesses had already correctly identified the target, thus making the NB irrelevant. For the simultaneous lineups, positions of target and NB did not influence response probabilities.

Evaluation of the Target-to-Foils Shift

The foil and no-ID response probabilities relevant to the target-to-foils shift are shown in Fig. 2. Again, the figure shows foil and no-ID rates for the relevant comparisons. The expected values (not shown) would show flat TP-TR lines for foils and steep increases for no-ID responses. The results showed a target-to-foils shift of equal magnitude for both simultaneous and sequential lineups, and a large order effect for sequential lineups. The statistical analyses underlying these conclusions are as follows:

The target-to-foils shift was evaluated as a chi square, first without consideration of lineup type, $\chi^2(1) = 29.728$, and then taking lineup type into consideration, $\chi^2(2) = 31.337$. Adding the lineup type variable added very little to the analysis, $\chi^2(1) = 1.609, p > .20$, indicating that the size of the shift did not vary for simultaneous and sequential lineups.

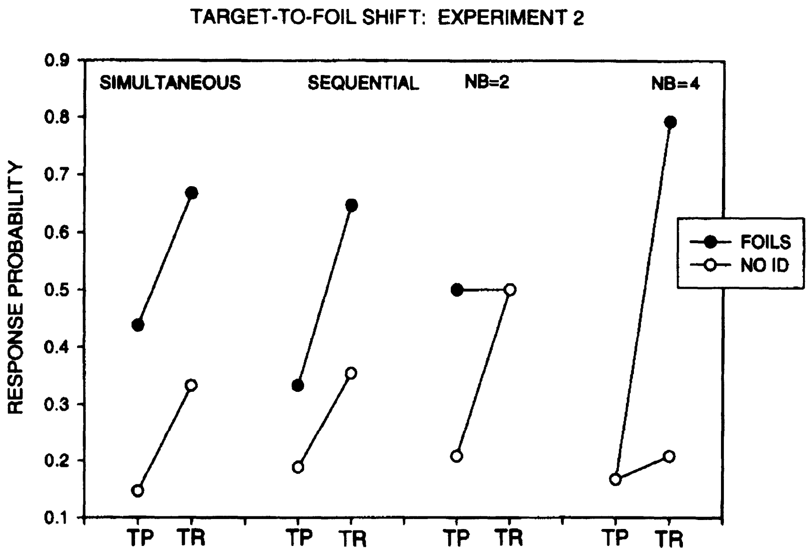

Fig. 2. Target-to-foils shift for simultaneous and sequential lineups with NB in position 4 and NB in position 2. For each case, data are shown for foil and no-ID response rates for both target-present (TP) and target-removed (TR) lineups.

Order and Position Effects in the Target-to-Foils Shift

Again for simultaneous lineups, there were no position effects. The deviation from expectations measured as before was only slightly larger when order was considered ($\chi^2(2) = 10.222$) than when it was not, $\chi^2(1) = 8.392$, leaving a difference $\chi^2(1) = 1.830, p > .10$. By sharp contrast, for sequential lineups, the Chi-square increased significantly when order was considered, $\chi^2(2) = 67.500$ compared to when it was not, $\chi^2(1) = 21.094$, with a difference $\chi^2(1) = 46.406, p < .001$.

Again, the explanation of these order effects is straightforward. In the sequential, TP case, when NB was presented in position 2, the proportion of witnesses identifying him was .292. However, when the target was presented in position 2 prior to NB, most witnesses identified the target (.667), a few identified a foil (.167), and a few identified NB (.125). In this case, the identification rates for foils and for NB were low because most witnesses had already selected the target. Thus, when the target was removed, and NB was in position 4, there was a large shift toward picking a foil, driven primarily by the .458 identification rate for NB. The removal of the target allowed witnesses the opportunity to view the NB, an opportunity they did not have in the TP lineups. The lack of a target-to-foils shift for the NB = 2 lineups is also a product of the order effect.

Testing the Constant-Criterion Hypothesis

As in Experiment 1 we consider whether the position (simultaneous) or ordering (sequential) had an effect on the decision criterion. There were no effects of position in simultaneous lineups for comparisons of target identification, next-best identification, or reject rates ($0 < \chi^2 < 1.38$).

Order effects for sequential lineups were analyzed as before, comparing reject rates and conditional probabilities for target and NB identification, considering only witnesses who had not already made an identification.

Reject rates did not differ for TP lineups as a function of order, $\chi^2(1) = .137$, but differed considerably for TR lineups, $\chi^2(1) = 4.463$, $p < .05$. This latter result differs from the outcome of Experiment 1, which did not show any difference in reject rates as a function of lineup order.

Considering now witnesses who had not already made an identification, the identification rates of the target did not vary as a function of lineup order, $\chi^2(1) = .021$. Target identification rates were nearly identical when the target was presented in position 2 (16/24 = .667) compared to position 4 (8/13 = .615). However, the probabilities of identifying NB in the TR lineup were not the same for NB in position 2 (7/21 = .333) and NB in position 4 (11/17 = .647), $\chi^2(1) = 3.709$, $p < .06$. This latter result suggests that witnesses did lower their criterion in order to identify NB when NB was presented in position 4 of the TR lineup.

The contrast between this result and the result from Experiment 1 points to a likely explanation—that the criterion shift was the result of the lower similarity of the NB alternative to the target. When a reasonably good alternative is presented early, a witness may feel that a better choice will come along, and then when that better choice is not presented, the witness correctly rejects the lineup. Conversely, when that same alternative occurs later in the lineup and is preceded by low similarity foils, a witness may choose that alternative because it is far and above a better choice than anything seen previously. In the TP lineup, because of the presence of a very good alternative, witnesses did not need to drop their criterion in order to make an identification. However, in the TR lineup, without a good alternative, an identification required that some witnesses drop their decision criterion, which they were more likely to do when next-best occurred later rather than earlier.

Summary

The results of Experiment 2 replicated those of Experiment 1, with one important exception. As was the case in Experiment 1, Experiment 2 showed a sequential lineup advantage in higher correct identification rates when the target preceded the next-best alternative. Experiment 2 also showed a target-to-foils shift that did not differ in magnitude for simultaneous and sequential lineups. Experiment 2 also replicated the results of Experiment 1 in finding no position effects for simultaneous lineups, but large order effects for sequential lineups.

Experiment 2 differed from Experiment 1 in the criterion analyses for TR sequential lineups. The conditional probability of identifying NB was higher and the correct rejection rate was lower when NB occurred later rather than earlier in the lineup. In addition the no-ID rates were higher when the next-best alternative was presented in position 2 than in position 4, also consistent with a drop in the criterion when the next-best alternative came later in the lineup.

GENERAL DISCUSSION

The Target-to-Foils Shift in Simultaneous and Sequential Lineups

Both experiments showed a large target-to-foils shift for both simultaneous and sequential lineups. The magnitude of the shift—that is the degree to which the observed results from target-removed lineups deviated from the expected outcome—did not differ for simultaneous and sequential lineups. This result is contrary to the logic and prediction outlined in the introduction. Presumably, if the target-to-foils shift is the product of relative decision processes, and relative decision processes play less of a role in sequential lineups, then the size of the target-to-foils shift should be reduced for sequential lineups relative to simultaneous lineups.

These results suggest that the target-to-foils shift may be produced by decision processes that are common to both simultaneous and sequential lineups. The most straightforward decision rule is for sequential lineups: If the match of a given alternative is above some criterion, identify that person, and reject that alternative otherwise. The decision rule may be similar for the simultaneous lineup, except when there are multiple alternatives above criterion, in which case witnesses may pick the best match. In this case the target-to-foils shift can be produced with no change in decision criterion because there will still be at least one alternative above criterion, even when the target is removed. This seems a reasonable account of the results for Experiment 1.

In Experiment 2, it is reasonable to assume within this framework that there would be fewer cases with multiple alternatives above criterion. Certainly for sequential lineups, the criterion-shift analyses suggest that some witnesses lowered their criterion in order to make an identification in the TR lineups. It is not clear whether such criterion-dropping occurred for simultaneous lineups.

These analyses suggest two ways in which relative decisions may be made: by identifying the best match when there are multiple matches above criterion, or by adjusting the criterion downward in order to make an identification. Other variations of relative decision rules include basing decisions on the difference between the best match and the next-best match (Clark, 2003) or by using a process of elimination strategy (Dunning & Stern, 1994). Further research is necessary to distinguish between these various possible relative decision processes.

Position and Order Effects in Simultaneous and Sequential Lineups

Position and order effects were examined in both simultaneous and sequential lineups. Simultaneous lineups showed no effects due to the positions of the target and next-best lineup alternative. This minor aspect of the results has important implications: (1) even when the lineup was presented in a single row such that left-to-right reading could have an influence on identification responses, there was no such effect in the present experiments, and (2) the order effects found in sequential lineups truly are order effects, in that they cannot be reduced to position.

Order effects were quite strong for sequential lineups. The ordering of the target and next-best alternative mediated the sequential advantage over simultaneous lineups, as well as the target-to-foils shift in both experiments. Order did not appear to induce a criterion shift for Experiment 1, but did for Experiment 2.

Why did we find strong order effects where other studies have found none? In Experiment 1 the order effect could have been due to the strong competition of a very similar next-best alternative in the lineup. However, this explanation cannot account for the order effects found in Experiment 2 for which the next-best alternative was less of a competitor to the target.

For some previously published studies the order analysis simply did not have enough statistical power to detect order differences because the order analysis required that the data set be cut into very small slices (e.g., Sporer, 1993). This should not be taken as a criticism of those studies given that they were not designed with the purpose of testing for order effects. Many other studies did not test for order effects, making reference to the lack of an order effect found in the original study by Lindsay and Wells (1985).

The lack of an order effect in the Lindsay and Wells study cannot easily be attributed to low statistical power, as their analysis was conducted on 20 witnesses per order condition and the present analyses were conducted on 24 witnesses per order condition. One notable difference between their study and this study is that they showed very low foil identification rates across the board, for both simultaneous and sequential lineup conditions. The foil identification rates ranged from .02 to .18. By contrast, if we assign the next-best alternative the role of the innocent suspect in the TR lineups (thus reclassifying it so that it does not count as a foil), the foil identification rates in the present experiments ranged from a low of .271 (Experiment 2, sequential, TR lineup) to a high of .542 (Experiment 1, simultaneous, TP lineup, in which the NB would be counted as one of the foils). The contrast of these foil identification rates suggests that the foils used by Lindsay and Wells were very weak competitors that were rarely identified by any of the witnesses, whereas those used in the present experiments were much stronger competitors, frequently identified by witnesses. The contrast suggests that whether the sequential lineup procedure will show an effect of order depends on the degree to which the foils are competitors to the suspect. With a moment's reflection, and the 20/20 hindsight provided by seeing the results, this makes perfect sense. If the foils are not competitors, then they cannot have much of an effect vis-à-vis the identification of the suspect, in which case the ordering of such noncompeting foils should not matter.

In the present experiments, the order effect was produced because the identification of foils presented prior to the target precluded the identification of the target. In the Lindsay and Wells study, because foils were rarely identified, this mechanism would have contributed very little. As the similarity of the foils to the target increases, so too should the likelihood of an order effect.

Constant Criterion in Sequential Lineups

The presence of order effects does not necessarily imply a shift in the decision criterion. Indeed, order effects are predicted by a constant criterion model. Assuming that the foils are "contenders," if the foils precede the target, any witness who identifies a foil will not have the opportunity to identify the target, and thus the target identification rate will be decreased.

Because order effects alone do not provide evidence for criterion shifting, we used two other data indicators to test criterion shifting in sequential lineups—the conditional probability of identification, limited only to those witnesses who had not already made an identification and the no-ID rates. A shifting criterion predicts that conditional identification rates and no-ID rates will both change if the criterion shifts.

Experiment 1 showed no evidence of a shifting criterion: Conditional identification rates were virtually identical for the target in TP lineups and the NB in TR lineups. In contrast, the results of Experiment 2 indicated no evidence of order-based criterion-shifting for TP lineups, but a clear downward shift in the criterion for TR lineups. Evidence for the criterion shift was shown in both increased conditional identification rates for the next-best alternative, and also in decreased reject rates.

The explanation of this pattern of results is quite straightforward. For Experiment 1 and for the TP lineups of Experiment 2, because of the presence of a good match in the lineup, witnesses did not need to lower their decision criteria in order to make an identification. In the TR lineups of Experiment 2 witnesses had to lower their criterion in order to make an identification because even the best match in the lineup did not qualify as a "good" match to memory. This account of the results assumes that there are some witnesses whose desire to make an identification is sufficiently strong that they will drop their decision criterion in order to do so. This is not an unreasonable assumption.

Implications for Policy and Police Procedure

There is a strong movement toward the use of sequential lineups (Kolata & Peterson, 2001; Lindsay, 1999). This preference rests on a number of experiments showing that false identification rates are reduced—in some cases reduced dramatically—by the use of the sequential lineup, compared to a simultaneous lineup (see Steblay et al., 2001 for a meta-analytic review). The present results may give additional support to the preference. In both experiments sequential lineups showed not only lower false identification rates (although only slightly lower in some cases), but also showed increased correct identification rates. Considering both kinds of correct responses - correct identification of the target as well as correct rejection of target-absent lineups - sequential lineups showed better performance than simultaneous lineups. One of the most striking aspects of the present experiments is that, in contrast to typical findings, the advantage for sequential lineups rested primarily on increased correct identification rates. Thus, the present results suggest that, under some circumstances, the use of the sequential lineup can also increase the likelihood of correctly identifying the perpetrator of the crime.

The question, of course, is *what circumstances?* In the present experiments, the correct identification of the target may have been suppressed by the presence of a very good (Experiment 1) or at least reasonably good (Experiment 2) next-best alternative in the lineup. In the simultaneous lineup both the target and the good alternative are present at the same time so that they may compete for the witness's choice. This, of course, is not the case in a sequential lineup. In the two experiments presented here, correct identification rates were decreased when the good alternative preceded the target and were increased when the good alternative followed the target, and importantly, relative to the simultaneous lineup, the increase in hit rate in the sequential lineup was much larger than the decrease. Thus, we tentatively suggest that sequential lineups may show higher hit rates relative to simultaneous lineups as the similarity of the foils to the target increases.

This still leaves open a question about the positioning of the suspect in the lineup. Should the suspect be placed earlier or later in the lineup? Certainly when the target was in the lineup, hit rates were much higher—twice as high—when he was positioned toward the beginning, rather than toward the end, of the lineup. This alone does not answer the question, because the police do not know a prior whether the target (perpetrator) is in the lineup, or whether their suspect is innocent. This requires us to address the case when the suspect is innocent.

We should first note that the present results cannot speak directly to this question to the extent that we used a target-removed lineup rather than a target-absent lineup, in which the target was replaced by another alternative in the role of the innocent suspect. However, with that caveat, we can assign the next-best alternative the role of the innocent suspect in the target-removed lineups. The picture here is not clear because the two experiments showed different results. In Experiment 1, the next-best identification rate was higher when presented early (.417) than when presented late (.250), but Experiment 2 showed the reverse pattern—a lower rate of identification early (.292) and higher when presented late (.458). This conflicting pattern of results makes it impossible to give any clear guidelines regarding the positioning of the suspect in the lineup.

Conclusions and Future Research

The present experiments showed several surprising results. First, the target-to-foils shift, a result thought to be a signature of relative decision processes, was shown to occur in sequential lineups, which presumably minimize relative decision processes. This result suggests that there is much more to learn about the decision processes that underlie these two lineup presentation procedures. Second, the present studies replicated the sequential advantage, but did so in a different way, by increasing the rate of correct identification of the target, with only small decreases in false identifications in TR lineups. Third, clear order effects were shown for sequential lineups, also contrasting with previous results (Lindsay & Wells, 1985; Sporer, 1993). We suggest that the presence or absence of order effects is tied to the composition of the lineup, specifically the similarity of the foils to the target. This possibility calls for more research into the interaction of lineup composition, order effects, and decision processes in sequential lineups.

APPENDIX: CONFIDENCE ANALYSES

Experiment 1

For all confidence analyses, don't know responses were excluded because the meaning of confidence for such responses is ambiguous and difficult to interpret. For the remaining data, a 2 × 2 × 2 analysis of variance (pre-ID or post-ID, TP or TR, simultaneous or sequential) showed higher confidence for pre-identification confidence than for postidentification confidence, $F(1, 186) = 30.900$, $p < .001$. There were no differences due to lineup type or target presence or removal, and no interactions among any of the variables. Point biserial confidence-accuracy correlations, calculated separately for sequential and simultaneous lineups showed no significant deviation from zero, for either simultaneous ($r = .01$) or sequential lineups ($r = -.16$).

Experiment 2

A 2 × 2 × 2 analysis of variance (same factors as Experiment 1) showed higher confidence for pre-identification confidence than for postidentification confidence, $F(1, 185) = 5.182$, $p < .05$, and no other main effects or interactions. Point biserial confidence-accuracy correlations calculated as in Experiment 1 showed a signification deviation from zero for simultaneous lineups ($r = .27$, $p < .01$) but not for sequential lineups ($r = .16$, $p > .10$).

The extremely low confidence-accuracy correlations in Experiment 1 are likely to have been due, at least in part, to the high similarity of the foils to the target. The correlations were higher in Experiment 2, but the correlation was only significantly above zero for simultaneous lineups. The low correlation for sequential lineups may have been due to obtaining the confidence measure at the end of the sequence of photographs. Witnesses may have second-guessed themselves as a result of seeing additional photographs after having made their identification.

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