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Eyewitness Accuracy Rates in Sequential and Simultaneous Lineup Presentations: A Meta-Analytic Comparison[1]

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Most police lineups use a simultaneous presentation technique in which eyewitnesses view all lineup members at the same time. Lindsay and Wells (R. C. L. Lindsay & G. L. Wells, 1985) devised an alternative procedure, the sequential lineup, in which witnesses view one lineup member at a time and decide whether or not that person is the perpetrator prior to viewing the next lineup member. The present work uses the technique of meta-analysis to compare the accuracy rates of these presentation styles. Twenty-three papers were located (9 published and 14 unpublished), providing 30 tests of the hypothesis and including 4,145 participants. Results showed that identification of perpetrators from target-present lineups occurs at a higher rate from simultaneous than from sequential lineups. However, this difference largely disappears when moderator variables approximating real world conditions are considered. Also, correct rejection rates were significantly higher for sequential than simultaneous lineups and this difference is maintained or increased by greater approximation to real world conditions. Implications of these findings are discussed.

Standard police lineups present the eyewitness with all lineup members (e.g., six or eight persons) at one time. Under these conditions, eyewitnesses tend to compare lineup members to each other to determine which one most closely resembles the perpetrator relative to the others, a process called *relative judgment* (Wells, 1984). Even in a perpetrator-absent lineup, it is likely that one lineup member can provide a better relative match to memory than the others and thus generate a lineup choice by the eyewitness. To avoid this potential for mistaken identification, techniques (e.g.,

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unbiased lineup instructions) have been empirically developed to inhibit relative judgment processes.

Lindsay and Wells (1985) devised an alternative lineup presentation procedure, sequential presentation, to reduce the tendency of eyewitnesses to rely on relative judgment. The sequential procedure presents the eyewitness with one lineup member at a time and, prior to being allowed to view the next member, requires the eyewitness to decide whether or not that person is the perpetrator. This one-at-a-time procedure is intended to discourage the eyewitness from simply deciding who looks most like the perpetrator. Although the eyewitness could decide that the lineup member being viewed currently looks more like the perpetrator than did the previous person, the eyewitness cannot be sure that the next (not yet viewed) person does not look even more like the perpetrator. Lindsay and Wells reasoned that this would force eyewitnesses to use a more "absolute" criterion (i.e., Is this the perpetrator or not?) rather than the relative-judgment criterion (i.e., Is this person more similar to the perpetrator than the other lineup members?). Their data showed that the simultaneous and sequential procedures produced nearly identical correct identification rates when the perpetrator was present in the lineup. When the lineup did not contain the perpetrator, however, the rate of mistaken identifications was 43% with the simultaneous procedure and only 17% with the sequential method. Other studies have shown that the sequential procedure is also less sensitive to lineup biases (Lindsay et al., 1991).

This *sequential-superiority effect* has been replicated in experiments across the United States, Canada, the United Kingdom, South Africa, Germany, and Australia. The simplicity of the sequential technique, along with many promising research outcomes, has made it one of the most important of all the practical contributions of eyewitness research to actual eyewitness evidence collection procedures. In a recent survey of 64 eyewitness experts, Kassin, Tubb, Hosch, and Memon (2001) found that 81% agreed with the general proposition that "Witnesses are more likely to misidentify someone by making a relative judgment when presented with a simultaneous (as opposed to sequential) lineup." However, as with most established lines of research, some disparity in outcomes is apparent. A quick scan of results across 28 available tests of overall accuracy for sequential versus simultaneous lineups demonstrates support for sequential superiority. Nineteen tests indicate outcomes in the expected direction; however, 10 of these 19 report statistically nonsignificant results, and one reports no difference. Eight tests generated results in the opposite direction of the hypothesis. Thus there is a need to examine the data in a more comprehensive and precise manner. Fortunately, the review technique of meta-analysis allows us to quantitatively identify any underlying pattern across studies, while lessening the noise of extraneous error components. In particular, statistical limitations of small samples may be overcome; the combination of many data sets and the examination of effect size indicators provide the tools to uncover effects otherwise masked by low power. Meta-analysis provides the additional benefit of exploration of theoretical and methodological moderator variables. The goal of this work is to use the technique of meta-analysis (see Steblay, 1992; Steblay, Besirevic, Fulero, & Jimenez-Lorente, 1999) to examine the sequential-superiority effect and the variables that might moderate it, across the extant studies.

METHOD

Sample

A computer search of the CD-Rom database PsycLIT provided an initial sample of studies relevant to the hypothesis. Direct contact with lineup researchers provided access to additional published and unpublished work. In order to be included in the sample, the experimental study must have compared a sequential to a simultaneous lineup presentation and provided a statistical test of the relationship between lineup presentation and identification accuracy. Multiple dependent measures of accuracy were available in the sample, and the review incorporated performance frequencies of the following: (1) overall correct decisions, collapsed across target-present and target-absent lineup presentation (correct identifications plus correct lineup rejections); For target-present lineups, (2) correct identifications, (3) false rejections of the lineup, and (4) choice of a lineup foil (a known error); For target-absent lineups, (5) correct rejections, (6) identification of any foil, and (7) identification of a designated innocent suspect or target.[6] The majority of experimental tests (93%) employed photo lineups and 67% of lineups were of size six. Mean time of exposure to perpetrator was 75 s; maximum exposure was 4.75 min.

Twenty-three papers were located (9 published and 14 unpublished), providing 30 tests of the hypothesis. The sample included work completed between 1983 and 2000, representing 4,145 participants. Both male and female participants were included in 97% of the tests. Sample sizes ranged from 32 to 327, with a mean of 138.2.

Study Characteristics

Methodological and theoretical variables were coded as part of the data set. Methodological variables included researcher, year of publication, source (published or unpublished) number of hypothesis tests per study, sample size, subject gender, sample makeup (undergraduate students, elementary students, preschool children, other), lineup size and format (photo, video, both), design (within-subject, between-subject), type of crime (robbery, theft, other, no crime), and event stimulus (video, live, slides, transparencies). Variables of more theoretical import included time of delay between event and lineup, number of perpetrators (single, multiple), inclusion of a verbal description task (present, not present), lineup instructions (biased, unbiased), and participants' awareness of a number of sequential photos to be viewed (aware, not).

One author (JD) initially recorded data from each paper. A second author (NS) independently calculated and coded the data, then compared information to the first

[6]In some studies, a particular individual has been designated as "the innocent suspect" for the purpose of testing the ability of lineup procedures to protect an innocent suspect who just happens to resemble the true criminal. In these studies the innocent suspect has been selected to maximize resemblance to the criminal. In studies of lineup bias (e.g., clothing bias), the innocent suspect is the lineup member toward whom the bias is directed (wearing clothing similar to that worn by the criminal during the crime). In general, false positive choice rates indicate propensity to choose despite the absence of the criminal without specifying which lineup member in particular is likely to be selected.

author's data set in order to check for oversights in the process. The variables coded were derived directly from the papers, with minimal interpretation necessary. Multiple coders were employed simply to assure that available information was recorded correctly. Thus ultimate agreement among coders was 100%.

Statistics

Following the work of Rosenthal (1991), the Pearson correlation coefficient r was used as the measure of effect size. The mean effect size for a group of hypothesis tests is referred to in subsequent discussion simply as r. A meta-analytic Z (Z_{ma}) was calculated by combining Z-scores of individual tests of the hypothesis using the Stouffer method (Rosenthal, 1991). This method produces an overall probability level associated with the observed pattern of results. A fail-safe N (N_{fs}) was calculated to estimate the number of additional tests averaging null results that would be needed in order to bring the significance level attained through the meta-analysis to a value larger than .05.

Rather than using 0.00 as an estimate for imprecisely reported values, only tests for which r and Z values could be calculated are included in the analyses.

RESULTS

Thirty tests of the hypothesis were available to examine the status of the effect, that is, the hypothesis that sequential lineups foster better eyewitness lineup performance than do simultaneous lineups. Positive r and Z values reported below denote support of this hypothesis. Negative r and Z values indicate results in the opposite direction, that is, that subjects in the simultaneous lineup condition performed better than subjects in the sequential condition.

Overall Frequency of Correct Decisions

The first pass through the data set was to ascertain the overall level of correct lineup decisions by eyewitnesses. This figure represents, from available data in each of 28 data sets,[7] the frequency of correct identifications in target-present lineups or correct lineup rejections in target-absent lineups or both. Sequential lineups produced 56% correct decisions; simultaneous lineups generated 48% correct decisions, a significant difference, $Z_{ma} = 5.27$, $p < .0001$,[8] $N_{fs} = 259$, with a small effect size, $r = .09$, favoring the sequential lineup format. This calculation, however, collapsed data across a critical moderator variable in lineup research (e.g., see Steblay, 1997): whether the perpetrator is present in or absent from the lineup. The next

[7]Two of the data sets did not include the statistics necessary to be included in this dependent measure calculation. In like manner, for subsequent calculations, the N reported is the number of tests of the hypothesis that were available and included in that calculation.

[8]For a one-tailed test of the hypothesis, a Z_{ma} of 1.65 has an associated p value of .0001. To present the results most efficiently, remaining calculations do not report the specific significant p value if $Z_{ma} > 1.65$.

calculations attempt to assess the impact of sequential versus simultaneous presentation for target-absent and target-present lineups separately.

Decision Making in Target-Present Lineup Conditions

Three outcomes are possible for an eyewitness faced with a target-present lineup: the correct identification of the perpetrator, an incorrect choice of a foil (typically a "known error"), and an incorrect rejection of the lineup (a "false rejection"). The following statistics utilized the frequency of each of these outcomes to assess accuracy in the sequential versus simultaneous lineup conditions. The data demonstrate that correct identifications are significantly more likely in the simultaneous lineup, $Z_{ma} = -4.79$, $N = 21$, $N_{fs} = 166$ and $r = -.14$, (r calculation based on $N = 22$), with a 15% performance advantage (50% vs. 35%, simultaneous vs. sequential, respectively). False rejections are significantly fewer in the simultaneous condition, $Z_{ma} = -4.60$, $N_{fs} = 81$, $r = -.21$, (26% vs. 46%), $N = 12$. Choice of a foil is not significantly different across the lineup formats, $Z_{ma} = 1.09, = .08$ (see Table 1).

Decision Making in Target-Absent Lineup Conditions

Two outcomes are possible for an eyewitness who approaches a lineup that does not include the perpetrator: correct rejection of the lineup or false choice. In this case, the sequential lineup produces significantly better eyewitness performance. Correct rejections of the lineup are 23% higher (72% vs. 49%) in the sequential lineup condition, $Z_{ma} = 9.93$, $N_{fs} = 851$, $r = .25$, $N = 24$, and false choices (of any lineup member) are significantly lower for sequential lineups (28% vs. 51%) $Z_{ma} = 9.85$, $N_{fs} = 836$, $r = .24$, $N = 25$.

Nine of the research teams have further explored the perpetrator-absent scenario by planting a suspect in the lineup that closely matches the description of the

Table 1. Lineup Performance: Sequential Versus Simultaneous Lineup Formats

	N	Sequential (%)	Simultaneous (%)	Effect (r)	Z_{ma}
Overall correct decisions	28	56	48	.09	5.27*
Target present lineup					
Correct ID	22	35	50	−.14	−4.79*
False rejection	12	46	26	−.21	−4.60*
Choice of foil	13	19	24	.08	1.09
Total		100	100		
Target absent lineup					
Correct rejection	24	72	49	.25	9.93*
False identification of any foil	25	28	51	.24	9.85*
Total		100	100		
False identification of designated suspect	15	09	27	.23	8.06*

*$p < .0001$.

true perpetrator. This person thus becomes an "innocent suspect" in the perpetrator-absent lineup. Sequential lineup conditions foster significantly lower false identification of the innocent suspect compared to simultaneous lineups (9% vs. 27%), $Z_{ma} = 8.06$, $N_{fs} = 345$, $r = .23$, $N = 15$.

Identification Accuracy of Choosers

Eyewitness participants may decline to choose from a lineup, thereby making an error if the target is in the lineup and a correct decision for a target-absent lineup. Participants who make a choice from the lineup ("choosers") may select the perpetrator (if present) or may choose a foil. First, considering a target-present lineup, we find that 74% of participants viewing a simultaneous lineup are "choosers," that is, they actually make a choice from the lineup, whereas 54% of sequential lineup participants are choosers (see Table 1). This 20% represents a significant difference, $Z = 5.03$, $p < .0001$, $r = .18$. Of those who do choose, the accuracy differential is small: 68% of choosers in the simultaneous lineup condition make a correct choice, 32% a mistaken choice; in the sequential condition, 65% make a correct identification, 35% an incorrect choice. A statistical significance test for this last comparison could be computed with data from only a subset of 13 tests (those for which precise frequencies were available). For these tests, the accuracy differential between simultaneous and sequential conditions is 5%, (71% vs. 66%), but not statistically significant, $Z = -1.23$, $p = .11$, $r = -.05$.

Presented with a target-absent lineup, there is again a significantly higher level of choosing in the simultaneous lineup condition: 51% versus 28%, $Z = 10.43$, $p < .0001$, $r = .08$. In this situation, however, any lineup choice is an error, thus simultaneous lineup conditions generate false identification errors, and the rate of false identification of the "designated innocent suspect," as reported earlier, is 3 times as high in the simultaneous condition (27% vs. 9%).

Summary

Participants in the sequential lineup condition are less likely to make a lineup choice. When the perpetrator is present, this lower choosing rate results in false rejection errors. In fact the errors committed by sequential lineup participants are primarily those of false lineup rejection. In the target-absent lineup, the caution of the sequential lineup participant aids accuracy; participants are more hesitant to make a lineup choice, thereby reducing false identification errors.

The reverse is true of the simultaneous lineup participant: An increased tendency to choose favors this participant if the target is indeed present, while increasing false identification errors, particularly of an designated innocent suspect, in a perpetrator-absent lineup.

For those participants who make a lineup choice and for which the perpetrator is actually in the lineup, a simultaneous lineup presentation produces a 3% higher accuracy rate in perpetrator identification.

The stem-and-leaf plot for target-present lineup correct identifications (Table 2) shows a relatively normal distribution of effect sizes around the mean of −.14, (95%

Table 2. Stem-and-Leaf Display of Effect Sizes (r). Target Present Lineups: Correct Identifications

Stem	Leaf
.8	
.7	
.6	
.5	
.4	
.3	
.2	
.1	1
.0	5,6
−.0	2,6,6,8,8,8
−.1	0,0,1,5,8
−.2	0,0,8,9
−.3	0,4,4
−.4	3
−.5	
−.6	
−.7	
−.8	

CI: −.57 to +.27). As the stem-and-leaf for target-absent correct rejection demonstrates (Table 3), effect sizes for this subset are, with only one exception (Vanderwal, 1996), above zero. A 95% confidence interval around the mean of .25 is −.15 to +.65. Subsequent analyses attempt to explore those moderator variables that might determine conditions under which lineup presentation effects are most pronounced or constrained. These analyses are separated by target-present and target-absent lineups.

Table 3. Stem-and-Leaf Display of Effect Sizes (r). Target Absent Lineups: Correct Rejection

Stem	Leaf
.8	
.7	8
.6	
.5	6
.4	2,2,3,6,7
.3	0,2,4,6,6,6
.2	3
.1	0,0,0,2,6
.0	0,0,2,7
−.0	
−.1	
−.2	
−.3	
−.4	
−.5	0
−.6	
−.7	
−.8	

Moderator Variables

Results of moderator variable analyses are reported in Table 4. This discussion can best be framed by the outcomes of the previous analysis: A simultaneous lineup presentation produced superior accuracy in target-present lineups, whereas a sequential lineup format produced superior accuracy in target-absent lineups. Table 4 reflects this pattern in a uniform outcome across moderator variables (indicated by the consistent negative effect sizes in column 1 and positive effect sizes in columns

Table 4. Effect Size Analysis by Moderator Variables

Variable	Target present lineup: Correct identification *r* (*N*)	Target absent lineup: Correct rejection *r* (*N*)	False target ID *r* (*N*)
Sample			
Undergraduates	−.14 (18)*	.28 (21)*	.26 (13)*
Elementary students	−.30 (1)	.10 (1)	−.08 (1)
Lineup size			
6	−.20 (15)*	.23 (15)*	.15 (8)*
>6 (8–18)	−.07 (6)*	.29 (8)*	.34 (6)*
Lineup construction			
Biased against suspect	−.10 (1)	.37 (4)*	.37 (4)*
No reported bias	−.14 (19)*	.21 (19)*	.19 (10)*
Instructions			
Unbiased instructions	−.13 (20)*	.23 (21)*	.21 (14)*
Unreported	−.25 (2)*	.36 (3)*	.56 (1)*
Number of perpetrators			
Single	−.14 (18)*	.29 (21)*	.23 (15)*
Multiple	−.19 (4)*	−.03 (3)	—
Delay			
Immediate	−.15 (18)*	.25 (23)*	.23 (15)*
1 hr or more	−.13 (4)*	.32 (1)*	—
Awareness of number of photos to be viewed (in sequential condition)			
Yes	−.11 (4)*	.25 (2)*	—
No	−.17 (12)*	.22 (11)*	.16 (6)*
Verbal description			
Yes	.11 (12)*	.22 (13)*	.24 (10)*
No	−.01 (14)	.25 (9)*	.09 (3)
Event stimulus			
Video	−.11 (10)*	.24 (9)*	.16 (1)*
Live	−.11 (8)*	.28 (12)*	.28 (11)*
Slides/transparencies	−.30 (4)*	.18 (3)*	.09 (3)
Type of event			
Robbery/theft	−.13 (11)*	.30 (13)*	.26 (11)*
Noncriminal staged event	−.15 (2)*	.09 (2)*	.18 (1)*
Erratic driving	−.15 (1)	.78 (1)*	—
Undefined crime	−.16 (8)*	.13 (8)*	.15 (3)*
Design			
Between-subject	−.12 (20)	.25 (24)	.23 (15)
Within-subject	−.32 (2)	—	—
Publication status			
Published	−.07 (11)*	.33 (13)*	.29 (10)*
Not published	−.22 (11)*	.16 (11)*	.12 (5)

*$Z_{ma} > 1.65$. $p < .0001$.

2 and 3). Three noteworthy exceptions to this pattern appear for the moderators of verbal description, number of perpetrators, and sample.

Verbal Description

The phenomenon of verbal overshadowing, most recently reported by Meissner and Brigham (in press), is triggered by an eyewitness's verbal description of the perpetrator prior to the lineup task. A verbal overshadowing effect occurs when this verbal description hinders the subsequent identification attempt. Table 4 data indicate that superior accuracy of the sequential format in target-absent lineups remains largely intact regardless of whether a verbal description task was employed, with the exception of a reduced effect (.09) for false identification of the target suspect. However, when a verbal description was required in the context of target-present lineups, the typical outcome pattern of simultaneous presentation superiority was reversed: sequential lineup presentation produced significantly greater accuracy and positive effect sizes in 9 of the 12 tests. Thus, a verbal description prior to the lineup is associated with a consistent, superior effect of sequential lineup format across both target-present and target-absent lineups. For the 14 hypothesis tests that did not employ verbal descriptions, the lack of effect is salient ($r = -.01$), although it should be noted that great variability exists for effect size within this subgroup (ranging from $-.42$ to $+.42$).

Multiple Perpetrators

For three tests in which the lineup contained multiple perpetrators, the sequential superiority pattern was eliminated, $r = -.03$, in target-absent lineups. In target-present lineups, the simultaneous lineup effectiveness pattern was retained for both single and multiple perpetrator lineups.

Sample

One study exclusively used elementary students, producing a reversed, but not significant effect for false identifications in the target-absent lineup ($r = -.08$).

Table 4 also details moderators that are associated with greater and lesser effect sizes. The difference in target-present lineup performance produced by simultaneous versus sequential lineup formats ($r = -.14$) is larger for those tests in which no cautionary instructions are provided to the witness, when slides or transparencies are used as the event stimulus, when a within-subject design is employed, and for unpublished studies. This pattern is diminished in tests that included lineups greater than size six, lineups biased against the suspect, and for published studies.

The target-absent lineup effect (which favors sequential presentation, $r = .25$) is greater in those studies that include a crime as the stimulus event, use a live event, included a biased lineup, or are published. A smaller effect is associated with studies in which slides or transparencies provide the stimulus, when the stimulus event is a noncrime, and for unpublished work.

DISCUSSION

Significant Effects

The results of the meta-analysis clearly indicate that sequential and simultaneous lineup presentation lead to dramatically different patterns of results. Almost every hypothesis test for which data were available produced a statistically significant effect. As a result, the choice of lineup procedure is not a trivial matter in the applied context and the details of the relative strengths and weaknesses of the two procedures are important. The overall pattern of lineup accuracy supports the sequential superiority hypothesis. However, potential complexities in the results must also be explored before uncritical acceptance of an unqualified conclusion. Thus, both the presence versus absence of the target in the lineup and moderator variables should be considered.

Presence Versus Absence of the Target

Separation of the data into results from target-present and target-absent lineups produces a caveat to the overall result. Simultaneous lineups generate more choices than sequential lineups and this is reflected in both higher rates of correct identification of targets from target-present lineups and false positive choices from target-absent lineups.

The superiority of simultaneous lineups when the target is in the lineup may reflect an advantage of using relative judgments (Wells, 1984). A witness employing a relative judgment strategy selects the lineup member who most closely matches his or her memory of the target. When the target is present in the lineup, it is not surprising that the target usually is the best match to the witness' memory. Simultaneous lineups facilitate making relative judgments; indeed, they may even encourage the use of a relative judgment process (Lindsay & Bellinger, 1999). Sequential lineups were designed specifically to reduce reliance on relative judgments and to force witnesses to employ a different strategy, absolute judgments (Lindsay & Wells, 1985). Using an absolute judgment strategy, the witness compares each individual in the lineup to the memory trace of the target. If the lineup member fails to reach a threshold of recognition; that is, if the match between the memory trace and the lineup member is not strong enough, then the witness does not select the lineup member. Since the lineup members are presented individually and the witness is unaware of how many lineup members will appear, it is easier for the witness to reject all of the lineup members from a sequential than a simultaneous lineup. This pattern results in a lower choosing rate overall for sequential lineups. The lower overall choosing rate in turn produces a lower correct identification rate in target-present sequential-lineup conditions because the target is more likely to fail to meet the absolute threshold of match to the memory trace than the relative criterion of lineup member most similar to the memory trace.

The loss of correct identifications may appear to be a serious problem in the applied setting but there are two reasons to be cautious about such a conclusion. First, moderator variables to be discussed below indicate that the problem may be much smaller than the analysis would indicate up to this point (possibly nonexistent).

Second, the correct identifications that are lost can be conceived of as calculated guesses. That is, sequential lineups may establish the rate at which witnesses in a given context can actually recognize the target. If they see him later, they are aware he is the person previously seen. Simultaneous lineups generate a higher correct identification rate by leading some witnesses who have a weak memory trace to choose anyway. Because the target is the best match to their memory (on average), these guesses are somewhat better than chance and a higher rate of target choices is obtained. In the applied setting, it is not clear that the police should solicit or that the courts should accept guesses as evidence. To the extent that any difference in target choices is due to correct guessing, there is no reason to recommend simultaneous lineups.

We may safely assume that not all police (and possibly not all researchers) would agree that correct guesses are undesirable. This may seem to leave the police (and researchers) in the position of having to decide which error is more important, failing to identify a criminal or falsely identifying an innocent person. However, the moderator variable analyses suggest that the dilemma may not be a serious problem. The moderator effects can be divided into three groups of variables: whether or not the studies were published, methodological differences in conducting the studies, and practical issues (factors that would or could vary in real world situations).

Published Versus Unpublished Studies

An issue that is routinely addressed in meta-analysis is the possibility that published reports misrepresent the phenomenon of interest by suppressing evidence of inconsistent or nonsignificant effects. The fact that publication was a significant moderator suggests the possibility that studies that obtained significantly higher accuracy with simultaneous than sequential lineups are harder to publish. If true, then police would truly be faced with a tradeoff of correct versus false positive identifications. If other moderators do not explain the difference in pattern across studies, this issue is a major concern. However, if other moderators account for the differences and could conceivably be related to publication decisions as well, publication as a moderator may not be that important.

Methodological Issues

Two research issues, within-subject designs and medium used to present the event, significantly influenced the results of sequential lineup studies. These manipulations can be described in terms of mundane realism or ecological validity. Between-subject designs and live or videotaped events are more ecologically valid in general than within-subject designs and static presentation of the events via slides or transparencies. Both of these factors are related to the superiority of simultaneous to sequential lineups with regard to target identifications from present lineups. The more realistic the stimuli used in the research, the smaller the difference in correct identification rate produced by the simultaneous and sequential lineup procedures. As the experimental conditions become more realistic, the results increasingly approach the pattern of results frequently attributed to lineup procedures: sequential

lineups result in approximately the same rate of correct identification and significantly lower rates of false identification than simultaneous lineups. Generalizing to real world identification situations, the tradeoff between correct and false identifications would appear to be not a serious problem.

Practical Issues

The practical issues or factors that moderated effects in studies of sequential lineups include verbal description, cautionary instructions, lineup biases, multiple perpetrators, age of witness, and nature of the event (crime vs. not). These variables can be further subdivided into system and estimator variables (Wells, 1978). Verbal description, cautionary instructions, and lineup biases are all system variables in that the system has control over their occurrence. The results suggest that simultaneous lineups lead to higher rates of correct identification when cautionary instructions are not employed. Cautionary instructions are likely and intended to reduce guessing. Failure to use such instructions is considered poor police procedure (Technical Working Group for Eyewitness Evidence, 1999). Because it is unlikely that cautionary instructions will be or should be abandoned, the difference in correct identification rate between simultaneous and sequential lineups in real cases will be smaller than that obtained in the target-present conditions examined in general.

Verbal description is perhaps the strongest moderator as its presence eliminates the superiority of simultaneous lineups for correct identification (though not the superiority of sequential lineups for correct lineup rejections). Although verbal description of the perpetrator is technically a system variable, in practice it may prove difficult for police to eliminate this variable. How are suspects to be apprehended if the witness is not asked to provide a description of the perpetrator? In cases of identification of strangers (the issue addressed by virtually all of the sequential lineup research), verbal person description is likely to occur. The only situation in which this problem might be avoided would be cases involving multiple witnesses such that police could obtain a description from some, but not all, witnesses. Those who did not provide descriptions would then be reserved for identification purposes. However, this strategy is not devoid of problems, as police would have to decide which witnesses to ask for descriptions. If the witnesses with the best view of the criminal provide the description, the accuracy of identification of the remaining witnesses may be questionable and questioned in court. If the witnesses with the worst view of the criminal provide the description, the accuracy of description may be poor, the criminal may never be apprehended, and the witnesses with the best view may never be used as a source of evidence. Even without this issue, it is not clear that witnesses who had not provided a description would not be exposed to the descriptions made by other witnesses. This could lead to misinformation effects or some sort of second hand verbal overshadowing (Loftus & Greene, 1980). Police will likely continue to ask all witnesses for descriptions and under this condition simultaneous lineups will not produce superior identification of criminals.

The nature of the event (crime vs. not), multiple perpetrators, and age of witness are estimator variables not under the control of police. Correct rejections of

target-absent lineups were influenced by the nature of the event as a moderator. The superiority of sequential lineups is greater when the event presented was a crime rather than a noncrime. Presumably police seek identification evidence more often in crime than noncrime situations. As a result, in more realistic situations, sequential lineups perform better.

The remaining two issues, multiple perpetrators and child witnesses, present a serious challenge to eyewitness researchers. Sequential lineups do not produce superior results in either situation and can be inferior (e.g., with very young children, Lindsay, Pozzulo, Craig, Lee, & Corber, 1997). Alternative procedures are required to deal with child witnesses and some work has been directed toward developing such procedures (Parker & Ryan, 1993; Pozzulo & Lindsay, 1997). Pozzulo and Lindsay (1999) tested a radically different procedure that produced relatively good identification performance from children as young as 8 or 9 years of age. Reliable identification evidence from younger children may be difficult to obtain until a new innovation occurs in identification research. Very little work has been directed toward the topic of identification procedures to be used specifically in cases involving multiple perpetrators and multiple suspects. In such situations, identification accuracy rates tend to be low regardless of the identification procedure employed (e.g., Clifford & Hollin, 1983). It appears that sequential lineups are not the answer. This area also awaits an innovative breakthrough.

CONCLUSIONS

Identification of perpetrators from target-present lineups occurs at a higher rate from simultaneous than from sequential lineups. However, this difference largely disappears when moderator variables are considered. Under the most realistic simulations of crimes and police procedures (live staged events, cautionary instructions, single perpetrators, adult witnesses asked to describe the perpetrator), the differences between the correct identification rates for simultaneous and sequential lineups are likely to be small or nonexistent. On the other hand, correct rejection rates are significantly higher for sequential than simultaneous lineups and this difference is maintained or increased by greater approximation to real world conditions. In cases involving either multiple perpetrators and suspects or child witnesses, no known procedures provide sufficient protection from false positive choices to be perceived as producing unquestionably superior evidence. In all other situations, sequential lineups are superior.

REFERENCES

References marked with an asterisk indicate studies included in the meta-analysis.

*Bellinger, K. (1997). *Correct lineup rejections as a function of lineup presentation.* Undergraduate thesis, Queen's University. Published as Lindsay & Bellinger, 1999.

*Blank, H., & Krahe, J. (2000). *The influence of an outstanding similarity between two persons in a lineup on target identification in sequential and simultaneous lineups.* Unpublished manuscript, University of Leipzig, Germany.

Clifford, B. R., & Hollin, C. R. (1983). Effects of the type of incident and the number of perpetrators on eyewitness memory. *Journal of Applied Psychology, 66,* 364–370.

*Corber, S. K. (1995). Identification procedure: Implications for preschoolers' eyewitness identification accuracy. Queen's University. Published as Lindsay, Pozzulo, Craig, Lee, & Corber, 1997.

*Cutler, B. L., & Penrod, S. D. (1988). Improving the reliability of eyewitness identification: Lineup construction and presentation. *Journal of Applied Psychology,* 73(2), 281–290.

*Dormer, G. (1983). *Effect of absolute judgmental processes on eyewitness identification accuracy.* Unpublished undergraduate thesis, Queen's University.

*Hannaford, K. M. (1985). *Relative versus absolute judgments in lineup identifications.* Unpublished undergraduate thesis, Queen's University.

*Jacob, P. (1994). *The feasibility of using multiple perpetrator sequential lineups.* BA Honors thesis, Queen's University.

Kassin, S. M., Tubb, V. A., Hosch, H. M., & Memon, A. (2001). On the general acceptance of eyewitness testimony research: A new survey of the experts. *American Psychologist, 56,* 405–416.

*Kneller, W., & Memon, A. (2000). *Decision processes of accurate and inaccurate eyewitnesses.* Paper presented at the American Psychology-Law Biennial Conference, New Orleans, LA.

*Laldin, S. (1997). *Contextual effects on lineup identification of multiple perpetrators.* Unpublished undergraduate thesis, Queen's University.

Lindsay, R. C. L., & Bellinger, K. (1999). Alternatives to the sequential lineup: The importance of controlling the pictures. *Journal of Applied Psychology, 84,* 315–321.

*Lindsay, R. C. L., Lea, J. A., & Fulford, J. A. (1991). Sequential lineup presentation: Technique matters. *Journal of Applied Psychology, 76*(5), 741–745.

*Lindsay, R. C. L., Lea, J. A., Nosworthy, G. J., Fulford, J. A., Hector, J., LeVan, V., & Seabrook, C. (1991). Biased lineups: Sequential presentation reduces the problem. *Journal of Applied Psychology, 76*(6), 796–802.

*Lindsay, R. C. L., Martin, R., & Webber, L. (1994). Default values in eyewitness descriptions: A problem for the match-to-description lineup foil selection strategy. *Law and Human Behavior, 18*(5), 527–541.

*Lindsay, R. C. L., Pozzulo, J., Craig, W., Lee, K., & Corber, S. (1997). Simultaneous lineups, sequential lineups, and showups: Eyewitness identification decisions of adults and children. *Law and Human Behavior,* 21(4), 391–402.

*Lindsay, R. C. L., & Wells, G. L. (1985). Improving eyewitness identifications from lineups: Simultaneous versus sequential lineup presentation. *Journal of Applied Psychology, 70*(3), 556–564.

Loftus, E. F., & Greene, E. (1980). Warning: Even memory for faces may be contagious. *Law and Human Behavior, 4,* 323–334.

*Martins, S. (1996). *The effects of changes in the appearance and lineup position of targets on eyewitness identification.* Unpublished undergraduate thesis, Queen's University.

Meissner, C., & Brigham, J. (in press). A meta-analysis of the verbal overshadowing effect in face identification. *Applied Cognitive Psychology.*

*Melara, R. D., Dewitt-Rickards, T. S., & O'Brien, T. P. (1989). Enhancing lineup identification accuracy: Two codes are better than one. *Journal of Applied Psychology, 74*(5), 706–713.

*Newman, K. (1998). *The effects of a weak memory trace on sequential and simultaneous lineup identifications.* Unpublished undergraduate thesis, Queen's University.

*Parker, J. F., & Ryan, V. (1993). An attempt to reduce guessing behavior in children's and adults' eyewitness identifications. *Law and Human Behavior, 17*(1), 11–26.

*Parker, J. F., Tredoux, C., & Nunez, D. (2000). *Lineup measures, lineup procedure, and optimality of encoding.* Paper presented at the AP-LS Biennial Conference, New Orleans, LA.

Pozzulo, J. D., & Lindsay, R. C. L. (1997). Conducting identifications with children: What not to do. *Expert Evidence, 5,* 126–132 .

Pozzulo, J. D., & Lindsay, R. C. L. (1999). Eliminating the innocent: Enhancing the accuracy and credibility of child witnesses. *Journal of Applied Psychology, 84,* 167–176.

*Rombough, V. J. (1994). *The effects of lineup presentation and practice on lineup identification accuracy in child eyewitnesses.* Unpublished undergraduate thesis, Queen's University.

Rosenthal, R. (1991). *Meta-analytic procedures for social research.* Newbury Park, CA: Sage.

*Smyth, L. (1994). *Sequential presentation and practice: The jury is still out.* Unpublished undergraduate thesis, Queen's University.

*Sporer, S. L. (1993). Eyewitness identification accuracy, confidence, and decision times in simultaneous and sequential lineups. *Journal of Applied Psychology, 78*(1), 22–33.

Steblay, N. (1992). A meta-analytic review of the weapon-focus effect. *Law and Human Behavior, 16,* 413–424.

Steblay, N. (1997). Social influence in eyewitness recall: A meta-analytic review of lineup instruction effects. *Law and Human Behavior, 21,* 283–297.

Steblay, N., Besirevic, J., Fulero, S., & Jimenez-Lorente, B. (1999). The effects of pretrial publicity on juror verdicts: A meta-analytic review. *Law and Human Behavior, 23,* 219–235.

Technical Working Group for Eyewitness Evidence. (1999). *Eyewitness evidence: A guide for law enforcement* [Booklet]. Washington, DC: United States Department of Justice, Office of Justice Programs.

*Vanderwal, A. (1996). *The effects of the sequential presentation of lineups with multiple perpetrators on eyewitness identification.* Unpublished undergraduate thesis, Queen's University.

*Varrette, T. K. (1994). *The effects of similarity-to-suspect versus match-to-description strategies for selecting lineup foils when perpetrator appearance has been altered.* Unpublished undergraduate thesis, Queen's University.

Wells, G. L. (1978). Applied eyewitness testimony research: System variables and estimator variables. *Journal of Personality and Social Psychology, 36,* 1546–1557.

Wells, G. (1984). The psychology of lineup identifications. *Journal of Applied Social Psychology, 14,* 89–103.