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A POLICY EVALUATION OF SIMULTANEOUS AND SEQUENTIAL LINEUPS

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Many states and communities are rewriting their eyewitness identification policies. Some of these jurisdictions are excluding simultaneous lineups altogether, and others are allowing them if double-blind administration of sequential lineups is not possible. The Innocence Project advocates the latter and puts forward blind sequential-lineup administration as the best form of lineup identification. Although sequential lineups are claimed to be superior, no explicit policy analysis has been done. In the present study, the author uses a policy-analysis model based on decision theory to examine the utility of simultaneous and sequential lineups, as well as to examine a range of values placed on identification outcomes and their probabilities. Simultaneous lineups are shown to be superior to sequential lineups under most conditions examined in this analysis.

Keywords: simultaneous lineups, sequential lineups, identification outcomes, policy, utility model

Eyewitness identification has been the focus of vigorous investigation for more than a quarter of a century. The range of topics studied has grown, and the presence of the field has expanded in journal publications, in the courses available in universities, and in the textbooks available for these courses. To some degree, the field has attracted attention from television and print media, with programs on both broadcast and cable networks devoted in whole or in part to eyewitness identification.

The focal concerns of eyewitness research have always included the improvement of the investigative tools available to law enforcement. Part of this focus is on a reduction in identification errors through improved procedures and personnel training. It is obvious that every erroneous conclusion that an innocent person is guilty involves two injustices: prosecuting, and perhaps incarcerating, an innocent person and causing the actual culprit to remain free and unprosecuted, with the possibility of the culprit committing additional crimes.

The injustice of wrongful conviction and the role of eyewitness identification in the process have been brought to public attention periodically in the last 200 or so years, sometimes through widely publicized cases and sometimes through systematic (self-) examination of errors and inadequacies in the criminal justice system. The early 19th century case of Sergeant Lesurques is interesting because seven men were executed in the wake of a robbery committed by five persons (Sporer, Koehnken, & Malpass, 1996). More recent prominent efforts include Borchard's (1932) review of 65 wrongful conviction cases, the analysis of

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wrongful convictions by Brandon and Davies (1973), and the assessment by Lord Devlin (1976) in his report to the Home Secretary. Influential accounts of psychologists' role in evaluating eyewitness evidence in widely known criminal cases have appeared. Wagenaar (1988) presented an in-depth analysis of the case known as Ivan the Terrible—the story of the role of eyewitness evidence in the trials of John Demjanjuk in Israel during 1987 and 1988. Loftus (Loftus & Ketchum, 1991) described her role in a number of highly visible cases. More recent analyses of the wrongful conviction problem have included Huff, Ratner, and Sagarin's (1996) and Radelet, Bedau, and Putnam's (1992) analysis and inventory of 400 wrongful death penalty cases. One of Borchard's cases (the Boorn brothers) served as a stimulus for Wilkie Collins's (1874) novel *The Dead Alive,* which was recently reprinted with cases and commentary (Warden, 2005). In the last decade, there has been vastly accelerated activity on the eyewitness front. In the late 1990s, there was a confluence of activities related to the field's development and the construction of policy for the administration of eyewitness identification lineups.

One of the earliest developments was the interest shown by the United States Department of Justice (USDOJ) in studying the implications of the relatively new DNA technology for criminal identification and exoneration of already incarcerated, but possibly innocent, individuals. This project, from which issued the now well-known research report *Convicted by Juries, Exonerated by Science: Case Studies in the Use of DNA Evidence to Establish Innocence After Trial* (Connors, Lundregan, Miller, & McEwan, 1996), was the basis of USDOJ interest in what has become widespread use of DNA technology. During the process of examining the cases presented in this report, it became apparent that a factor important in the initial wrongful convictions was false identification by eyewitnesses.

Perhaps equally visible to the public was the emergence of the Innocence Project at New York's Benjamin N. Cardozo Law School under the direction of Barry Scheck and Peter Neufeld and the emergence of their popular book *Actual Innocence: Five Days to Execution, and Other Dispatches From the Wrongly Convicted* (Scheck, Neufeld, & Dwyer, 2000). In the book, they describe cases in which persons convicted of crimes and incarcerated for them were found to be actually innocent (as supported by DNA analysis) and were released from prison. At the date of this writing, 175 wrongfully convicted persons have been released, and courses on wrongful conviction are offered at an increasing number of universities. Of the first 70 cases of exoneration through the work of the Innocence Project, 61 cases involved false eyewitness identification as a major influence in the wrongful conviction.

During the same time period, a small group of eyewitness researchers under the leadership of Gary Wells published a policy article (Wells et al., 1998) sponsored by the American Psychology-Law Society in the Society's journal *Law and Human Behavior*. This article contained four model rules for the administration of eyewitness identification by law enforcement, along with a review of the scientific findings behind them. This white paper was a unique lead-in to another USDOJ project that emerged after Connors et al. (1996).

Attorney General Janet Reno asked the National Institute of Justice to convene the Technical Working Group for Eyewitness Evidence to draft a document to assist law enforcement agencies in the development of eyewitness evidence, including the administration of eyewitness identification procedures (Technical Working Group for Eyewitness Evidence, 1999). The group contained experienced law enforcement investigators, defense attorneys, prosecutors, and scientists from various regions of the country (and, in the case of the scientists, from Canada). A commentary on the process of the technical working group was also published (Wells et al., 2000).

By this time, the procedural issues in eyewitness identification were well formulated, and much of the material was made available to law enforcement agencies. However, it was apparent that law enforcement agencies by themselves, as a widely dispersed and fractionated institution in the United States, would be unlikely to adopt techniques recommended by psychological scientists or even those recommended by the USDOJ. Clearly, reform of eyewitness identification procedures (lineup reform) would have to come with an impetus from policymakers rather than from those who would implement the policies. That impetus could only come through high officials in jurisdictions such as states and municipalities. Reform of lineup procedures is clearly important. And given what researchers have learned about the psychology of identification and the dangers of errors, it is clear that there are important areas of lineup procedure that are amenable to reform.

The Innocence Project has been an important influence in this direction. The project's underscoring of the impact of mistaken eyewitness identification in wrongful conviction provides a convincing base for lineup reform. And although much of the substance of the reform proposals (Innocence Project, 2005b) derives from the Technical Working Group for Eyewitness Evidence (1999), the focus on sequential lineups is notable.

The most frequently used eyewitness lineup is the simultaneous display of five or six photographs (or more, in some jurisdictions or nations; Wogalter, Malpass, & McQuiston, 2004). Simultaneous lineups are generally displayed in a 2 row $\times$ 3 column array. There are varying instructions given to witnesses in different jurisdictions, but the witness' task is to determine whether the offender is in the lineup and, if so, to indicate which person in the lineup is the offender.

Sequential lineups have long been used by law enforcement, but since the 1980s, sequential lineups have been developed and advocated by Gary L. Wells and Rod C. L. Lindsay (e.g., Levi & Lindsay, 2001; Lindsay, 1999; Wells, 2002). Sequential lineups generally display the persons or photos of interest (the suspect and a number of fillers, the number of which depends on the location) one at a time, so that only one is visible at any time. There are differing task structures, some that allow for multiple viewings of the entire set of faces and others that only allow for one viewing. In some sequential procedures, the process is stopped after the first identification (if any); in others, the witness must see all of the faces regardless of whether the witness has made an identification. As with simultaneous lineups, officials provide varying instructions or admonitions that depend on local policies.

The model legislation proposed by the Innocence Project (2005b) recommends exclusive use of sequential lineups, except where an independent administrator is unavailable. In that case, a simultaneous-lineup presentation can be used. The Innocence Project's (2005a) facts sheet suggests that sequential lineups with blind administration are the best form of eyewitness identification procedure.

Other organizations have followed the lead. The Attorney General of New Jersey (Office of the Attorney General, Department of Law and Public Safety, 2001) mandated the exclusive use of sequential lineups unless an independent administrator is unavailable, in which case a simultaneous-lineup presentation can be used. The North Carolina Actual Innocence Commission (2005) made the same recommendation. The Northampton Police Department (2005) specified sequential lineups exclusively, with no mention of simultaneous lineups, as did the Police Chiefs' Association of Santa Clara County (2005) and the Manitoba (Canada) Ministry of Justice (Manitoba Justice, 2001; see also, Yarmey, 2003).

The sequential-lineup recommendation is based on the apparent sequential superiority effect as shown in the meta-analysis by Steblay, Dysart, Fulero, and Lindsay (2001). The meta-analysis showed two major results, conditional on the presence or absence of the culprit in the lineup. When the culprit is absent, the lineup is correctly rejected as not containing the culprit 72% of the time for sequential lineups, as opposed to only 49% of the time for simultaneous lineups. However, when the culprit is present in the lineup, he is correctly identified 35% of the time in sequential lineups versus 50% of the time in simultaneous lineups (Table 1 in Steblay et al., 2001). Although sequential lineups are associated with fewer false identifications, they are also associated with fewer correct identifications. One explanation for this finding is that sequential lineups induce a higher decision criterion in witnesses, which results in a general reduction of lineup choices, regardless of whether the culprit is present, an interpretation supported by Meissner, Tredoux, Parker, and MacLin (2005).

Apart from the debate over the nature, interpretation, and source of the sequential superiority effect, researchers do not know how it fares in a more broadly based policy analysis. The field of research on eyewitness identification has matured rapidly over a quarter of a century and is at the point of transforming science into policy, a kind of terra incognita for eyewitness researchers in the United States.[1] My purpose in the remainder of this article is to use the available empirical evidence to evaluate sequential lineups as a wholesale replacement for simultaneous lineups, as the central focus of eyewitness identification lineup reform. To address this task, one needs an evaluation model, an assessment of the importance of the outcomes of policy adoption, and a means of assessing the degree to which the science addresses the outcomes.

The Evaluation Model

Many forms of evaluation are related to a decision-making model known generically as expected utility, a form of decision theory. A classic statement of the decision-theoretic approach to evaluation research is given by Edwards, Guttentag, and Snapper's article (1975), in which they specify the multiattribute form of the utility model. The utility model indicates the value of an entity as a function of the sum of the values of the attributes of the entity, with each attribute value weighted by its conditional probability given the entity. In the present case,

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[1]Eyewitness researchers in the United Kingdom have had a long history of participation in developing policy and interacting with their nation's law enforcement policy entity: the Home Office.

attribute should be thought of as an outcome of an eyewitness identification procedure under simultaneous or sequential presentation rules. Attributes can be divided into kinds or categories, and the relative importance of these can be studied. Fishbein and Ajzen (1975) took this approach with their distinction between intrinsic outcomes of actions and the social normative outcomes of the same action and found the two kinds of attributes to have different predictive value. Expected utility has been offered as a model of behavior in a number of areas of research and theory (e.g., Ajzen & Fishbein, 1980), and I have argued (Malpass, 1990) that it embodies a ubiquitous theory of behavior. The Fishbein and Ajzen (1975) theory of reasoned action, explicitly based on the decision-theoretic utility model, has been widely used in public health settings to evaluate the utility of intervention programs (Fishbein & Yzer, 2003) and to evaluate product acceptance in consumer research (Sheppard, Hartwick, & Warshaw, 1988). Computer programs are available that provide decision support for multiattribute evaluation (Jiménez, 2003), and the technique is used in studying infrastructure vulnerabilities to terrorism (Apostolakis & Lemon, 2005).

Some forms of utility models have been criticized as models of personal decision making because of the limited number of consequences and attributes that can be considered simultaneously and the unstable aspects of individual estimation of the conditional probabilities. But for deliberative decision making in which the decision process can be prescribed in explicit quantitative terms, and in which empirical quantities can be substituted for subjective quantities, the model, or one of its elaborations, has been useful in a number of domains. Examples include measuring the utility of maintaining a health status (Hawthorne, Osbourne, McNeil, & Richardson, 1996; Hawthorne, Richardson, & Day, 2003), making treatment decisions in breast cancer (Stanton et al., 1998), motivating volunteers in a homeless shelter (Harrison, 1995), managing and making a risk analysis in nuclear plant operation (Hämäläinen, Lindstedt, & Sinkko, 2000), and handling emergency management (French, Bedford, & Atherton, 2005).

The specific model used in the present analysis is the following:

$$V_{pa} = \sum_{i=1}^{n}[V_{o_i} \times p(o_i|pa)], \tag{1}$$

where V = value; pa = policy alternative; and o = the outcome of a policy alternative.

To apply the model, one must complete the following steps:

1. Identify the policy alternatives. For this study, there were two policy alternatives under consideration: simultaneous eyewitness identification lineups and sequential eyewitness identification lineups.

2. Identify relevant conditional states and proceed separately for each condition. Lineups are applied under two distinct conditions: The person suspected of an offense may be the culprit (S = C) or may not be the culprit (S ≠ C).

3. Identify the important attributes (outcomes) of the various policy alter-

natives. The important outcomes are the correct and erroneous choices eyewitnesses can make.

4. Specify the values placed on these outcomes. These values come from consideration of the relative value or importance of the possible correct and erroneous outcomes of eyewitness identification.
5. Specify the conditional probability of each outcome given each policy alternative. These probabilities are the empirical proportions of the respective correct and erroneous choices made by eyewitnesses in research studies or as reflected in meta-analyses.
6. Integrate the values and probabilities for each outcome as specified by the above formula.
7. Sum these calculations for the various outcomes associated with each policy alternative.
8. Weight these sums by the probabilities of the conditional states: in this case, the probability that the culprit is or is not in the lineup.

The utility model is particularly useful in the present context because it is explicit, allows the analysis to focus on the specific outcomes appropriate to the question, and uses outcome probability estimates that come directly from empirical research, which emerge as a matter of course from statistical (meta-analytic) reviews. In addition, the analysis can be readily updated as new meta-analytic reviews become available.

The policy alternatives and their respective outcomes are shown in Table 1. Adaptation of this model to the problem at hand is straightforward, requiring one to populate the model with quantities representing outcome values, likelihoods, and conditional probabilities. It is also apparent that the model includes the elements of a cost–benefit analysis in that it reflects both the positive and the negative outcomes of a policy, with each outcome weighted by its likelihood to achieve an overall value.

The Value of the Outcomes

How shall researchers decide on the quantities to use to represent the value of the various outcomes? From what considerations should these derive? Assistance

Table 1
Outcomes of Eyewitness Identification

Alternative	Outcome
Suspect = culprit	The witness identifies the suspect as the culprit. The witness identifies a lineup filler. The witness incorrectly identifies no one.
Suspect ≠ culprit	The witness identifies the innocent suspect. The witness identifies a lineup filler. The witness correctly identifies no one.

with these questions are found in the work done by Hammond and Adelman (1976). They advised the city of Denver on the choice of ammunition for use in police department handguns. The policy-analysis model they used was a weighted value (utility) model, similar to that above, in which the outcomes of a person being shot by a police officer were determined, the relative values of these outcomes agreed on, and the probability of the outcomes estimated. There were two important outcomes considered: stopping power (the need for the person shot to fall down) and injury. Stopping power was considered a good thing, whereas injury was considered a bad thing. After debate in the city council, it was agreed that these would be considered equal in magnitude but opposite in sign, nominally +1 and –1, respectively.

Disaggregation of Tasks

An important contribution of Hammond and Adelman (1976) was to show that in a policy context, the estimation of the value and probability parameters of the model should come from very different sources. The case of finding appropriate handgun ammunition for the Denver police began with members of the city council implicitly assuming the role of ballistics experts and advocating for one or another specific choice of ammunition. The result was considerable disagreement in the debate, and values and scientific judgments were richly confounded. Each side sought their own ballistics expert to advocate for their choices. But Hammond and Adelman (1976) suggested that the role of a legislative body is to make judgments about the value (importance) of the various outcomes, whereas judgments about the probability that these outcomes would be achieved by any given policy alternative (in this case, handgun load), were the responsibility of experts in the field. When this approach was adopted, the disagreement was resolved, the questions (the conditional probabilities) were clarified, and the experts were in agreement. I follow this disaggregation of tasks in the present analysis. I begin with assumptions of values that are equal in magnitude but opposite in sign for the major outcomes and in a subsequent analysis explore the implications of different patterns of value. For the initial analysis, I used a value scale of −10 to +10, with a middle 0 point. The effects of scale are explored below.

The initial assignment of values to outcomes is shown in Table 2. Correct identification of the culprit is considered a good thing (+10), and false identification of a nonculprit is a bad thing (−10). Similarly, nonidentification of the culprit is a bad thing (−10), and nonidentification of a nonculprit is a good thing (+10). Filler identifications are considered indifferent (0) both where the suspect is the culprit (S = C) and where he is not (S ≠ C). These value judgments are shown in Table 2.

The Conditional Probabilities

Hammond and Adelman (1976) were able to obtain the conditional probabilities in their analysis from ballistics experts from multiple sources, such as the U.S. Army and the National Bureau of Standards. The experts were called on to estimate the degree of both stopping power and injury for each item in a moderately long list of candidate handgun loads. The agreement among experts on

Table 2
Outcomes of Eyewitness Identification and Their Value (Equal Value Model)

Outcome	Value
Suspect = culprit	
The witness identifies the suspect as the culprit.	+10
The witness identifies a lineup filler.	0
The witness incorrectly identifies no one.	−10
Suspect ≠ culprit	
The witness identifies the innocent suspect.	−10
The witness identifies a lineup filler.	0
The witness correctly identifies no one.	+10

this cleanly focused task was quite high. The choice would be that handgun load that produced an acceptably high level of stopping power and at the same time an acceptably low level of injury. More than one such handgun load existed, and the task came to a conclusion that was acceptable to the legislators. The important thing to note here is that the expert judgments were based on scientific findings.

Possibly the best source for empirical estimates of the important outcomes of eyewitness identification would be documented law enforcement records that have been reviewed and quantified for the probable guilt of the lineup suspect. The last few years have produced information from law enforcement studies from a number of jurisdictions. Table 3 displays the findings from a number of them.

These studies include one in Hennepin County, Minnesota (Klobuchar, Steblay, & Caligiuri, in press), a second in Queens County, New York (Mecklenburg, 2006), and a third in three jurisdictions in Illinois (Mecklenburg, 2006), all of which were implemented by law enforcement using actual cases. The Hennepin County study included only sequential lineups, and the Queens County study included only simultaneous lineups. The Illinois study, however, included both. A number of studies from the United Kingdom are available (Pike, Brace, & Kynan, 2002; Slater, 1994; Valentine, Pickering, & Darling, 2003; Wright & McDaid, 1996); however, their lineup procedures are quite different from U.S. procedures; and for some data sets, identifications of offenders known to the witness are embedded. Behrman and Davey (2001) provided estimates of the probable guilt

Table 3
Field Study Findings With Meta-Analysis Aggregation of Witness Identifications

	Sequential procedure			Simultaneous procedure		
Identification	Steblay et al. (2001)	Hennepin Co.	Illinois	Illinois	Queens Co.	Steblay et al. (2001)
Suspect	20.5%	45.1%	45.0%	59.9%	53.6%	32.5%
Filler	19.0%	10.3%	9.2%	2.8%	3.0%	30.0%
No one	59.0%	44.2%	47.2%	37.6%	43.4%	37.5%

Note. Co. = County.

of the suspects in lineups but gave suspect identification rates without filler identifications and false identifications.

The laboratory studies summarized by Steblay et al. (2001), in broad terms, show that simultaneous lineups produce more correct identifications when the suspect is the culprit and that sequential lineups produce more correct rejections when the suspect is not the culprit. The data sets for Hennepin County and Queens County are not available for analysis; however, in a descriptive analysis that simply examines the overall percentages, these field data fit with the laboratory findings. The Hennepin County and Illinois studies of sequential lineups show great agreement and, when compared with the Illinois simultaneous study and the Queens County study, show that simultaneous lineups produce more suspect identifications than sequential lineups, whereas sequential lineups produce more nonidentifications than simultaneous lineups. A problem of comparability arises when one considers disaggregating the three outcome categories of field studies into the six outcome categories of laboratory studies. Figure 1 displays this diagrammatically.

It would be possible to disaggregate the field study categories under two conditions. If one makes assumptions about (a) the proportions of each field category to be distributed to each of the two cognate lab categories and (b) the proportion of each of these figures to be considered as a reflection of the a priori probability of the suspect being or not being the perpetrator. However, the quantities that would have to be derived with the first of these assumptions defeat one's desire to use empirically derived quantities.

It is easier and more reasonable to move in the other direction—aggregating laboratory data into the three categories of field studies. When this aggregation is done for the summary percentages given by the Steblay et al. (2001) meta-analysis, the figures in Table 3 are the result. Note that the pattern is the same: Simultaneous-lineup procedures produce more suspect identifications than sequential procedures produce, and sequential procedures produce more nonidentifications than simultaneous procedures produce. The absolute levels of the data derived from the laboratory studies are of a noticeably lower magnitude than the

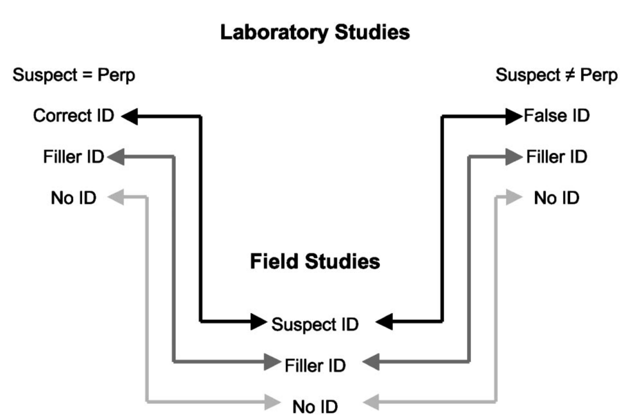

Figure 1. Relationships between the laboratory and field study outcomes are shown. ID = identification; Perp = perpetrator.

field studies. This is not a particular difficulty for the purposes of the present analysis, for a number of reasons. First, this analysis focuses on the relative differences between simultaneous and sequential lineups. Because these seem to be broadly consistent, I felt safe in proceeding on the basis of the laboratory data from Steblay et al., which provide the more differentiated outcome categories of interest and which cannot be obtained from field study data. Second, I did not take the Steblay et al. data to be accurate point estimates of the various outcome probabilities. Rather I considered them starting points, and in the analysis to follow I explore the consequences of different patterns of outcome probabilities on the overall utility of the two forms of lineup. For these reasons, I began the analysis with the outcome probabilities estimated by Steblay et al.

One adaptation was required to use all of the available false identification data from the meta-analysis. A researcher can designate an "innocent suspect" in the culprit-absent condition ($S \neq C$) of an identification study or consider any of the fillers as equally appropriate innocent suspects. Both of these strategies are found in the literature and acknowledged in the meta-analysis. For "false identification of designated suspect," Steblay et al. (2001) reported a 9% identification for sequential lineups and a 27% identification for simultaneous lineups. For "false identification of any foil," they reported 28% for sequential lineups and 51% for simultaneous lineups. These latter figures cannot be taken at face value because they include all identifications of any lineup member (suspect + fillers) and are not comparable with the percentages reported for designated-suspect studies. Considering each member of a culprit-absent lineup to be a candidate for the suspect role is an interesting strategy because it does not make false identifications dependent on the physical appearance of only one designated suspect out of the entire lineup. But to then count all identifications in such a research design as false identifications leaves no filler identifications at all. Consider that 100 witnesses randomly identifying any member of a fair, culprit-absent lineup with 1 suspect and 5 fillers should result in 1/6th of the 100 (16.7) identifying the suspect and the remainder (83.3) identifying the fillers. By this logic, the false identifications in the identify-any-foil studies should be 28% / 6 (4.6%) for sequential lineups, and 51% / 6 (8.5%) for simultaneous lineups, values of a very different magnitude and implication from those reported.

To use all of the available data, aggregating data from the two strategies for measuring false identifications, I divided the identification rates from the identify-any-foil strategy by the average number of lineup fillers in this set of studies and weighted the identification rates by their proportion of the total number of studies, as reflected in Steblay et al.'s (2001) Table 1. Likewise, the false identification rates from the designated-suspect strategy were weighted with their proportion of the total number of studies and summed with the previous result to get a weighted average of the two conditions. This combinatorial process results in the overall quantities used in part b of Table 4: The false identification probability for sequential lineups = .06, and the false identification probability for simultaneous lineups = .15.[2]

[2]These numbers are expressed here to two decimal places. All calculations, however, were done in an Excel spreadsheet in which the numbers were not rounded to two places.

Table 4
Estimating the Utility of Two Eyewitness Identification Policies

Variable	Lineups: Simultaneous	Lineups: Sequential
a. Estimating utility when the suspect is the culprit[a]		
Hits	$+10 \times .500 = +5.00$	$+10 \times .350 = +3.50$
Miss	$-10 \times .260 = -2.60$	$-10 \times .460 = -4.60$
Utility	$= 2.40$	$= -1.10$
b. Estimating utility when the suspect is not the culprit[a]		
False ID	$-10 \times .154 = -1.54$	$-10 \times .063 = -0.63$
Correct rejection	$+10 \times .490 = 4.90$	$+10 \times .720 = 7.20$
Utility	$= 3.36$	$= 6.57$
c. Including p(S = C) and p(S ≠ C) and combining the two utilities[b]		
S = C	$2.40 \times .800 = 1.92$	$-1.10 \times .800 = -0.88$
S ≠ C	$3.36 \times .200 = 0.67$	$6.57 \times .200 = 1.31$
Overall policy value	2.59	0.43

Note. ID = identification; S = suspect; C = culprit.
[a]Value × Probability = Utility. [b]Utility × p(S = C) = Policy value.

The A Priori Probability That the Suspect Is the Culprit

Finally, the two policy alternatives, sequential lineups and simultaneous lineups, both entail consideration of outcomes specific to two different environmental conditions (S = C; S ≠ C). The utilities of the policy alternatives under each of these two conditions must be calculated separately and associated with their respective probabilities. The probability that the suspect is the culprit [p(S = C)] and the probability that the suspect is not the culprit [p(S ≠ C)] are estimated on the basis of Table 2 of Behrman and Davey (2001), in which they presented the frequencies with which suspects who were identified were also booked into custody (considered likely to be guilty by law enforcement under California's probable cause convention). By combining cases in which high and moderate degrees of extrinsic evidence of guilt were available, one finds that 83% of these suspects were booked. This was taken as an estimate of p(S = C), and rather than implying a false precision, the nearest round number (80%) was used as the estimate of the a priori probability that S = C. However, as with the empirical outcome probabilities, I do not accept this as more than a starting estimate, and below, I explore the entire range of possible values of this parameter of the evaluation model.

The Utility Analysis

Now I am able to proceed with a quantitative analysis of the relative utility of simultaneous and sequential lineups as policy recommendations. Their utilities are calculated as follows.

When the suspect is the culprit,

$\text{hit} = [V_{IDS|S\,=\,C} \times p(IDS|S = C)]\; p(S = C)$, and

$\text{miss} = [V_{IDN|S\,=\,C} \times p(IDN|S = C)]\; p(S = C)$.

When the suspect is not the culprit,

$\text{false alarm} = [V_{IDS|S\,\neq\,C} \times p(IDS|S \neq C)]\; p(S \neq C)$, and

$\text{correct rejection} = [V_{IDN|S\,\neq\,C} \times p(IDN|S \neq C)]\; p(S \neq C)$.

V = value; IDS = identify suspect; IDN = identify no one; p(S = C) = the probability the suspect is the culprit; and p(S ≠ C) = the probability the suspect is not the culprit = 1 − p(S = C).

Results and Discussion

The calculations are shown in detail in Table 4. Panel a shows the estimates of the utility of the two lineup methods when the suspect is the culprit. Panel b shows the estimates of the utility of the two lineup methods when the suspect is not the culprit. Panel c combines the results under the two environmental conditions for the overall policy value of the respective lineup methods. An Excel spreadsheet that embodies the calculation of the policy utilities for the starting assumptions is available on the internet (Malpass, 2006).

Under the starting assumptions specified above, the overall result favors simultaneous lineups, which have a utility of 2.59 on a scale from −10 to +10, whereas sequential lineups have a utility of 0.43. The basis for this appears to be that the strength of the sequential lineup for the S ≠ C case is more than offset by the strength of the simultaneous lineup in the S = C case, which in the present analysis is assumed to be the more probable environmental condition. Further explorations are provided in the following sections.

Effects of Scale

A number of additional analyses are of interest. Different numbers of scale points can be used to represent values, and a question may be raised about the effects of different numbers of scale points. Figure 2 shows that the ordinal relations are retained across a range of scale values from 1 to 10. This property of the analysis becomes important in the context of comparison of the equal value model with others in which value ratios are constrained.

Exploring Variations in A Priori p(S = C)

In this analysis, I used a .80 estimate of p(S = C) that was based on Behrman and Davey (2001) as a starting point. However, the actual p(S = C) may vary widely. For example, if an eyewitness identification procedure is used early in an investigation when there are few other bits of evidence to incriminate a suspect, the probability that the suspect is the culprit may be low. However, if the identification procedure is done as corroboration in the presence of highly probative evidence of the suspect's guilt, then p(S = C) may be very high. Using the same model as above, I set p(S = C) at values ranging from .01 to .99, and

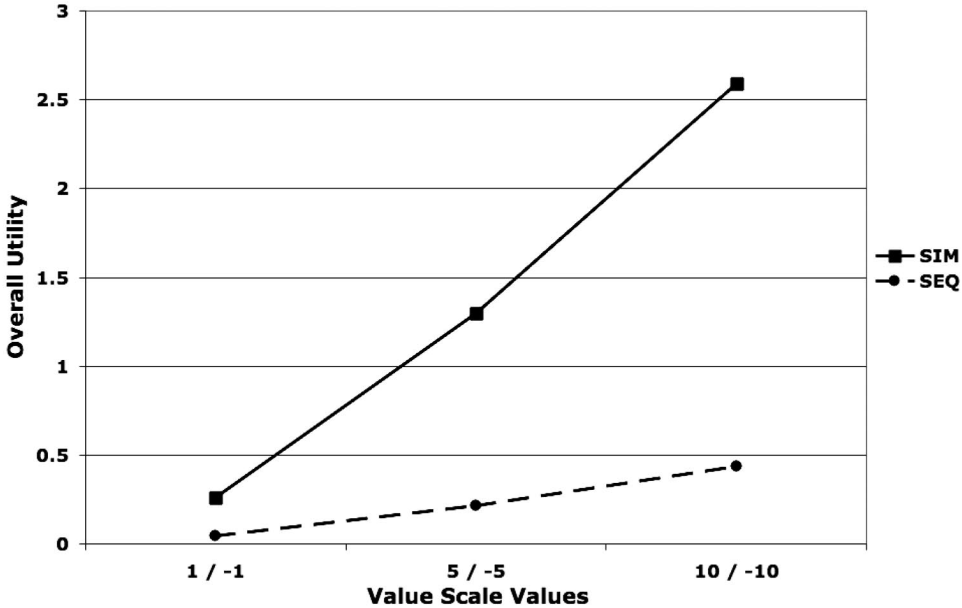

Figure 2. Utilities for simultaneous (SIM) and sequential (SEQ) lineups at a varying number of scale points for the outcome values are shown.

calculated overall utilities for those variations. The result is shown for both simultaneous lineups and sequential lineups in Figure 3.

Under the equal value assumption, when p(S = C) is below approximately

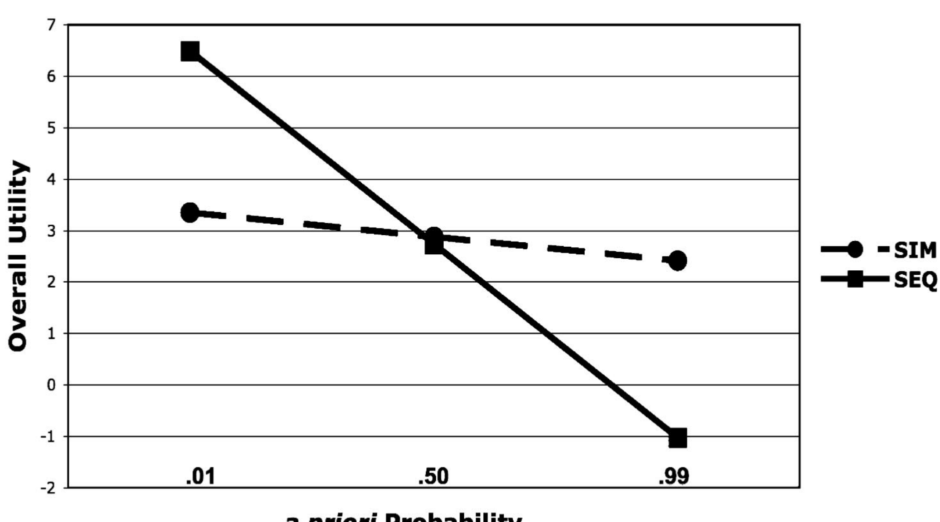

Figure 3. Utilities for simultaneous (SIM) and sequential (SEQ) lineups across the range of a priori probabilities that the suspect is the culprit are shown (equal value model).

.50, sequential lineups have a higher utility than do simultaneous lineups, whereas above .50, the preference is for simultaneous lineups. It may be useful to find the conditions under which p(S = C) assumes different values in actual law enforcement investigations or varies with investigative strategy. These may bear on the conditions under which different lineup procedures are advantageous.

Exploring Variations in Value

The equal value assumptions used above for purposes of simplicity may not represent the values that different constituencies would prefer. There are many alternatives to consider. I developed a number of value models (Table 5) and show the policy utilities resulting from the various value patterns in Figure 4. Although the models are compared with each other, they are not shown in comparison with the equal value model. All of these alternative models require a 10:1 ratio of values placed on different identification procedure outcomes. It is not clear at which point on the value scale the equal value model should be placed for purposes of comparison with these alternative models. Because a range of scale values is available in Figure 2, the reader can make the comparison.

One question, historically posed many times, draws a ratio between guilty persons acquitted and innocent persons convicted—essentially a value ratio between correct identifications and false identifications. Voltaire (1749/1974) indicated that the ratio should be 2:1 (false identifications are twice as negative as correct identifications are positive): ". . . that generous maxim that 'tis much more Prudence to acquit *two* Persons tho actually guilty, than to pass sentence of condemnation on one that is virtuous and innocent" (p. 53).

Blackstone, however, believed the correct ratio to be 10:1. "For the law holds, that it is better that ten guilty persons escape, than that one innocent suffer" (Blackstone, 1783/1978, p. 358). Benjamin Franklin, possibly out of revolutionary zeal, held, "That it is better 100 guilty Persons should escape than that one Person should suffer, is a maxim that has been long and generally approved." (Franklin, 1780/1906, p. 293).

There are many other views on the subject, and an extensive treatment can be found in Volokh (1997). According to Volokh, Jeremy Bentham, credited as the

Table 5
Value Models

Variable	False identifications are bad	Blackstone's 10:1 ratio	Models: Serious crime	Models: Trivial crime (Blackstone)
Suspect is the culprit				
Hits	1	1	10	1
Misses	−1	−1	−10	−1
Suspect is not the culprit				
Correct rejection	1	10	1	10
False identification	−10	−10	−1	−10

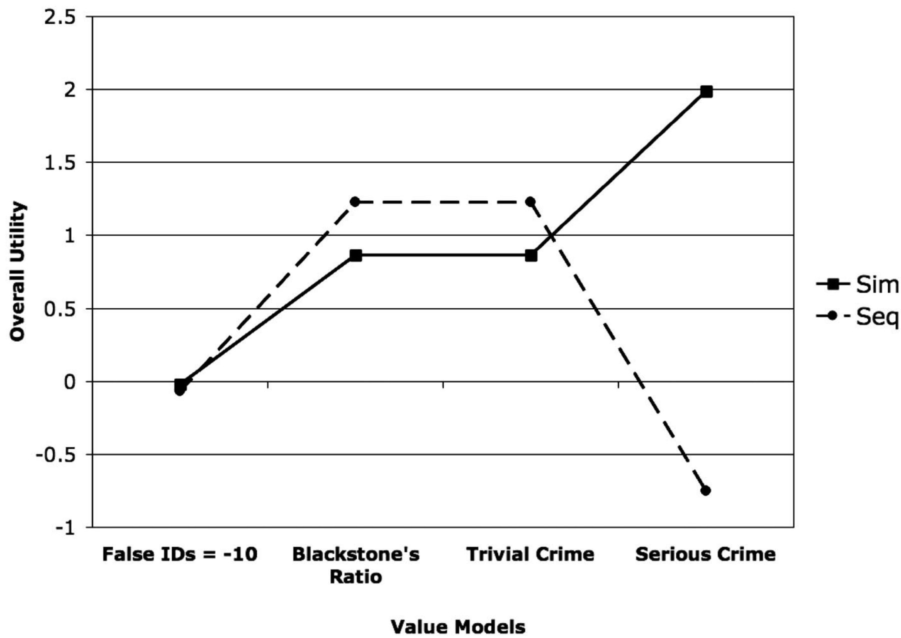

Figure 4. Utilities for simultaneous (Sim) and sequential (Seq) lineups for four value models are shown. IDs = identifications.

founder of utilitarian thinking, asked, "Rather than see one guilty individual escape, what number of innocent ones he would see suffer, it is not so easy to say." (Bentham, 1843, p. 119). And later he stated,

> We must be on guard against those sentimental exaggerations which tend to give crime impunity, under the pretext of insuring the safety of innocence. Public applause has been, so to speak, set up to auction. At first it was said to be better to save several guilty men, than to condemn a single innocent man; others, to make the maxim more striking, fix the number ten; a third made this ten a hundred, and a fourth made it a thousand. All these candidates for the prize of humanity have been outstripped by I know not how many writers, who hold, that, in no case, ought an accused person to be condemned, unless evidence amount to mathematical or absolute certainty. According to this maxim, nobody ought to be punished, lest an innocent man be punished. (Bentham, 1843, p. 119)

According to Volokh (1997), German Chancellor Otto von Bismarck is said to have remarked that "it is better that ten innocent men suffer than one guilty man escape" (part VIII, no. 129), and Feliks Dzerzhinsky, founder of the Soviet secret police, raised the stakes with the following: "Better to execute ten innocent men than to leave one guilty man alive" (part VIII, no. 130). There may be social conditions that exert strong influences on people's preferences for the relative values placed on the two major errors in eyewitness identification.

False Identifications Are Uniquely Bad

One anticipated stance is that false identifications are uniquely negative outcomes for an identification procedure. With the value model taken from Table

5, Figure 4 graphically represents utilities that result from this pattern of values in the utility model in a context that allows comparison with other value models. When this value pattern is represented in the utility model, the utility of simultaneous lineups and sequential lineups are essentially equivalent, at a utility of approximately zero—the neutral point on the utility scale.

Blackstone's Ratio

Blackstone's ratio is represented in Figure 4. Were Blackstone's value ratio to be represented in the values and decision making of the criminal justice system, and were the other conditions of the policy utility model to remain the same, sequential lineups would be slightly preferable.

Effects of Crime Severity

The post-9/11 world, in which dramatic terrorist acts reached many nations, may be a very different context for justice values. Print and television media depict terrorist acts instantly, and terrorists are blowing up themselves and others all over the world. Many programs on television depict serious and violent crimes, and news programs appear obsessed with violence, kidnapping, and other serious crimes and criminals. This may serve to enhance distinctions among crimes of various kinds. One pattern of values may apply to criminal acts that are relatively minor, whereas another pattern may apply to criminal acts that are relatively serious.

If identification of the culprit in serious crimes is valued much more highly than the avoidance of false identification, a value model similar to the serious crime model shown in Table 5 might result in the overall utility pattern shown in Figure 4. This model is counterposed with a model valuing avoidance of false identifications more than identification of culprits. This trivial crime model reflects the same distribution of values as the previous interpretation of Blackstone's ratio. Simultaneous lineups have a positive and considerably higher policy utility for the value pattern representing serious crimes, probably because of the greater likelihood of correct identifications and the high a priori S = C probability.

Malpass and Rigoni (2005) reported an empirical study in which respondents made judgments about the importance of the four eyewitness identification outcomes for each of three serious crimes (terrorism, murder, and rape) and three not-serious crimes (parking, noise, and curfew violation). Correct identifications and correct rejections were valued positively for serious crimes (8.2 and 6.9, respectively) and for trivial crimes (6.1 and 6.2, respectively), whereas false identifications and incorrect identifications were valued negatively for serious crimes (−3.8 and −5.3, respectively) and nonserious crimes (−2.2 and −5.1, respectively). When these empirical values were used in the policy utility analysis, the result is that shown in Figure 5. The value of simultaneous lineups is more positive for both crime categories and increases with the move to more serious crimes.

For all of these results, I assume that p(S = C) is equal to .80. As shown earlier, however, simultaneous-lineup and sequential-lineup utilities converge as they approach p(S = C) = .50. The importance of the a priori probability that the suspect is the actual culprit is very high and runs through the entire policy consideration.

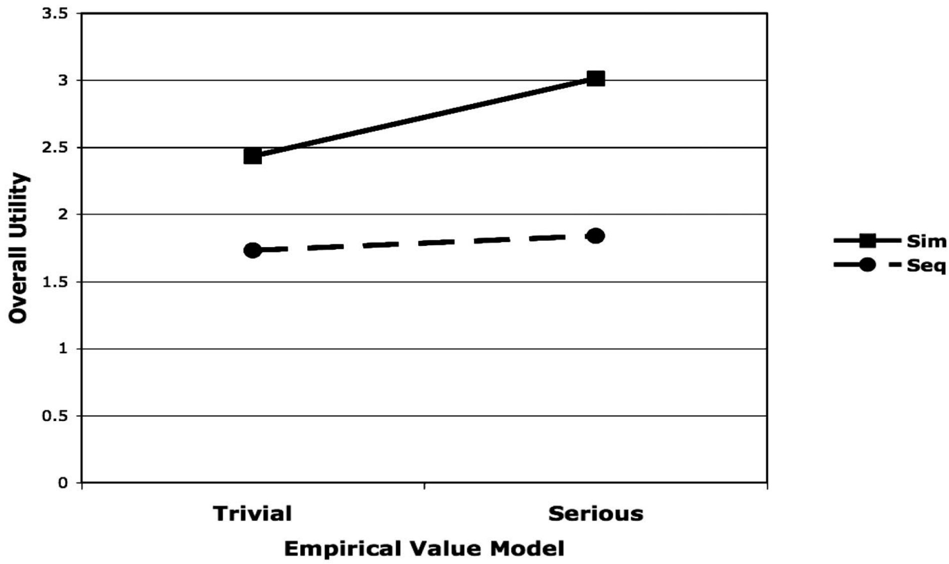

Figure 5. Utilities for simultaneous (Sim) and sequential (Seq) lineups are compared on the basis of value data on crime scene seriousness.

Effects of Changes in Lineup Performance

All of the above explorations with the utility model have been based on variations in the values placed on various eyewitness identification outcomes or the context factor of the likelihood of the suspect's guilt. However, there are also lineup performance factors to consider. Simultaneous lineups appear to be superior to sequential lineups in many of the previous analyses. But this is because of two factors. First, simultaneous lineups lead to more correct identifications, an almost universally highly valued outcome, and second, this simultaneous advantage is magnified by the normally expected higher probability that the suspect will be the actual culprit than that he will not. However, what would be the result if sequential lineups could be brought to a level of performance identical to simultaneous lineups for correct identifications? A comparable question can be asked for simultaneous lineups. What would be the result if simultaneous lineups could be brought to a level of performance identical to sequential lineups for false identifications? These questions are explored in Figures 6 and 7 for $p(S = C) = .80$ and $p(S = C) = .50$, respectively.

Under the equal value assumption, and when $p(S = C) = .80$, sequential lineups achieve higher utility than simultaneous lineups achieve when the ability to make correct identifications in sequential lineups is brought to the level of simultaneous lineups. Although the advantage of simultaneous lineups when $S = C$ is taken away, the superiority of sequential lineups when $S \neq C$ is retained. This would represent a considerable improvement when compared with the performance of sequential lineups for the existing (Steblay et al., 2001) levels under the same assumptions. When simultaneous lineups are brought to the same level of effectiveness at reducing false alarms as sequential lineups, the overall utility of simultaneous lineups is also enhanced, under the same assumptions. Although the

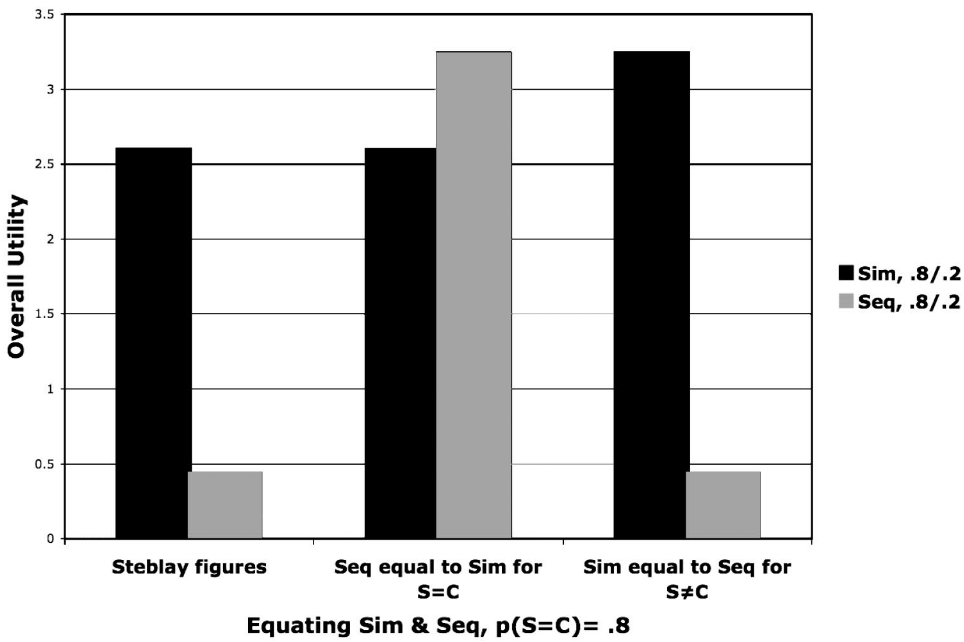

Figure 6. The resulting overall utility when sequential correct identifications are set equal to simultaneous identifications and simultaneous false identifications are set equal to sequential false identifications are shown for p(S = C) = .80. Sim = simultaneous; Seq = sequential; S = C = suspect is the culprit; S ≠ C = suspect is not the culprit; p(S = C) = probability that the suspect is the culprit.

advantage for sequential lineups when S ≠ C is removed, the advantage for simultaneous lineups when S = C remains, which accounts for the very large differences between them. As shown in Figure 7, these improvements are achieved even when the a priori probability that S = C is .5.

General Discussion

I have used an expected utility model to comparatively evaluate simultaneous and sequential eyewitness identification lineups. I assumed a particular pattern of values placed on the outcomes of eyewitness identifications (the equal value model) and then varied the value pattern to examine the effects of changing values. The outcome expectancy values used in the model were initially derived from Steblay et al. (2001) and were then varied to explore the possible effects with new lineup performance achievements. I explored the implications of variations in the a priori probability that law enforcement has placed the actual culprit in the lineup, with an initial assumption that the probability was .8, and then I varied this probability over the entire range of the variable to examine the effects on the overall utility calculations.

The assumptions I used to begin the analysis are the best available starting points, but are not quantities to which the analysis is committed. The equal value model treats correct and false identifications as equal in magnitude but opposite in sign. The two empirically derived assumptions, lineup performance expectations and the a priori

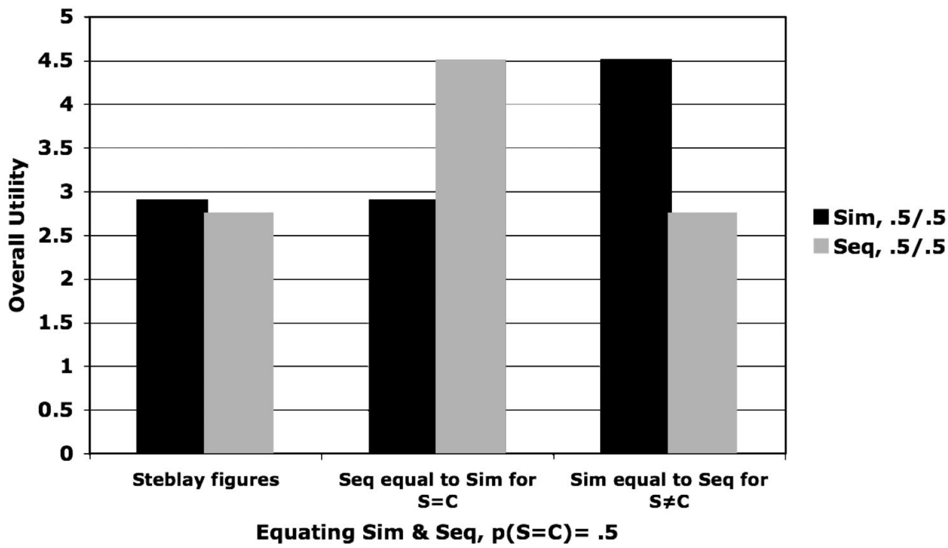

Figure 7. The resulting overall utility when sequential correct identifications are set equal to simultaneous correct identifications and simultaneous false identifications are set equal to sequential false identifications are shown for p(S = C) = .50. Sim = simultaneous; Seq = sequential; S = C = suspect is the culprit; S ≠ C = suspect is not the culprit; p(S = C) = probability that the suspect is the culprit.

probability that the suspect is actually the culprit, are derived from the available literature. The lineup performance expectations used as starting values come from a 2001 meta-analysis of the literature (Steblay et al., 2001) that has served as a justification for claims of sequential superiority. The estimation that the a priori probability that the suspect is actually the culprit equals .8 is based on Behrman and Davey (2001). Under these assumptions, the utility of simultaneous lineups is generally superior to sequential lineups. The source of this result can be discerned from the effects of changing the assumptions used in application of the utility model.

The values placed on the outcomes of eyewitness identifications have an important influence on the relative utility of the two lineup procedures under consideration. If other starting assumptions are held constant, when false identifications are accorded a negative value that is 10 times that placed on the other three outcomes, the two lineup forms have almost equal (and nearly zero) overall utility, lower than either lineup form under the equal value model. When Blackstone's ratio is applied, sequential lineups achieve a greater overall utility than simultaneous lineups. Although the extreme (idealized) forms of value differentiation between serious and trivial crimes showed a high degree of polarization of the overall utility for simultaneous and sequential lineups (simultaneous > sequential), the differences were much more modest when the empirical values reported by Malpass and Rigoni (2005) are entered into the analysis, (though simultaneous > sequential for both kinds of crime). Values alone will probably not prove to be decisive in making a choice between these lineup forms on the basis of a utility analysis.

The a priori probability that the suspect is the culprit has a strong effect on overall utility and on preference for form of identification procedure, as shown in Figure 3 and in Figures 6 and 7. Of course, an increase in the probability that law enforcement has placed the guilty person in the lineup as a suspect must be thought of as a good thing; although a very large reduction in law enforcement's effectiveness would render sequential lineups preferable, it is hardly a condition to be sought. At the upper limit, $p(S = C) = .99$, simultaneous lineups have a higher overall utility. However at any lesser levels of probability, the vulnerability of simultaneous lineups to false identifications cannot be ignored. How can this vulnerability be reduced?

The answer has to come from changes in the effectiveness of the two lineup forms. Changes in their effectiveness that cause their effectiveness to be equal to each other under the $S = C$ and $S \neq C$ conditions (Figures 6 and 7) indicates that great changes in overall utility could be achieved. This highlights both a problem posed by theory and a problem posed in the history of research in this area.

It would be very useful to find identification methods that raise the level of correct identification when the suspect is the culprit but which do not, at the same time, raise the level of identifications when the suspect is not the culprit. This is a difficult problem. It requires that the witness' ability to discriminate between faces previously seen and those not previously seen be increased. This requires an increase in the amount of information available to witnesses from their initial memory of the criminal event. In the terms of signal detection theory, this requires techniques that improve discrimination (d') rather than those which merely change the witness' decision criterion and consequent rate of making a lineup choice (beta). A change in discrimination may not be possible to achieve without some improvement of the information possessed by the witness or the witness' access to that information. It is not clear how law enforcement procedures can achieve these goals. Perhaps procedures can be improved so that they restrict contamination of the original memory, and perhaps techniques can be developed for getting more effective access to the original memory through more sophisticated interviewing (Fisher, 1995; Malpass, 1996; Malpass & Devine, 1981) or source monitoring techniques (Johnson, Hashtroudi, & Lindsay, 1993). As noted earlier, an overall difference in lineup choosing rate appears to be the major contrast between simultaneous- and sequential-lineup techniques.

A useful criticism of the literature in which researchers compare simultaneous and sequential lineups is that the research and development effort has been primarily associated with investigating variations in sequential-lineup technique compared against a static simultaneous lineup (McQuiston-Surrett, Malpass, & Tredoux, 2006). This is the rationale behind the examination of the effects of modifying the outcome expectancies of simultaneous and sequential lineups that emerge from Steblay et al. (2001). I examined the effects of improvements over the weakness of each technique in the direction of the strength of the other technique (Figures 6 and 7). Improving either simultaneous lineups or sequential lineups in the direction of the other lineup can result in improvements of lineup efficiency in both absolute and comparative terms. But while either of these changes serve to raise and equate the overall utility of the two lineup forms, across a range of a priori probabilities that $S = C$, only one of these changes addresses a reduction in the risk of false identification: adjusting the effectiveness of simultaneous lineups to be more similar to sequential lineups when $S \neq C$. How might this be accomplished?

There are several matters that might improve lineup effectiveness overall, but it is not apparent at the present time whether they would have differential effects on the two lineup types. Placing greater importance on the use of corroborating evidence in the process between identification and conviction would reduce wrongful convictions but would not address differences between the two lineup procedures. This would mean that eyewitness identification would be lowered to the status of a technique for nominating individuals as suspects—possible criminals—rather than be the source of information for making a conclusion. Many may believe that this would be a good thing. It would require that criminal investigation be conducted in a somewhat different manner, and this would in itself produce a need for changes in the practices surrounding the use of eyewitness identification evidence in the prosecution of suspects, in the training of personnel, and in the implementation and oversight of identification procedures. From the perspective of wrongful conviction, and from the literature on the effectiveness of safeguards (Devenport, Stinson, Cutler, & Kravitz, 2002), the expectations for the effectiveness of such protections is not high.

Consistently higher quality lineups, in the sense of fairness criteria (Malpass, Tredoux, & McQuiston-Surrett, in press), would reduce the overall magnitude of the false identification problem, but to what degree this would occur in a law enforcement field environment is not yet clear. More sharply focused instructions or admonitions to witnesses may also be beneficial and are already being used by many law enforcement agencies. Again, though, these may not have differential contributions to make for the two lineup forms.

McQuiston-Surrett et al. (2006) discussed the confounding of the simultaneous-lineup and sequential-lineup comparison, identifying two factors that differentiate the two procedures: back loading the faces to be shown to the witness (leading the witness to believe that there are many more faces to be examined than the normal number for simultaneous lineups) and asking an identification question about each lineup member in turn, even in a simultaneous lineup. Theoretically, this would encourage a greater use of absolute judgments by witnesses. Zimmerman, Malpass, and MacLin (2006) found that these two procedures, heretofore unique properties of sequential lineups, may actually be stronger contributions to the previous findings of sequential superiority than is sequential presentation itself. Whether this result withstands replication, refinements in the technique of simultaneous lineups for the condition when $S \neq C$ seems to be a potentially fruitful area of research because of the higher level of effectiveness of simultaneous lineups when $S = C$.

One value of policy analyses that extend beyond even a statistical review of empirical studies is that they can reveal aspects of the problem that are strongly related to policy utility. The present analysis is based on the scientific findings and allows for the exploration of a range of background assumptions and changes in the effectiveness of policy options. Very little is known about the effects of variations in lineup administration on the important consequence variables used in this analysis. The trade-off between control and ecological validity that is traditional in applied research is important here. Unless true field experiments can be implemented, many of the important questions revealed by analysis such as this may remain unanswered. In addition, beyond survey data (e.g., Wogalter et al., 2004), very little information is available on the costs and benefits of the application of lineup procedure in actual law enforcement investigation contexts. Surveys cannot reach the level of detail and specificity needed.

As more information becomes available about the empirical probabilities of the outcome variables associated with different specific lineup administration strategies and the values placed on identification outcomes as explicit policy decisions, application of policy evaluation models can be used to further refine researchers' vision of the research directions that may be useful in developing more effective reforms in eyewitness identification policy and practice.

A few things can be said with a high degree of confidence. The utility of simultaneous and sequential lineups is responsive to two factors external to their actual performance: the values that are placed on the various eyewitness identification outcomes and the a priori probability that the police have been able to place the actual criminal in the identification procedure. With no change in the actual performance of the two lineup procedures, there seem to be many circumstances in which simultaneous lineups have a utility advantage, as long as the probability that the criminal is in the lineup is better than .50. Caution is in order, however, because in this article I have not explored every combination of the three parameters to be considered. It is one of the advantages of the utility model, however, that any specific set of conditions within the models parameters are easily explored.

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