Eyewitness Identification

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Abstract

The criminal justice system relies heavily on eyewitness identification for investigating and prosecuting crimes. Psychology has built the only scientific literature on eyewitness identification and has warned the justice system of problems with eyewitness identification evidence. Recent DNA exoneration cases have corroborated the warnings of eyewitness identification researchers by showing that mistaken eyewitness identification was the largest single factor contributing to the conviction of these innocent people. We review major developments in the experimental literature concerning the way that various factors relate to the accuracy of eyewitness identification. These factors include characteristics of the witness, characteristics of the witnessed event, characteristics of testimony, lineup content, lineup instructions, and methods of testing. Problems with the literature are noted with respect to both the relative paucity of theory and the scarcity of base rate information from actual cases.

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Eyewitnesses are critical to solving crimes and sometimes eyewitness testimony is the only evidence that is available for making a determination as to the identity of the culprit. Psychological research programs that began in the 1970s, however, have consistently articulated concerns about the accuracy of eyewitness identification. Using various methodologies, such as filmed events and live staged crimes, eyewitness researchers have noted that mistaken identification rates can be surprisingly high and that eyewitnesses are often quite certain while being mistaken in selecting someone from a lineup. Although these experiments were quite compelling to the researchers themselves, it was not until the late 1990s that criminal justice personnel began taking the research seriously. This change in attitude about the psychological literature on eyewitness identification arose primarily from the development of forensic DNA tests in the 1990s. Over 100 people who were convicted prior to the advent of forensic DNA have now been exonerated by DNA tests and over 75% of these people were victims of mistaken eyewitness identification (Wells et al., 1998, Scheck et al., 2000). These DNA exoneration cases illustrate that mistaken eyewitness identification is the primary factor contributing to the conviction of people who have been proven innocent using definitive biological tests. The apparent prescience of the psychological literature regarding problems with eyewitness identification has created a rising prominence of eyewitness identification research in the criminal justice system (Wells et al., 2000).

Because most crimes do not include DNA-rich biological traces, reliance on eyewitness identification for solving crimes has not been significantly diminished by the development of forensic DNA tests. Interestingly, the only research on eyewitness reliability that has been conducted has been done by psychologists, primarily cognitive and social psychologists. The vast criminal justice system itself has never conducted an experiment on eyewitness identification and the psychological literature represents the only source of empirical data on eyewitness identification.

Coverage of This Review

No prior review of the eyewitness identification literature has appeared in the *Annual Review of Psychology*. Therefore, we have included reference to some articles from the 1970s and 1980s that we think were especially critical to the development of the literature, but we primarily emphasize more recent developments. Also, because the eyewitness identification literature has become so vast, we are necessarily selective in our citations and coverage. Readers should note that the current review focuses on eyewitness *identification* rather than eyewitness testimony in general. Eyewitnesses commonly testify about many things, such as which hand a gunman used, the color of a car, or recollections of a conversation, but these event memories are outside the scope of the current review. In addition, there is a large literature on child eyewitnesses, issues of suggestibility, and the issue of recovery of repressed memories that are not a part of this review.

Basic Concepts

The eyewitness identification literature has developed a number of definitions and concepts that require a bit of explanation. Readers of the primary literature on eyewitness identification will find these explanations useful. The term *lineup* refers to a procedure in which a criminal suspect (or a picture of the suspect) is placed among other people (or pictures of other people) and shown to an eyewitness for purposes of seeing if the witness will identify the suspect as the culprit in question. The term *suspect* should not be confused with the term *culprit*. A suspect might or might not be the culprit; a suspect is simply someone who is suspected of being the culprit. *Fillers* refer to people in the lineup who are not suspects. Fillers, sometimes called foils or distractors, are known-innocent members of the lineup. Therefore, the identification of a filler would not result in charges being brought against the filler. A *culprit-absent lineup* is one in which an innocent suspect is embedded among fillers and a *culprit-present lineup* is one in which a guilty suspect (culprit) is embedded among fillers. The primary literature sometimes calls these target-present and target-absent lineups.

A *simultaneous lineup* is one in which all lineup members are presented to the eyewitness at once and is the most common lineup procedure in use by law enforcement. A *sequential lineup*, on the other hand, is one in which the witness is shown only one person at a time but with the expectation that there are several lineup members to be shown.

Functional size refers to the number of lineup members who are “viable” choices for the eyewitness. For example, if the eyewitness described the culprit as being a tall male with dark hair and the suspect is the only one who is tall with dark hair, then the functional size would be 1.0 (one) even if there were 10 fillers. Technically, the term functional size was introduced as a specific measure (Wells, Leippe, & Ostrom, 1979) and there are other competing measures that have been proposed, such as Malpass’ (1981) “effective size,” but the term functional size has taken on a generic meaning as the number of lineup members who can serve the function of making the lineup fair to the suspect. *Mock witnesses* are people who did not actually witness the crime event but instead are simply given the verbal description that the eyewitness gave of the culprit and asked to pick a person from the lineup. Mock witnesses are used to test the functional size of the lineup.

The term *diagnosticity of suspect identification* refers to the ratio of the accurate identification rate that occurs with a culprit-present lineup to the inaccurate identification rate that occurs with a culprit-absent lineup. The term *diagnosticity of "not there"* refers to the ratio of "not there" response rates that occur with culprit-absent lineups to "not there" response rates that occur with culprit-present lineups. The term *diagnosticity of filler identifications* refers to the ratio of filler identification rates with culprit-absent lineups to filler identification rates with culprit-present lineups.

The term *system variable* refers to a variable that affects eyewitness identification accuracy that is (or could be) under control of the criminal justice system. The term *estimator variable* refers to a variable that affects eyewitness identification accuracy that is not under control of the criminal justice system. Examples of system variables include instructions given to eyewitnesses prior to viewing a lineup or the functional size of a lineup. Examples of estimator variables include lighting conditions at the time of witnessing or whether the witness and culprit are the same or different race.

The distinction between estimator and system variables has taken a strong hold on the eyewitness identification literature since it was first introduced in the late 1970s (Wells, 1978). In large part, the prominence of this distinction attests to the applied nature of the eyewitness identification literature. Whereas the development of a literature on estimator variables permits some degree of postdiction that might be useful for assessing the chances of mistaken identification after the fact, the development of a system variable literature permits specification of how eyewitness identification errors might be prevented in the first place. We use the estimator-system variable distinction to organize our review of the literature.

Estimator Variables

Estimator variables can be categorized broadly into four categories: characteristics of the witness, characteristics of the event, characteristics of the testimony, and abilities of the testimony evaluators to discriminate between accurate and inaccurate witness testimony. We review each in turn.

Characteristics of the Witness

The idea that some eyewitnesses are better than others seems an obvious truism, but the empirical evidence is not overwhelming. For example, there is no clear evidence that males are better or worse overall at identifying people from lineups than are females. A meta-analysis by Shapiro and Penrod (1986) indicated that females might be slightly more likely to make accurate identifications but also slightly more likely to make mistaken identifications than are males, thereby yielding an overall diagnosticity that is largely the same for males and females. Although males and females might take interest in different aspects of a scene and thereby remember somewhat different details (e.g., Powers, Andriks, and Loftus, 1979), overall abilities of males and females in eyewitness identification performance appear to be largely indistinguishable (but see Brigham & Barkowitz, 1978, and Shaw & Skolnick, 1999).

The age of the eyewitness, on the other hand, has been consistently linked to eyewitness identification performance, with very young children and the elderly performing significantly worse than younger adults. The eyewitness identification errors of young children and the elderly is highly patterned: When the lineup contains the actual culprit, young children and the elderly perform nearly as well as young adults in identifying the culprit but when the lineup does not contain the culprit the young children and the elderly commit mistaken identifications at a higher rate than do young adults (see meta-analysis on children versus adults by Pozzulo & Lindsay, 1998).

There is little evidence that intelligence is related to eyewitness identification performance. Although an early study by Howells (1938) indicated a significant relation between face recognition accuracy and intelligence, later studies have shown no relation (e.g., Brown, Deffenbacher, & Sturgill, 1977). A word of caution is in order here, however, because Howells' sample of witnesses included a much greater range of intelligence at the low end than have later studies. At the low extremes of intelligence, it seems likely that a pattern would emerge that is similar to that found with children, namely a high rate of mistaken identifications in response to culprit-absent lineups.

The race of the eyewitness has been examined extensively. Although no consistent overall differences have emerged, there is a clear interaction between the race of the witness and the race of the culprit. The evidence is now quite clear that people are better able to recognize faces of their own race or ethnic group than they are at recognizing faces of another race or ethnic group. A recent meta-analysis by Meissner and Brigham (2001) shows that this effect is robust across more than 25 years of research.

There is little published research relating personality characteristics to eyewitness identification accuracy. Hosch, Leippe, Marchioni, and Cooper (1984) found that high self-monitors are more susceptible to biased lineup procedures than are low self-monitors and Hosch and Platz (1984) found a relation between self-monitoring and correct identifications. Also, a meta-analysis by Shapiro and Penrod (1986) indicated that individuals high in chronic trait anxiety made fewer mistaken identifications than individuals low in chronic trait anxiety. Their meta-analysis also indicated that field independents made fewer accurate identifications (but equal mistaken identifications) relative to field dependents. However, no strong theory relating personality to eyewitness identification performance has emerged in the literature and there is a relative paucity of research directed at the role of personality in eyewitness identification.

Characteristics of the Event

Witnessed events vary greatly along a variety of dimensions. The amount of time the culprit is in view, the lighting conditions, whether the culprit wears a disguise, the distinctiveness of the culprit's appearance, the presence or absence of a weapon, distractions, and the timing of knowledge that one is witnessing a crime, all play a role in the chances that the witness can identify the culprit at a later time.

Distinctive faces are much more likely to be accurately recognized than non-distinctive faces (e.g., Light, Kayra-Stuart, & Hollander, 1979). Faces that are highly attractive or highly unattractive are easier to recognize than are faces that are average in attractiveness (e.g., Fleishman, Buckley, Klosinsky, Smith, & Tuck, 1976), but what makes a face distinctive is not entirely clear. Because the arithmetic mean (averaged at the pixel level) of several faces (a prototype) is judged to be more attractive than the individual faces that were averaged (see Langois & Roggman, 1990), the distinctiveness-recognition relation is probably not due to a simple deviation from the arithmetic mean of individual facial features.

Simple disguises, even as minor as covering the hair, result in significant impairment of eyewitness identification performance (Cutler, Penrod, & Martens, 1987). Sunglasses also impair performance, although the degree of impairment can be reduced by having the targets wear sunglasses at the time of the recognition test (Hockley, Hemsworth, & Consoli, 1999). Photos of criminal suspects used in police lineups are sometimes several years old. Changes in appearance that can occur naturally over time or changes that are made intentionally by suspects can have quite strong effects on recognition. Read, Vokey, and Hammersley (1990) found that photos of the people taken two years later were much less likely to be recognized when their appearance had naturally changed (via aging, facial hair) than when their appearance had remained largely the same.

Clearly, at the extreme of low light levels there is a point at which a face cannot be perceived well enough to be able to recognize that face later. Surprisingly, however, we know of no experiments that have measured the light levels required for the encoding of faces. We encourage researchers to address this question.

As would be expected, the amount of time a culprit's face is in view affects the chances that the eyewitness can identify the person later (Ellis, Davies, & Shepherd, 1977). However, this relationship depends less critically on the eyewitness's opportunity to view per se and more on the amount and type of attention that the witness directs at the culprit. Given equal exposure time to a face, people are more likely to be able to recognize that face later if they make abstract inferences about the face (e.g., is this person honest?) than if they make physical judgments (e.g., does this person have a large or small nose?). Presumably, this effect occurs because the abstract inferences require holistic processing of the face whereas the physical judgments require feature processing (Wells & Hryciw, 1984). In general, the amount of time a culprit's face is in view is not as critical for eyewitness identification accuracy as the type or amount of attention given by the witness. For example, Leippe, Wells, and Ostrom (1978) exposed unsuspecting people to a staged theft of a package. Some were led to believe that the package contained a valuable item and some were led to believe that the package contained a trivial item. In addition, some learned of the value of the item in the package before the theft and some only learned the value after the thief had fled. Although all had the same exposure opportunity to the thief, the witnesses who knew the value of the item beforehand were significantly more accurate than the other three groups. Often, witnesses do not even realize that they are witnesses to a crime until after the culprit has fled. Although they might have had significant opportunity to view the culprit, they might have had little reason to attend closely.

One of the factors that can signal to eyewitnesses that a crime is occurring is the presence of a weapon. Unfortunately, learning that one is an eyewitness to a crime via the culprit's display of a weapon might not make the person a better eyewitness. A number of studies have been directed at the question of the so-called weapon-focus effect. A meta-analysis of these studies indicates that the presence of a weapon reduces the chances that the eyewitness can identify the holder of the weapon (Steblay, 1992). Loftus, Loftus, and Messo (1987) monitored eye movements and found that weapons draw the visual attention of the person at a cost to attention being paid to other things (such as the culprit's face). Complicating the issue somewhat is the fact that the presence of weapons or other types of threatening stimuli can cause arousal, fear, and emotional stress. There remains some debate about the effects of such stress on memory. Some research shows that increased levels of violence in filmed events reduces eyewitness identification accuracy (e.g., Clifford & Hollin, 1981) whereas other research has failed to find this effect (e.g., Cutler, Penrod, & Martens, 1987). Deffenbacher (1983) suggested that the effect is likely to follow the Yerkes-Dodson Law where only very high and very low levels of arousal will impair memory. Christianson's (1992) review of the evidence relating emotional stress to memory suggests that emotional events receive preferential processing and that there is a narrowing of attention (as suggested by Easterbrook, 1959) with loss of peripheral details.

Characteristics of Testimony

There has been considerable interest and research directed at the question of whether there are characteristics of an eyewitness's testimony that could be used to postdict whether the witness made an accurate or false identification. The bulk of this research has focused on the certainty (confidence) of the eyewitness. Although early research suggested that the certainty an eyewitness expresses in an identification is largely unrelated to the accuracy of the identification, current analyses suggest a more hopeful but also more complex view of the certainty-accuracy relation. Although any given experiment might show a statistically non-significant relation between certainty and accuracy, meta-analyses of the literature show a reliable point-biserial correlation. Several moderators of the strength of the relation have been identified. One important moderator is the overall accuracy of the eyewitnesses. When accuracy is low (e.g., from poor witnessing conditions), the certainty-accuracy relationship suffers (Bothwell, Deffenbacher, & Brigham, 1987). Later meta-analyses indicate that the certainty-accuracy relation is stronger if the analysis is restricted to those making an identification (choosers only) than if it also includes witnesses who make correct and false rejections (Sporer, Penrod, Read, & Cutler, 1995). In fact, using a weighted average of effect sizes for choosers only, Sporer et al. reported a .37 certainty-accuracy correlation across 30 studies. More recent work indicates that having eyewitnesses reflect on their encoding and test conditions or having them entertain hypotheses regarding why their identification might have been mistaken can improve the relation between accuracy and certainty, especially when this relation is calculated using calibration methods rather than the point-biserial correlation (Brewer, Keast, & Rishworth, in press).

Although the .37 correlation estimate for the certainty-accuracy relation is more optimistic than the early estimates, recent studies suggest the literature might be overestimating the utility of eyewitness certainty in actual cases. In a series of experiments, it has been shown that eyewitness certainty is highly malleable among eyewitnesses who have made mistaken identifications (Wells & Bradfield, 1998; 1999). After making mistaken identifications, some eyewitnesses were given confirming feedback by the lineup administrator ("Good, you identified the suspect") whereas others were given no feedback about their identification. This feedback served to distort the eyewitnesses' recollections of the certainty they had in their identifications. Those given confirming feedback recalled having been very certain in their identification compared to those given no confirming feedback. This certainty-inflation effect is greater for eyewitnesses who make mistaken identifications than it is for those who make accurate identifications, resulting in a significant loss in the certainty-accuracy relation (Bradfield, Wells, & Olson, 2002). In actual cases, it is common for lineup administrators (usually the detective in the case) to give confirming feedback to eyewitnesses, thereby inflating the certainty of the eyewitness and confounding the certainty-accuracy relation. Even if the lineup administrator refrains from giving the witness confirming feedback, the witness is likely to make confirming inferences from later events (e.g., an indictment of the identified person). Another real-world factor that can muddle the meaning of eyewitness certainty is repeated testing. Shaw and his colleagues (Shaw, 1996; Shaw & McLure, 1996) have shown that repeated questioning of eyewitnesses on a matter about which they were inaccurate serves to inflate their certainty that they were accurate. Hence, it is unclear whether the .37 correlation between certainty and accuracy revealed in the Sporer et al meta-analysis of experiments can be directly applied to actual cases in which there are other influences that inflate the certainty of eyewitnesses.

Perhaps even more promising than the certainty of the eyewitness is the speed with which the eyewitness makes an identification from a lineup. Several studies have now found that witnesses who make accurate identifications from a lineup reach their decision faster than do witnesses who make mistaken identifications (Dunning & Perretta, in press; Dunning & Stern, 1994; Robinson, Johnson, & Herndon, 1997; Smith, Lindsay, & Pryke, 2000; Sporer, 1992, 1993, 1994). In an impressive set of results, Dunning and Perretta found that those who made their decision in less than 10-12 seconds were nearly 90% accurate in their identifications from a lineup whereas those taking longer were approximately 50% correct. The 10-12 second rule was developed post hoc to produce the best separation of accurate and inaccurate witnesses, so some caution is called for with regard to how well the 10-12 second rule works in other situations, but the general relation between accuracy and speed of identification has received support in several studies. In addition, the idea that faster identifications are more likely to be accurate than are slower identifications makes good theoretical sense. It has long been theorized that mistaken identifications result from a deliberated judgment in which witnesses compare one lineup member to another and use inferences and elimination strategies to decide which person must be the culprit whereas accurate identifications result from a more automatic recognition process that does not require comparisons of one lineup member to another (Wells, 1984a).

Lay Observer's Judgments of Accuracy

Unlike the results from the decision time analyses and the potentially useful value of eyewitness certainty, the potential ability of observers (e.g., jurors) to make correct discriminations between accurate and inaccurate eyewitness identification testimony does not appear particularly promising. Several approaches have been taken to address the adequacy of people's judgments about eyewitness identification accuracy. One approach has been to use surveys to find out what people believe about variables affecting eyewitness identification accuracy. Results from these surveys show rather poor agreement between the answers that lay people give about variables affecting eyewitness identification accuracy and the answers scored correct by researchers based on the empirical literature, with agreement often at less than 50% (e.g., Deffenbacher & Loftus, 1982; McConkey & Roche, 1989; Noon & Hollin, 1987). Another approach has been to use “prediction” studies in which eyewitness identification experiments are described and people are asked to predict the results. The patterns of results in these studies typically show an overall tendency to overestimate eyewitness identification accuracy and a failure to correctly predict interactions between variables (e.g., Brigham & Bothwell, 1983: Wells, 1984b).

A third approach is one in which eyewitnesses to staged crimes are cross-examined and the subject-jurors’ task is to determine which witnesses made accurate identifications and which witnesses made mistaken identifications. In a series of experiments using this methodology, subject-jurors have shown little or no ability to make such discriminations (Lindsay, Wells, & O’Connor, 1989; Lindsay, Wells, & Rumpel, 1981; Wells, Ferguson & Lindsay, 1981; Wells & Leippe, 1981; Wells, Lindsay, & Ferguson, 1979). These studies are commonly cited as evidence that people are overbelieving of eyewitnesses because the overall percentage of observers who believed that the eyewitnesses had made accurate identifications exceeded the percentage of eyewitnesses who were accurate. However, this pattern of overbelief is restricted primarily to poorer witnessing conditions; when witnessing conditions were good, belief rates and eyewitness identification accuracy rates were more similar. In addition, mock witnesses sometimes underbelieved the eyewitnesses who had quite low levels of certainty.

System Variables

System variables are those that affect the accuracy of eyewitness identifications over which the criminal justice system has (or can have) control. In general, these tend to be lineup test factors, such as how witnesses are instructed prior to viewing a lineup or how the lineup is structured. The distinction between system variables and estimator variables is consequential in several respects. Whereas estimator variables can at best sharpen the probabilistic ability of the criminal justice system to sort accurate from inaccurate eyewitness identifications, system variables can help prevent inaccurate identifications from occurring in the first place. Consider, for instance, the idea that jurors are overbelieving of eyewitness identification testimony. Although expert testimony about eyewitness identification might manage to bring jurors' levels of beliefs down to the level of eyewitness identification accuracy, the system variable approach might manage to bring eyewitness identification accuracy up to the level of jurors' beliefs (Seelau & Wells, 1995).

Crime investigators conducting a lineup has been likened to researchers conducting an experiment (Wells & Luus, 1990). Crime investigators begin with a hypothesis (that the suspect is the culprit), create a design for testing the hypothesis (embed the suspect among fillers), carry out a procedure (e.g., pre-lineup instructions), observe and record the behavior (witness decision), and then interpret and revise their hypothesis (regarding the guilt of the suspect). All the types of things that can go wrong with an experiment to cause misleading results can also go wrong with a lineup. For instance, the instructions might be suggestive, the hypothesis might be prematurely leaked, the design might be flawed, the behavior might be misinterpreted, confirmation biases might be operating, and so on. Indeed, a great deal of the system variable eyewitness identification research literature could be construed as the extension of sound experimental methodology to the design and procedure of police lineups.

Most system variable research in eyewitness identification can be placed into four categories: instructions, content, presentation method, and behavioral influence. Before reviewing these system variables, however, it is important to understand the role played by the presence versus absence of the culprit in the lineup and the concept of a relative-judgment decision process.

Culprit-present versus culprit-absent lineups. A lineup might or might not include the actual culprit. If police investigators have unknowingly focused on an innocent person as their suspect and place that suspect in the lineup, then the eyewitness(es) will end up viewing a lineup for which the only correct answer is “not there.” Research repeatedly shows that culprit-absent lineups present great problems for eyewitnesses. The same eyewitnesses who identified an innocent person from a culprit-absent lineup might otherwise have been able to identify the actual culprit from a culprit-present lineup (Wells, 1984a). In one study, for example, 54% of eyewitnesses were able to identify the actual culprit from a 6-person culprit-present lineup and 21% made no identification. When the culprit was removed without replacement (making it a 5-person culprit-absent lineup), however, the rate of no identification rose only to 32%, with the other 68% of the eyewitnesses mistakenly identifying someone from the five remaining members of the lineup (Wells, 1993).

A theoretical view that has been used heavily in the eyewitness identification literature is that eyewitnesses tend to use a relative-judgment decision process in making identifications from a lineup (Wells, 1984a). The relative-judgment conceptualization states that an eyewitness tends to select a person from a lineup who most resembles the eyewitness’s memory of the culprit *relative* to the other lineup members. Although the relative-judgment decision process permits eyewitnesses to do a reasonable job of identifying the culprit from a culprit-present lineup, when eyewitnesses happen to encounter culprit-absent lineups there is still someone who looks more like the culprit than the remaining members of the lineup. An alternative to the relative-judgment conceptualization is simply that eyewitnesses tend to have a low criterion for their eyewitness identification decisions (Ebbesen & Flowe, in press). According to this view, culprit-absent lineups cause difficulties for eyewitnesses because there is a good chance that innocent lineup members will exceed the relatively low criterion that eyewitnesses have under some conditions for making a positive identification. At the time of this *Annual Review* article, definitive data sorting between the relative-judgment conceptualization and the low-criterion interpretation have not yet been put forward. Recent mathematical modeling of lineup data by Clark seems a promising avenue for refining our understanding of the role of both relative judgments and criterion setting (Clark, in press).

Instructions

One of the early variables that has been shown repeatedly to have considerable impact on eyewitness identifications from lineups is the pre-lineup instructions given to eyewitnesses. Malpass and Devine (1981) were the first to demonstrate that the ratio of accurate to inaccurate identifications relies strongly on instructing (warning) eyewitnesses prior to their viewing the lineup that the culprit might or might not be in the lineup. A meta-analysis of the eyewitness identification literature on pre-lineup instructions reveals that the loss of accurate identifications from such instructions is minimal whereas the reduction of mistaken identifications is considerable (Steblay, 1997). Steblay's meta-analysis showed that the presence of the "might or might not be present" instruction (compared to no instruction) reduced mistaken identification rates in culprit-absent lineups by 41.6% whereas accurate identifications rates in culprit-present lineups was reduced by only 1.9%. Based on this compelling research, the U.S. Department of Justice included this type of instruction in its first set of national guidelines for law enforcement on the collection of eyewitness evidence (Technical Working Group on Eyewitness Evidence, 1999).

Lineup Content

Lineup content refers to the people that lineup constructors use for fillers in a lineup. When there is a suspect in a case and police decide to conduct a lineup, decisions must be made regarding how to choose these non-suspect (filler) members. The selection of fillers for lineups was one of the earliest demonstrations of the importance of system variables and it remains one of the primary active issues in the eyewitness identification literature. The general idea is rather simple: Lineup fillers serve their intended role to the extent that they help prevent an innocent suspect from “standing out” and being mistakenly identified and yet they do not prevent accurate identifications by “hiding” the actual culprit. The first experimental demonstration of the importance of fillers showed that the use of fillers who do not at all resemble the culprit (versus fillers who fairly resemble the culprit) led eyewitnesses to mistakenly identify an innocent suspect who happens to resemble the culprit; when the suspect was the culprit, however, the manipulation of fillers had little effect on the rate of accurate identifications (Lindsay & Wells, 1980).

Although the issue of lineup fillers seems simple at first glance, it is in fact quite complex. In the early demonstrations, researchers used their knowledge of who the actual culprit was in order to select fillers. In actual cases, the identity of the culprit is not known (that is why the lineup is being conducted); the suspect is the culprit some unknown percentage of the time and is an innocent person the remainder of the time. Using the suspect as a proxy for the culprit will do different things to accurate identification rates and mistaken identification rates depending on whether the suspect is the culprit or an innocent person. Accordingly, selecting fillers who are highly similar to the suspect can help protect the innocent suspect in a culprit-absent lineup, but can also reduce accurate identifications in a culprit-present lineup (Luus & Wells, 1991). Another line of research has shown that using the suspect as the reference point to select fillers can create a "backfire effect" in which an innocent suspect, being the origin or central tendency of the lineup, actually increases the chances that the innocent suspect will be identified (Clark & Tunnicliff, 2001; Navon, 1992; Wogalter, Marwitz, & Leonard, 1992).

An alternative to the strategy of selecting fillers based on their resemblance to the suspect is to select fillers based on their fit to the verbal description the eyewitness had given of the culprit. This fit-to-description strategy has several practical advantages (see Wells, Seelau, Rydell, & Luus, 1994) and has managed to work rather well some experiments (Juslin, Olson, & Winman, 1996; Wells, Rydell, & Seelau, 1993). However, biases against the innocent suspect can remain with the fit-to-description method when the description is especially sparse or when the innocent suspect happens to show a high resemblance to the culprit (Clark & Tunnicliff, 2001; Lindsay, Martin, & Weber, 1994). In actual cases, high resemblance between the innocent suspect and the culprit can occur by chance or it can occur whenever the innocent person became a suspect because she or he resembled a composite or a security video image of the culprit.

Lineup Presentation Method

There are now many alternatives to the traditional lineup that have been proposed and tested and this is likely to be one of the most researched lineup system variable problems in future research. The first alternative to the traditional lineup was the blank lineup control method (Wells, 1984a). A blank lineup is one that contains only fillers (no suspect). Using this method, the eyewitness is first shown the blank lineup under the belief that this is the only lineup to be shown. The identification of someone from a blank lineup is known to be an error (because they are all fillers) and witnesses who make an identification from a blank lineup can thereby be discarded. Witnesses who do not make an identification from the blank lineup can then be shown the actual lineup (which contains a suspect). Data indicate that eyewitnesses who do not make an identification from the blank lineup are much more reliable on the second (actual) lineup than are those who were not screened with the blank lineup method. In effect, the blank lineup method is analogous to the use of a control condition in a within-subjects design and could be used in actual cases. In general, however, crime investigators have not liked the idea of the blank lineup control method on grounds that it "tricks" the eyewitness and could sever the trust that the eyewitness has in the investigators.

Another alternative to the traditional lineup procedure, and the best known of these alternatives, is the sequential lineup (Lindsay & Wells, 1985). Unlike the traditional lineup in which the lineup members are shown to the eyewitness simultaneously, the sequential lineup shows the eyewitness only one lineup member at a time and requires the eyewitness to make a decision ("Is this person the culprit or not?") prior to viewing the next lineup member. The most powerful version of the sequential procedure is one in which the eyewitness does not know how many lineup members there are to be viewed. The theory behind the sequential lineup is that the sequential procedure prevents eyewitnesses from simply selecting the person who looks most like the culprit relative to the other lineup members, a process called the relative-judgment decision process (Wells, 1984a). To the extent that relative judgments are operating, eyewitnesses will have difficulty with culprit-absent lineups because there is always someone in the lineup who best resembles the culprit (relative to the others) even when the culprit is not in the lineup. Unlike the simultaneous lineup, the sequential lineup prevents eyewitnesses from using the relative-judgment decision process because of the possibility at any given point in the sequence that a lineup member who has not yet been viewed will resemble the culprit more than any person viewed thus far. According to the relative-judgment account, eyewitnesses given the sequential lineup must compare each lineup member to their memory and make a more “absolute judgment” regarding identification. A recent meta-analysis of across 25 studies comparing simultaneous and sequential lineups showed that the sequential lineup reduced the chances of mistaken identifications in culprit-absent lineups by nearly one half (Steblay, Dysart, Fulero, & Lindsay, 2001). Unfortunately, there was also a reduction in accurate identification rates in culprit-present lineups that, although not as great as the reduction in mistaken identifications, was nevertheless statistically reliable. The pattern of these results has led Ebbesen and Flowe (in press) to speculate that the sequential lineup raises the criterion for making a positive identification rather than changing the process from relative to absolute judgments.

Another alternative to the traditional lineup is the elimination lineup, a procedure in which the witness’s task is to eliminate all but one lineup member and then make a separate decision as to whether that person is the culprit or not (Pozzulo & Lindsay, 1999). Although the elimination lineup does not seem to work well with adults, it seems to take care of some of the problems that young children have with lineups.

Behavioral Influence: The Need for Double-Blind Testing

One of the ways that the justice system itself can influence eyewitness identification evidence is through the behaviors of the person who administers the lineup (Wells, 1993). Commonly, the person who administers a lineup is the case detective who, of course, knows which member of the lineup is the suspect and which members are fillers. The need for double-blind testing is well established in the behavioral sciences (Rosenthal, 1976) but is largely unknown or unheeded in criminal investigation procedures and forensic science (Risinger, Saks, Thompson, & Rosenthal, 2002). The knowledge that the lineup administrator has about which lineup member is the suspect and which are merely fillers could be inadvertently communicated to the eyewitness through various verbal and nonverbal means. Phillips, McAuliff, Kovera, & Cutler, (1999) manipulated lineup administrators' assumptions about the identity of the culprit in a lineup and found that this manipulation affected the choices that eyewitnesses made from the lineup, especially when a sequential lineup procedure was used. In addition to influencing eyewitnesses' choice of particular lineup members, the person administering the lineup can cause other problems. Wells and Bradfield (1998, 1999) found that post-identification suggestions to eyewitnesses from lineup administrators led mistaken eyewitnesses to develop high levels of false certainty that they had made an accurate identification. As a system variable, the problem of influence from the lineup administrator is easily fixed by having lineups administered by someone who does not know which lineup member is the suspect and which ones are fillers (Wells et al., 1998).

Base rates as system variables. Base rates can be considered system variables in some cases. The important base rate in eyewitness identification is the base rate for the culprit being present versus absent in a lineup. Recall the primary situation in which mistaken identifications occur is when the culprit is not in the lineup. Although the role of the culprit-absent versus culprit-present base rate for the chances of mistaken identification has been established and modeled mathematically (Wells & Lindsay, 1980; Wells & Turtle 1988), it was not until recently that the case has been made for treating this base rate as a system variable (Wells & Olson, in press). Previously, this base rate was treated as though it were a fixed (albeit largely unknown) variable in actual cases. In fact, however, there are no laws or rules to determine when a suspect can be placed in a lineup and, therefore, this base rate will vary as a function of the decision criteria that crime investigators use for deciding whether or not to conduct a lineup. Consider, for instance, two different police departments, a lax criterion department and a strict criterion department. In the lax criterion department, investigators will place a suspect in a lineup for the very slightest of reasons (e.g., a mere hunch) whereas the strict criterion department requires more sufficient evidence against a person (e.g., possession of stolen goods) before placing that person in a lineup. These two departments will, over the long run, have different base rates for culprit-present and culprit-absent lineups. Suppose, for example, that over a run of 1000 lineups the lax criterion department shows 500 culprit-absent lineups and 500 culprit-present lineups whereas the strict criterion department shows only 100 culprit-absent lineups and 900 culprit-present lineups. Given equivalent eyewitnesses in both of these departments, the odds that a given eyewitness who makes an identification of the suspect is mistaken will be nine times greater in the lax criterion department than in the strict criterion department. [These surprising differences in the chances that an identification will be mistaken are simple derivations from Bayes' Theorem.] Although the justice system has not chosen to take control of the culprit-present versus culprit-absent base rate via some mechanism such as "probable cause" before placing someone in a lineup, this is clearly a system variable that the justice system could control (Wells & Olson, in press). Among system variables, the base rate for culprit-present and culprit-absent lineups might be the most powerful one affecting the chances of mistaken identification.

Problems and Prospects

In spite of the applied success of the eyewitness identification literature, significant amounts of work have yet to be done. A major concern with the eyewitness identification literature is that it has been driven much less by theoretical frameworks than it has by practical perspectives. There are two related problems with this state of affairs. One problem with the premium on application and forensic relevance in the eyewitness identification literature is that it reduces the interplay and sharing of ideas between eyewitness identification research and basic areas of psychology, especially cognitive and social psychology. In addition, the experimental eyewitness identification literature is likely to never be complete enough to cover every possible situation that arises in actual cases; hence, better theory is needed to generalize this body of literature and to fill in gaps regarding what is likely to happen under various conditions.

A second concern in the eyewitness identification literature is that, although laboratory data on eyewitness identification are extensive, there is a relative paucity of some key forms of real-world data. There are some estimable rates of eyewitness identification behavior and lineup conditions from actual cases that could assist the design and interpretation of laboratory work. For instance, there have been no empirical estimates of the base rate for culprit-present versus culprit-absent lineups in actual cases. Although there are difficulties establishing the ground truth needed for precise estimates of this base rate in actual cases, there are methods of estimating some upper limits (see Wells & Olson, in press). In addition, although the identification of a suspect from a lineup usually cannot be definitively determined in an actual case, the identification of a filler is a known error in actual cases and the rate at which these known errors occur can be informative. There have been two published estimates of the rate of filler identifications in actual cases. Wright and McDaid (1996) reported a filler identification rate of about 20% and Behrman and Davey (2001) reported a rate of 24%. One problem in collecting filler identification data from real cases is that police records often do not distinguish between eyewitnesses who make identifications of a filler and those who make no identification, which can result in a serious underestimation of the rate of filler identifications (Tollestrup, Turtle, & Yuille, 1994). Another problem with using filler identification records in actual cases is that there is often no way to know how certain the eyewitnesses were in their mistaken filler identifications because the person administering the lineup knows at the time of identification that the witness identified a filler and leaks this information to the witness or does not bother to ask the witness about his or her certainty. These problems can be avoided by scripting data collection with police departments, but their normal methods of testing and record keeping generally are not sufficient to reconstruct this information. Actual case data of these types (e.g., base rates, filler identification rates, eyewitness certainty on known errors) can supplement the laboratory literature on eyewitness identification in two important ways. First, these data can serve as comparisons to laboratory data to see if the general rates of certain behaviors (e.g., non-identification responses) in laboratory research are similar to the rates in actual cases. Second, the rates for certain conditions in actual cases (e.g., rates of culprit-present versus culprit-absent lineups) are critical for Bayesian estimations of posterior probabilities that cannot themselves be derived from experiments.

Eyewitness identification research is likely to continue to stress system variables for the foreseeable future because of the way system variables can be mapped onto the problem of improving eyewitness identification accuracy in actual cases. At the same time, estimator variables might be re-emerging with new promise for postdiction for three reasons. First, conditions are being found in which eyewitness certainty might be more closely related to eyewitness identification accuracy than once thought, especially when external influences on eyewitness certainty are minimized. Second, new postdiction variables, such as decision time, are emerging. Third, Bayesian analyses are being used to show that some eyewitness responses to lineups, such as filler identifications, have postdiction value in the direction of exonerating information. Each of these represent potentially superior estimator variables because they can be more precisely measured in actual cases than can some of the more traditional estimator variables (such as stress or arousal). In any case, there is little evidence that eyewitness identification research is veering away from its applied orientation, especially in the face of recent successes in affecting legal policies and practices (Wells, 2001; Wells et al., 2000).

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