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PC_Eyewitness and the Sequential Superiority Effect: Computer-Based Lineup Administration

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Computer technology has become an increasingly important tool for conducting eyewitness identifications. In the area of lineup identifications, computerized administration offers several advantages for researchers and law enforcement. PC_Eyewitness *is designed specifically to administer lineups. To assess this new lineup technology, two studies were conducted in order to replicate the results of previous studies comparing simultaneous and sequential lineups. One hundred twenty university students participated in each experiment. Experiment 1 used traditional paper-and-pencil lineup administration methods to compare simultaneous to sequential lineups. Experiment 2 used PC_Eyewitness to administer simultaneous and sequential lineups. The results of these studies were compared to the meta-analytic results reported by N. Steblay, J. Dysart, S. Fulero, and R. C. L. Lindsay (2001). No differences were found between paper-and-pencil and PC_Eyewitness lineup administration methods. The core findings of the N. Steblay et al. (2001) meta-analysis were replicated by both administration procedures. These results show that computerized lineup administration using PC_Eyewitness is an effective means for gathering eyewitness identification data.*

KEY WORDS: memory; witnesses; computer; methodology.

INTRODUCTION

Computerization permeates many things. Enormous amounts of information are available on the Internet, and computers control many processes in business and government. Many aspects of scientific research are computer controlled, and psychological experiments are no exception. Computerization in research is particularly important when a procedure is sensitive to procedural integrity and when consistency is necessary from one time to the next. Eyewitness identification is one such procedure. It is well known from eyewitness identification studies that consistency of

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presentation, instruction to witnesses, order of tasks and consistent inclusion of all components of the lineup administration process are important to the integrity and validity of the outcome. Law enforcement organizations often have explicit policies and protocols that are intended to govern the administration of lineups to eyewitnesses. Yet, these policies and protocols are sometimes not followed. Computerization of eyewitness identification procedures can bring real advantages by insuring consistency of lineup protocols across administrations.

Computer Technology in Contemporary Law Enforcement

Computer technology is an increasingly important support system in law enforcement and has found practical implementation in some areas of eyewitness identification, such as with the use of mug shots and composites. Computer programs are used to maintain mug shot databases where background information and photographs of criminal culprits are stored. Both witnesses and investigators can use these computerized databases to search a photo database for criminal culprits. But the use of affordable computerized mug shot systems has not been widely extended to the construction and administration of lineups.

Composite images of criminal faces have traditionally been constructed by selecting cards of facial features and placing them on a face shape. This often results in a minimal likeness to a real face. Recently, manufacturers of composite production packages have responded to the computer environment by converting their manual systems to computerized systems. These systems offer more realistic facial likenesses. Composite production packages such as E-FIT (Aspley Limited, 1993) and Faces 3.0 (InterQuest, 1998) are available for personal (desktop and laptop) computers and are increasingly used by police agencies. Computerized composite systems are used more than twice as often as sketch artists and non-computerized systems (Wogalter, Malpass, & McQuiston, 2004).

Computerized lineup technology is important for use in law enforcement settings as well as in research settings and for promoting cross-talk between researchers and law enforcement officials allowing lineups to be conducted in experimental fashion. Eyewitness identification is a widely studied topic and researchers are often called upon to evaluate actual police lineups and give testimony about the forensic value of lineup identifications. If law enforcement agencies and researchers use the same software to administer lineups, procedures will become more standardized across disciplines. Researchers can evaluate procedures actually used by police officers, while police officers can readily test and apply techniques recommended by researchers. Eyewitness research is ready-made for this type of researcher–law enforcement cross-talk. Researchers have long promoted the analogy of the "lineup-as-experiment" (Phillips, McAuliff, Kovera, & Cutler, 1999; Wells & Luus, 1990).

Since it is increasingly necessary for laboratories examining eyewitness identification to co-evolve and adjust their data-collection procedures according to the needs of the field, it becomes apparent that a computer program is needed that is readily available and useful in both law enforcement and scientific settings. One such program is PC_Eyewitness (MacLin, Meissner, & Zimmerman, in press; MacLin, Tapscott, & Malpass, 2002).

Computer Technology in Psychological Research

Computer software has been used in psychological research laboratories for more than a decade to manage experiments in sensation, perception and cognition. Today, computer control in many areas of experimental research in psychology is the standard in the laboratory, and is gaining acceptance in web-based research as the factors related to sampling issues are examined (O'Neil & Penrod, 2001). Research in other psychological domains (particularly psychometric assessment) has compared computer to paper-and-pencil administrations to determine how, in general, data from paper-and-pencil studies compare with data from a computerized administration. For example, a computerized version of the Role Construct Repertory test (Rep test) was developed using Visual Basic programming (Woehr, Miller, & Lane, 1998). The paper-and-pencil version of the Rep test was found to be difficult to administer, with scoring procedures that were labor intensive. Computerization of the test offered relief from these difficulties plus offered increased standardization. The computerized version of the Rep test was compared to the paper-and-pencil Rep test. Several practical advantages were found in administration and measurement, but more important, the cognitive complexity scores were similar across both kinds of administration.

In another example, Vispoel, Boo, and Bleiler (2001) compared computerized to paper-and-pencil versions of the Rosenberg Self-Esteem Scale in order to evaluate the psychometric properties of the computerized measures. Construct equivalence was determined with a correlation of .96 and a congruence of the factor structures of responses across administration methods was established.

Pettit (2002) assessed participant responses to World Wide Web (WWW) questionnaires compared to participant responses to paper-and-pencil questionnaires. Random response, item non-response, extreme scores, acquiescent response, and errors were evaluated. No significant differences between administration modes were found in any of the response sets except for errors. The WWW administrations produced significantly fewer errors than the paper-and-pencil questionnaires. They concluded that administering questionnaires through the Internet was a valid data-collection tool.

Some other areas where researchers have examined computerized versus paper-and-pencil administrations are: social desirability (Fox & Schwartz, 2002; Whitener & Klein, 1995), the MMPI (Lambert, Andrews, Rylee, & Skinner, 1987), and Rotter's incomplete sentences (Rasulis, Schuldberg, & Murtagh, 1996). In each case, computerized administration was found to be a valid and useful alternative to traditional paper-and-pencil methods.

PC_Eyewitness

PC_Eyewitness is a computer program written specifically for the administration of a wide range of eyewitness identification tasks in both law enforcement settings and research laboratories. PC_Eyewitness offers many options for lineup presentations and can be easily installed and configured to adjust to various research protocols (Dunning & Perretta, 2002; c.f. Dunning & Stern, 1994) and for various uses by law enforcement personnel. Lineups can be displayed simultaneously or sequentially in a variety of configurations. For instance, the experimenter can specify the number of photos viewed, the number of identification decisions made, and whether or not the task terminates after a positive identification. The program can be set to automatically randomize the positions of the lineup members, record response times, and provide blind administration. For laboratory application, the program is capable of playing video or audio stimuli of the to-be-remembered event, collecting open-ended descriptions of the culprit, displaying instructions to participants, administering description checklists, gathering lineup identification data, and collecting confidence ratings and other self-assessment measures.

PC_Eyewitness is programmed using Visual Basic 6.0 (Dixon & MacLin, 2003) and uses Microsoft Excel spreadsheets as the control interface. Visual Basic programs are highly portable, allowing PC_Eyewitness to run on most PC-type computers. Because support files are packaged with PC_Eyewitness, it is not always necessary to have Visual Basic installed on the computer running the program. PC_Eyewitness is modular, and as research needs or law enforcement policies change only small modifications in the control interface are needed. Modularity adds greater flexibility to the program and faster modification (MacLin, Meissner, & Zimmerman, in press).

Evaluating PC_Eyewitness

Comparing results obtained using PC_Eyewitness to results obtained using traditional paper-and-pencil methods are obviously of interest. However, traditional methods are no "gold standard" against which to evaluate computerized procedures, especially if computerized procedures are expected to offer advantages. Traditional procedures may have originally been used merely because they were the most practical available, and/or they became customary with or without explicit examination of alternatives. On the other hand, even if traditional paper-and-pencil procedures are not a principled standard, they are the *de facto* standard in many areas, and eyewitness identification procedures are no exception.

Our evaluation strategy focuses on the replication of well-known findings—patterns of results—that are important for any new technique to be able to produce. We follow the experimental conditions used to establish the phenomenon by paper-and-pencil methods. The pattern of findings reliably found in comparisons of simultaneous and sequential eyewitness lineups are the target of our replication attempt. Our first experiment attempts to replicate these findings using typical paper-and-pencil administration methods. Our standard of comparison is the pattern of results found in the meta-analysis of studies comparing simultaneous and sequential lineups by Steblay, Dysart, Fulero, and Lindsay (2001). Our second experiment attempts to replicate these findings using PC_Eyewitness, set up to administer the procedures as specified by traditional methods. Our prediction is that experiment 1 will replicate the model findings of Steblay et al. (2001), and that experiment 2 will do the same. The pattern of results reported by Steblay et al. (2001) is shown in Table 1 (column 1). Three findings are of particular importance: When the target (culprit) is present in the lineup, simultaneous lineups are superior in securing

Table 1. Comparison of Paper-and-Pencil and PC_Eyewitness Findings with Results from the Steblay et al. (2001) Meta-Analysis

	Meta-analysis		Paper-and-pencil		PC_Eyewitness	
	Sim	Seq	Sim	Seq	Sim	Seq
Target-present lineups						
Correct ID	.50	.35*	.40	.33	.47	.27
Filler choice	.26	.19	.43	.16*	.23	.16
False rejection	.24	.46*	.17	.50*	.30.	.57*
Overall choosing rate[a]	.76	.54*	.83	.50	.70	.43
Target-absent lineups						
Correct rejections	.49	.72*	.37	.60	.50	.77*
False identification[b]	.09	.05	.11	.07	.08	.04
Filler identification[b]	.42	.23	.52	.33	.42	.19*
Overall choosing rate[c]	.51	.28*	.63	.40	.50	.23*

[a]Overall choosing rate in target-present lineups equals (1 − false rejection). The results of statistical analysis would be the same as for false rejection.
[b]Calculated according to Tredoux's method. See text for explanation.
[c]Overall choosing rate in target-absent lineups equals (1 − correct rejection). The results of statistical analysis would be the same as for correct rejection.
*Statistically significant at or beyond $p = .05$.

both correct identifications and reducing false rejections compared with sequential lineups. When the target is absent, sequential lineups are superior in securing correct rejections of the lineup and reducing lineup choices overall.[4] The experiments reported here are, therefore, important in two ways. They provide an independent attempt at replication of the comparison between simultaneous and sequential lineups in a different laboratory, and provide information about the degree to which the contrast is robust to variations in administration technique.

It is not clear that we should expect exactly no differences between the computerized and paper-and-pencil methods, beyond co-replication of the Steblay et al. (2001) findings. The studies comprising the meta-analysis itself varied in the degree of effects found. Also, it would be desirable for PC_Eyewitness to provide benefits not attainable with the paper-and-pencil method. For instance, it would be beneficial to improve on the sensitivity of eyewitness identification procedures in order to increase detection of the offender when he or she is present in the lineup, and conversely, to improve on the procedures' sensitivity to the actual absence of the culprit. Improvements in either of these situations by introducing computerized lineup methods would be a useful contribution. One might expect, for example, that computerized administration would reduce a witness's feeling that it is necessary

[4]False identifications and filler identifications were not disaggregated in the Steblay et al. (2001) meta-analysis. We include that calculation here for comparison with our own findings. We made the calculations in the following manner. First, we assume that the lineups were fair, in that all members of the lineup were approximately equally good alternatives to the actual culprit. Following this, we used Tredoux's procedure: The proportion of correct rejections (pCR) is first calculated as (number of correct rejections/total number of eyewitnesses). The proportion of suspect identifications can is estimated as [(1 − pCR)/number of lineup members], and the proportion of filler identifications as [(1 − pCR) − suspect ID proportion]. Consider the situation where 100 eyewitnesses view a six-member target-absent lineup. If 40 eyewitnesses correctly reject the lineup and 60 eyewitnesses identify a lineup member, then: pCR = 40/100 = .4; Suspect ID proportion = (1−.40)/6 = .6/6 = .1; and Filler ID proportion = (1−.40) − .1 = .6 − .1 = .5.

to choose someone from the lineup. For example, it has long been thought that the feeling of a necessity to choose is a social response to the lineup administrator (Steblay, 1997). Since PC_Eyewitness, to some extent, reduces the role of the lineup administrator, choosing rates might be expected to go down. In addition, it is probably not appropriate to expect no differences in the absolute levels of the proportions in the various response categories. Absolute levels of response are subject to a range of conditions, such as attributes of the culprit/target person, exposure time, viewing conditions, and properties of the lineup. The important results for purposes of replication are the relative differences, in this case, between simultaneous and sequential presentation modes under the two administration methods (paper-and-pencil versus computerized administration).

METHOD

Two experiments were conducted using participants from the same pool of introductory psychology students. Participants were randomly assigned to conditions within each of the two experiments. Many elements of the two experiments were shared.

Common Aspects of the Two Experiments

Design

Each experiment used a 2 (lineup presentation: simultaneous versus sequential) × 2 (target-present versus target-absent) between subjects design. An optimal cell size of 30 was determined using a statistical power analysis based on Cohen's (1988) estimate for a medium effect size and a power estimate of .80 ($\alpha = .05$).

Materials and Apparatus

Staged Crime Videos

The to-be-remembered stimulus event was a 45 s staged crime depicting the theft of a calculator from a student studying in a university library. Both the culprit and victim were Hispanic males.

Photographic Lineups

Lineups were constructed using color, frontal pose, head and shoulder photographs of Hispanic males obtained from a computerized mug shot database.

In order to construct lineups, verbal descriptions were gathered from participants who watched the crime video, then wrote free-recall verbal descriptions of the culprit and filled out a cued recall checklist, which prompted them to describe each of the culprit's features (e.g., eye color, eye shape, eye size). The descriptors that were reported most frequently were used to construct a modal description of the culprit. From the modal description, a lineup was constructed. Twenty mock witnesses were shown the modal verbal description and asked to make lineup identifications.

The fairness of the lineup was assessed using mock witness procedures outlined by Malpass and Lindsay (1999): Bias towards the suspect was assessed using the proportion of suspect identifications; Lineup size—the adequacy of the fillers—was assessed using Tredoux's E (Tredoux, 1998, 1999). The first lineup constructed was determined to be unfair because one lineup filler was chosen at a rate disproportional to the other lineup members. Therefore, this filler was removed and replaced. Twenty new mock witnesses evaluated the new lineup, which was determined to be fair and thus used in the actual experiment.

Procedure

After the informed consent procedure, participants viewed the simulated crime and completed a 5-min filler task (word search puzzle). Participants were told that the culprit may or may not be present in the lineup and were asked to make identification decisions. Participants viewing the faces sequentially were instructed:

> In a moment you will be shown a series of 18 photos, one at a time. Your task is to select the culprit you saw in the video. The culprit may or may not be present in the series of faces. For each face indicate with a "Yes" or "No" whether that was the culprit or not.

Instructions for simultaneous lineups were similar to the sequential lineup instructions except participants were instructed to make a single photo choice by indicating the photo number of their selection in an entry box next to the lineup or to indicate they were rejecting the lineup by selecting the "Not Present" option. Participants then rated their confidence in the accuracy of their decisions. Confidence was rated on a 10-point scale from "not at all confident" to "very confident." Finally, participants completed a brief biographical questionnaire, read a debriefing statement, were verbally debriefed, allowed to ask questions, thanked and dismissed.

Dependent Variables

Identification accuracy and choosing rates were assessed. In the *target-present lineups*, participants can make one of three responses: choose the suspect (correct identification), misidentify a filler known to be innocent (incorrect identification), or reject the lineup (incorrect rejection). In *target-absent lineups* where the true culprit is absent, participants can make one of three responses: identify the innocent suspect (false identification), identify a filler (incorrect identification), or reject the lineup (correct rejection). Most studies in the meta-analysis did not designate a specific lineup member as a substitute for the culprit, therefore we followed the same practice and used Tredoux's scoring system for allocating choices of any lineup member to suspect and filler identifications instead of arbitrarily designating one lineup member as the innocent suspect (see footnote 1).

Since the lineups were fair in the sense that no member of the target-absent lineup was better than another as a substitute for the actual culprit, all lineup members could reasonably serve as the target substitute. Therefore, each identification of any member of the target-absent lineup was considered to be composed of 1/6 false identification of the innocent suspect and 5/6 filler identification. We have shown the result of this conceptualization in the Steblay et al. (2001) results in Table 1. Because we did not revisit the meta-analysis data to do the statistical tests, the statistical significance of differences arising from this way of disaggregating overall target-absent identifications is only conjecture at this time.

EXPERIMENT 1: PAPER-AND-PENCIL ADMINISTRATION

Method

Participants

One hundred twenty University of Texas at El Paso (UTEP) undergraduate students enrolled in psychology courses participated in experiment 1 in exchange for partial course credit. UTEP is located on the U.S./Mexico border. All participants were Hispanic with a mean age of 21.08 ($SD = 5.12$), of which 43% were female.

The first experiment attempted to replicate the pattern of findings reported by Steblay et al. (2001), comparing simultaneous and sequential methods of lineup presentation using traditional paper-and-pencil administration methods.

Materials

Packets of instructions along with photographic lineups, word find puzzles, and questionnaires were compiled for each condition. Lineup photo order was randomized using a randomization table. The simulated crime video was presented on a 20 in. TV monitor. Two identification answer sheets were used depending on which lineup condition the participant was assigned to. The answer sheet for the simultaneous presentation consisted of six numbers representing the spatial location of the photos in the lineup. The answer sheet also included a "Not Present" option to enable the participant to choose no one, thus, rejecting the lineup. The answer sheet for the sequential presentation contained 18 spaces for yes or no questions, one question corresponding to each of the six actual photos and one for each of the 12 remaining presumed-to-be-seen photos. In this way, participants were unaware of the actual number of photos to be seen. This is a common method of sequential lineup presentation (Steblay et al., 2001).

Procedure

Participants were run in groups of no more than six. Instructions were read aloud by the experimenter while participants read along. Participants were not allowed to turn the pages in their packets until instructed to do so. After watching the simulated crime video on the TV monitor, participants were instructed to work on the timed word search puzzle task. After 5 min, the experimenter distributed the lineup response sheets and then read the lineup instructions out loud to instruct participants about the lineup identification task.

Participants receiving the simultaneous lineup were provided with a lineup containing all six photographs that were printed on a single page. They circled their identification choice on a separate answer sheet. Participants receiving the sequential lineup viewed single photos printed on separate sheets of paper. They were instructed to circle either "Yes" or "No" on their answer sheet for each photo before turning the page to the next photo. They were allowed to view all photos even after a positive identification was made. No explicit instructions were given regarding the number of choices a participant could make, but no participants made more than one photo choice. Participants were instructed not to go back to review prior photos. These packets contained 6 photos along with 10 blank sheets of paper. The page after the sixth photo contained instructions stating, "You have just viewed the first set of six faces. Do not go back and look at the photos again." The next page in the packet informed participants that no other faces would be seen. They were instructed to turn past the blank pages to the end of the packet and answer the remaining questions. The last pages in the packets, for participants in the both the simultaneous and sequential conditions asked participant to rate their confidence, and complete a background information questionnaire.

Results

Data from the target-present and target-absent lineups were analyzed separately. Chi-square analysis was use to determine if observed differences were statistically reliable.

Target-Present

Correct Identifications

Identification of the criminal culprit in the target-present lineups constitutes a correct identification. As indicated in Table 1 (column 2), 40% of participants identified the culprit when viewing simultaneous lineups, while 33% identified the culprit when viewing sequential lineups. These differences were not significant ($\chi^2(1) = .287, p = .592, \phi = .07$).

Filler Choice

While it is recommended that lineups be constructed with fillers that are known to be innocent, it is still of interest to examine under what condition the selection of a filler occurs. Filler choices reflect both the ability of the witness to distinguish the culprit from the fillers and the participants' inclination to make an identification. Results found here indicate that when viewing simultaneous lineups participants chose a filler significantly more often than when viewing sequential lineups (43% > 16%; $\chi^2(1) = 5.079, p = .024, \phi = .29$).

False Rejection

Because sequential lineups are thought to decrease participants' inclination to choose a lineup member, it is useful to assess whether or not participants incorrectly rejected the lineup by choosing no one. Overall, more participants in the sequential lineup condition incorrectly rejected the lineup (50% > 17%; $\chi^2(1) = 7.50, p = .006, \phi = .35$).

Confidence Ratings

We evaluated the relationship between participants' lineup identification choice and how confident they were that their lineup choice was correct. No significant confidence/accuracy correlations were found in any of the response categories. Correlations for simultaneous were as follows: Correct identifications: $r = .22, p = .122$; filler choice: $r = -.02, p = .468$; false rejections: $r = .268, p = .076$. For sequential lineups, the correlations were as follows: correct identifications: $r = -.13, p = .250$; filler choice: $r = -.102, p = .295$; false rejections: $r = -.20, p = .148$.

Target-Absent

Correct Rejections

In the target-absent condition, the correct choice is to reject the lineup indicating that the culprit is not a member of the lineup. Thirty-seven percent of the participants rejected the simultaneous lineup, while 60% rejected the sequential lineups. This difference was not significant ($\chi^2(1) = 3.270, p = .071, \phi = .23$).

Overall Choosing Rate

For target-absent lineups, overall choosing rate equals 1 − number of correct rejections, so the statistical analysis for choosing rate gives the same result as for correct rejections. Participants given a simultaneous lineup chose someone 63% of the time, while participants given a sequential lineup chose someone 40% of the time. This difference was not significant. Because a culprit substitute was not designated as the innocent suspect in the target-absent lineups, lineup choices were disaggregated into false identifications and filler identifications by Tredoux's procedure as described earlier.

False Identifications

Participants made false identifications at similar rates whether viewing a simultaneous lineup (11%) or a sequential lineup (7%) ($\chi^2(1) = .218, p = .640, \phi = .06$).

Filler Identifications

Those who identified a known innocent filler also did not differ significantly between simultaneous (52%) and sequential (33%) lineups ($\chi^2(1) = 2.443, p = .118, \phi = .20$).

Confidence Ratings

There was no significant correlation between confidence and accuracy in any of the response categories.

Discussion

The results provide a partial replication of the pattern of the Steblay et al. (2001) meta-analysis. For *target-absent lineups*, the expected difference for overall choosing rate was observed: Simultaneous lineups showed a greater overall choosing rate. Steblay et al. (2001) did not disaggregate the overall choosing rate into filler and filler choice components. Using Tredoux's procedure as discussed earlier it is possible to do this, assuming that all fillers were, on the average, equally good substitutes for the actual culprit. When overall choosing rate is disaggregated into suspect versus filler identifications, the statistical difference between simultaneous and sequential lineups disappeared for both suspect and filler choices.

Contrasting with the meta-analysis, the expected difference for correct rejections, that more correct rejections would be found with sequential presentations, was not observed.

For *target-present lineups*, the expected difference for false rejections was observed: there were fewer false rejections in simultaneous lineups. However, there was no difference in correct identifications between the two lineup methods. This contrasts with the meta-analysis which showed generally more correct identifications when participants were shown a simultaneous lineup.

EXPERIMENT 2: COMPUTER ADMINISTRATION

Method

Participants

One hundred twenty University of Texas at El Paso undergraduate students enrolled in psychology courses participated in experiment 2 in exchange for partial course credit. All participants were Hispanic with a mean age of 20.38 ($SD = 4.57$), of which 63% were female.

PC_Eyewitness was used to display stimulus materials and instructions, and to collect responses from the participants. Because PC_Eyewitness is modular, researchers can control the presentation sequence of stimulus materials and instructions by entering the form names in the command line on the Excel spreadsheet using the standard modules (contact the first author for more information). The sequence for PC_Eyewitness administration was designed to be the same as the paper-and-pencil presentations. All data were recorded to a text file.

Procedure

Participants were run in groups of no more than 20 in a computer laboratory containing 20 computer stations. PC_Eyewitness was installed on individual computers to display one of the four lineup conditions prior to participants entering the room. Each participant was randomly assigned to one of the lineup conditions. Participants viewed the crime scene video on their individual computer monitor and then completed a 5-min filler task (word search puzzle). Lineup instructions were then displayed on the computer monitor. The participants in the simultaneous presentation condition were presented with six images on the computer monitor and were instructed to type the photo number of their identification choice in a text box or to indicate with a mouse click the box specifying "not there." Participants in the sequential condition viewed faces one at a time, and made a "Yes" or "No" decision for each photo. Participants were not able to go back to review prior photos. After completing the identification task, participants rated their confidence, and completed a background information questionnaire.

Results

Target-Present

Correct Identifications. Forty-seven percent of the participants identified the culprit when the lineup was presented simultaneously compared to 27% when the lineup was presented sequentially (see Table 1, column 3). This difference was not significant ($\chi^2(1) = 2.584$, $p = .11$, $\phi = .21$). These results are similar to the paper-and-pencil method of administration, which also revealed no significant differences between simultaneous and sequential lineups. These data are consistent with the Steblay et al. (2001) meta-analysis in which more correct identifications were made when viewing simultaneous lineups.

Filler Choice. Participants chose fillers at similar rates when viewing simultaneous lineups and sequential lineups (23% > 16%; $\chi^2(1) = .417, p = .519, \phi = .08$), similar to the Steblay et al. (2001) meta-analysis. These results are different from experiment 1 and those calculated for Steblay et al. When viewing these same lineups on paper-and-pencil, the filler choice rates were significantly greater when participants viewed simultaneous lineups compared to sequential lineups.

False Rejection. Participants given the sequential lineup incorrectly rejected the lineup more often than those given the simultaneous lineup (57% > 30%; $\chi^2(1) = 4.34, p = .037, \phi = .27$). These results are similar to those in both the paper-and-pencil condition and the Steblay et al. (2001) meta-analysis.

Confidence Ratings. When viewing *simultaneous* target-present lineups, there was a significant correlation between confidence and accuracy ($r = .53$, $p = .001$). Participants who were accurate tended to be more confident. This correlation was not found for sequential lineups. These results are in contrast to experiment 1. This correlation was not found when the lineups were presented using the paper-and-pencil method.

Target-Absent

Correct Rejections. Fifty percent of the participants rejected the simultaneous lineups and 77% rejected the sequential lineups ($\chi^2(1) = 4.593, p = .032, \phi = .28$). This significant difference was not found when the lineup was administered using the paper-and-pencil method, but was found in the Steblay et al. (2001) meta-analysis.

Overall Choosing Rate. For target-absent lineups, overall choosing rate equals 1 − number of correct rejections, so the statistical analysis for correct rejections gives the same result as for choosing rate. Participants given a simultaneous lineup made significantly more lineup choices than those given a sequential lineup (50% > 23%), similar to the pattern in both the paper-and-pencil method and the Steblay et al. (2001) meta-analysis.

Because a culprit substitute was not designated as the innocent suspect in the target-absent lineups, lineup choices were disaggregated into false identifications and filler identifications by Tredoux's procedure as described earlier.

False Identifications. Participants made false identifications at the same rate whether viewing a simultaneous lineup (8%) or a sequential lineup (4%) ($\chi^2(1) = .351, p = .55, \phi = .08$). These results are similar to those found in experiment 1.

Filler Identifications. There was a significant difference between those who identified a known innocent filler in the simultaneous lineup (42%) compared to the sequential lineups (19%) ($\chi^2(1) = 3.774$, $p = .052$, $\phi = .25$). When viewing the lineups with the paper-and-pencil method, no difference was found.

Confidence Ratings. No significant correlations were observed between confidence and accuracy in any of the response categories.

Discussion

The results reveal a partial replication of the pattern of the Steblay et al. (2001) meta-analysis. The expected difference for false rejections of the *target-present lineup* was observed, with fewer false rejections made by participants who viewed the simultaneous lineup. However, no significant difference was found between the two presentation methods for correct identification, a contrast with the meta-analysis. Since both the paper-and-pencil and computerized methods failed to replicate the meta-analysis finding for correct rejections, it is likely that the basis for this difference is in the materials used in our experiments. For *target-absent lineups*, the expected difference for correct rejections was observed, with more correct rejections given by participants who viewed the sequential lineup. The expected difference for overall choosing rate was also observed (simultaneous > sequential). When the latter is broken down into suspect versus filler identifications, only filler identifications showed a statistically significant difference between simultaneous and sequential lineups (simultaneous > sequential).

PAPER-AND-PENCIL vs. PCE COMPARISON

Target-Present

Correct Identifications. Because the data are categorical, a 2 (computer versus paper-pencil) × 2 (simultaneous versus sequential) × 2 (identification: correct versus incorrect). Hierarchical Log Linear (Hilog) analysis was performed to compare correct identifications. Overall, these differences were not significant ($\chi^2(1) = .590$, $p = .44$). The main effect for lineup type was not significant ($\chi^2(1) = 2.306$, $p = .13$), and there was no difference in overall correct identifications for the computer condition (37%) and the paper-and-pencil condition (37%).

Filler Choice. Using Hilog, no overall interaction was found for filler choices ($\chi^2(1) = 1.061$, $p = .30$). A significant difference was found for filler identification across lineup presentation ($\chi^2(1) = 4.51$, $p = .03$, $\phi = .19$). Thirty-three percent of participants viewing simultaneous lineups chose a filler compared to 17% of participants viewing sequential lineups. No difference was found for administration conditions ($\chi^2(1) = 1.61$, $p = .21$, $\phi = .20$). In the paper-and-pencil condition, 30% chose a filler and in the computer condition 20% chose a filler.

False Rejection. Using Hilog, no overall interaction was found for false rejections ($\chi^2(1) = .368$, $p = .55$). A significant difference was found for the number of participants rejecting the lineup across lineup presentation ($\chi^2(1) = 11.66$, $p < .001$, $\phi = .31$). When viewing simultaneous lineups, 23% of participants incorrectly rejected the lineup and chose no one, while 53% of participants viewing sequential lineups incorrectly rejected the lineup. No difference was found for administration conditions with 33% rejecting the paper-and-pencil lineup and 43% rejecting the computerized lineup ($\chi^2(1) = 1.27$, $p = .26$, $\phi = .10$).

Overall Choosing Rate. No difference in choosing rates was found across administration conditions ($\chi^2(1) = 1.27$, $p = .26$, $\phi = .10$). Sixty-seven percent of people in the paper-and-pencil condition incorrectly rejected the lineup and 57% of participants in the computer condition incorrectly rejected the lineups. The difference in choosing rates across simultaneous and sequential lineups was non-significant.

Target-Absent

Correct Rejections. A 2 (computer versus paper-pencil) $\times$ 2 (simultaneous versus sequential) $\times$ 2 (correct rejection versus incorrect rejection) Hilog analysis revealed no overall interaction ($\chi^2(1) = .094$, $p = .76$). The difference between correct rejections across the simultaneous versus sequential lineups was significant ($\chi^2(1) = 7.69$, $p = .006$, $\phi = .25$). Forty-three percent of participants who viewed simultaneous lineups correctly rejected the lineup, while 68% of participants viewing sequential lineups correctly rejected the lineup. There was no significant difference between paper-pencil versus computer administration ($\chi^2(1) = 2.75$, $p = .10$, $\phi = .15$). When viewing lineups in the paper-and-pencil condition, 48% of participants made correct rejections, while 63% of participants made correct rejections in the computer condition.

False Identifications. Using Hilog, no significant differences were found in the overall analysis ($\chi^2(1) = .033$, $p = .85$). Furthermore, no main effects were found. Eight percent of participants in the paper-and-pencil condition made a false identification compared to 5% of participants in the computer condition ($\chi^2(1) = .54$, $p = .46$, $\phi = .07$). Similarly, 8% of participants viewing simultaneous lineups made a false identification compared to 5% of participant viewing sequential lineups ($\chi^2(1) = .54$, $p = .46$, $\phi = .07$).

Filler Identifications. Hilog analysis revealed no overall significant differences in rates of filler identifications ($\chi^2(1) = .136$, $p = .71$). No differences were found for administration condition ($\chi^2(1) = 1.75$, $p = .19$, $\phi = .12$). Forty-three percent of participants in the paper-and-pencil condition identified a filler, while 32% percent of people in the computer condition identified a filler. A significant main effect was found for lineup condition ($\chi^2(1) = 6.07, p = .014, \phi = .22$). When viewing simultaneous lineups, 48% chose a filler and when viewing sequential lineups 27% chose a filler.

Discussion

No significant differences were found between the paper-and-pencil and PC_Eyewitness administration conditions. Additionally, the choice rates for PC_Eyewitness were very similar to those found in the Steblay et al. (2001) meta-analysis. No interactions were found with the administration method variable.

GENERAL DISCUSSION

There are two sets of findings to be discussed: the substantive findings relating to the comparison of simultaneous and sequential lineups, and the procedural findings relating to the comparison of paper-and-pencil with computerized (PC_Eyewitness) administration methods.

Replication of the Meta-Analysis

If we consider the similarities between the results of our experiments and the meta-analysis by examining significant differences between simultaneous and sequential lineup presentation modes for each of the response categories, there are some differences. Most notable is that under target-present conditions the higher level of correct identifications found with simultaneous lineups in the meta-analysis was not replicated in our experiments. And, while there was no difference in target-present filler choices in the meta-analysis, there were more filler choices when viewing simultaneous lineups in the paper-and-pencil condition and when the results of the paper-and-pencil and PC_Eyewitness conditions were combined. Finally, for target-present conditions, simultaneous lineups showed a lower rate of false lineup rejections in the meta-analysis and both administration methods in the present experiment.

Even though some of the comparisons did not reach statistical significance, it is interesting to note that of the nine comparisons (three data sets $\times$ three dependent variables) there were no reversals in the relative proportions of responses between simultaneous and sequential target-present lineups. This further demonstrates the utility of PC_Eyewitness as a lineup administration tool.

Results of the target-absent lineups also present some differences. The superiority of sequential lineups to correctly reject target-absent lineups found in the meta-analysis was replicated with PC_Eyewitness but not with the paper-and-pencil administration method. The meta-analysis did not break down overall choices into false identification and filler identification, as we did using Tredoux's method, but we have displayed that breakdown of the meta-analysis data in Table 1 (column 1). For false identifications the rates are low in any case and the differences are small. None were significant. When lineups were viewed using PC_Eyewitness, we found significantly fewer filler identifications in the sequential condition. The pattern of results in the two experiments did not differ from the meta-analysis to a degree outside of the range of variation found in the studies comprising it.

How Do We Explain the Simultaneous Vs. Sequential Differences?

Even though the replication of the meta-analysis was not perfect in detail, there was a consistent pattern of results across the meta-analysis and the two experiments of the present paper. For target-present lineups, false rejections of the lineup were consistently greater for sequential lineups, and because the overall choosing rate was (1 – false rejections), the elevated choosing rate for simultaneous lineups is also a consistent finding. For target-absent lineups the consistent finding is an elevated rate of correct rejections for sequential lineups and the reflection of that result, a lower overall rate of choosing.

It is difficult to come to a definitive interpretation of these simultaneous versus sequential differences because there are so many aspects of these procedures that are confounded in the comparisons (MacLin & Malpass, 2004; Malpass, MacLin, Zimmerman, Tredoux, & McQuiston, 2003).[5] There is good indication that the consistent findings across the meta-analysis and the two experiments reported here all reflect the willingness of the participants to select someone from the lineup rather than reject the lineup. Of course, when the actual target is present, elevated choosing rates result in more identifications and when the actual target is absent, elevated choosing rates result in more erroneous identifications. This is exactly the common pattern we observe.

Simultaneous lineups are associated with higher rates of lineup choice than sequential lineups. This invites the question whether modifications in simultaneous lineups can be made to reduce overall choosing rates. It also invites the question as to what aspect(s) of sequential lineups is responsible for reducing choosing rates. The theoretical context in which we might look for answers is the response decision processes associated with criterion setting in signal detection theory (SDT). Criterion setting and the factors influencing decision making by eyewitnesses was discussed at some length in Malpass and Devine (1984), but little has been done to examine eyewitness lineup choices using explicit decision models. Since choosing rates are so clearly central to the findings in the simultaneous versus sequential lineup literature, the use of explicit decision making models to understand witness behavior would seem to be an important direction for further research. Evidence

[5]In eyewitness research, the terms simultaneous and sequential have become to mean more that presenting faces all-at-once or one-at-a-time. Sequential lineups have come to mean a package of procedures that differ radically from the simultaneous lineup. For example, unlike the simultaneous lineup where participants view faces and then make a single decision, participants in the sequential lineup are required to make decisions for each face. Sequential lineups have stopping rules where the lineup may or may not be terminated after a "Yes" response. Additionally, the participant is often deceived into believing that more faces will be seen than are actually presented. Therefore, when we use the term simultaneous we mean only that the faces were presented all-at-once, any additional manipulation will be explicit. When we use the term sequential, we mean only that the lineup was presented one-at-a-time; any additional manipulation will be stated explicitly. The PC_Eyewitness modules have been constructed so that experimenters can manipulate these factors on both lineup types.

that criterion setting manipulations are important contributors to the simultaneous/sequential differences are found in MacLin and Malpass (2004), MacLin et al. (2002), Malpass et al. (2003), Meissner, Tredoux, Parker, and MacLin (in press).

Paper-and-Pencil Vs. PC_Eyewitness

The results of the two experiments in the present experiment are highly similar to the pattern of results in the meta-analysis, and most of the important differences between simultaneous and sequential lineups were statistically significant. The findings of the meta-analysis were substantially replicated in both our paper-and-pencil and PC_Eyewitness conditions. And finally, there were no interactions and no main effects between the paper-and-pencil and PC_Eyewitness administration methods. Not only do these findings show that typical results are produced when using PC_Eyewitness, it also indicates that our experimental design has sufficient power to detect effects. Therefore, the absence of effects for administration method is likely to reflect the absence of a difference between the two methods.

These findings indicate that computerized lineup administration offers a useful method of data collection. There are clear benefits to collecting data using computerized systems such as PC_Eyewitness. Methodological benefits are that larger groups of participants can be run in a laboratory setting using individualized computer stations given their availability; however, this benefit may be lost when conducting experiments in a classroom setting. Staged events can be displayed on individual computer monitors allowing for multiple staged events to occur within the same research session. Participants can receive individualized instructions allowing for experimental manipulations requiring different instructions to be run at the same time. Also, all participants see the event from the same perspective and viewing distance on computer monitors. In paper-and-pencil administrations, participants are seated around a room with usually one TV or projection screen and view the same event at varying viewing distances and angles. Another advantage of computerized administrations is that lineup members can be randomized for each computerized session allowing for 720 possible combinations (6 factorial) when a six-member lineup is used. Data are stored directly into the computer to a text file, saving time and reducing potential data entry errors.

While the aforementioned benefits are directed at the research laboratory, one of the most important benefits of PC_Eyewitness is that it is highly useful in applied settings. Field research can be conducted wherever there is a PC available. This enables direct research in law enforcement settings. Standardized methods of lineup administration found beneficial in laboratory research can be easily implemented and tested in law enforcement settings, ensuring that agency policy and recommended lineup administration methods are carried out in actual practice. Perhaps more important, lineup administration procedures and policies developed in the field can be more readily returned to the laboratory for study. This would promote collaborative relationships, which at present are difficult to implement. However, it should be added that computer-based lineup administration may be problematic with witnesses who are either unfamiliar with computers (e.g., young children and older adults) or with those unable to use a computer for physical reasons.

Because PC_Eyewitness is modular and portable it can be complied and released at little or no cost to law enforcement. With PC_Eyewitness' flexibility, programs can be designed to display standardized instructions to the witnesses, present lineups in a standardized mode (sequentially or simultaneously), collect witness responses and response latencies, record confidence and any other witness reports including verbalizations when the computer is equipped with a microphone. Because PC_Eyewitness can be distributed at little or no cost, barriers to its adoption by law enforcement are reduced. Issues of departmental resources can be reduced to whether the officer has access to a PC-type computer. Law enforcement agencies can evaluate PC_Eyewitness modules for potential adoption, while researchers can evaluate the modules for efficacy and possible improvement. As new modules are developed, a wide variety of modules are available for selection so lineups can be customized based on current and novel criminal cases. This would allow precincts to 'shop around' for the most applicable lineup presentations and witness instructions for their departmental needs or for special population needs (e.g., older witnesses, children). And it would allow researchers the ability to compare the different administration procedures. Also, "blind" administration of lineups would be easy to implement.

Computerized lineups are not limited to desktop PCs. Laptops and hand-held PDAs can be used to administer lineups in the field. Problems associated with showups (Yarmey, Yarmey, & Yarmey, 1993; Yarmey, Yarmey, & Yarmey, 1996) can be eliminated using a PDA to administer sequential lineups, rather than having the witness confront a single suspect to determine if he or she is the culprit.

Lineup construction and administration can be greatly improved with computerization. The research presented here suggests that conversion to computerized lineup administration can be made without loss of continuity with well-established results of previous research.

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