A NEW APPROACH TO EYEWITNESS POLICE IDENTIFICATION

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ABSTRACT

Traditional ways of presenting police line-up for eyewitness identification using either simultaneous or sequential presentation of suspects have been problematic because the accuracy rate remains less than perfect. This study examines the feasibility of applying the Analytic Hierarchical Process (AHP) framework for eyewitness identification by presenting the photo line-up in a pairwise fashion. This experimental study was designed to test the hypothesis that presenting suspects in a pairwise fashion would increase the accuracy level of eyewitness identification, and offer precise estimation of identification confidence levels. Over 80 participants were instructed to identify the person they saw in a video 48 hours ago in one of three photo line-up conditions: simultaneous, sequential, and pairwise. Preliminary findings are discussed with implications for law enforcement and criminal justice practices. This preliminary research shows that using this AHP approach, with adjustment for judgment inconsistency, allows a statistically significant increase in success identification ratio (88% vs. 55%) and a decrease (17% vs. 23%) in false identifications in comparison to the sequential police line-up approach.

Keywords: police line-up, eyewitness identification, pairwise comparison, Analytic Hierarchy Process, AHP.

1. Introduction

According to research on the Innocence Project, eyewitness identification of criminal suspects using police line-ups is the most common cause of wrongful convictions of innocent people in the United States (Garrett, 2012). One feature of eyewitness identification that has been examined extensively is the line-up presentation method. Two methods have been examined extensively in the literature: The simultaneous (SIM) versus sequential (SEQ) presentation format. The SIM format is the conventional method where the witness is shown a simultaneous line-up of individuals. The eyewitness then is asked to determine whether the person who committed the crime is present in the line-up. The SEQ method, in contrast, presents one individual at a time for the same purpose of identifying the criminal suspect. In either case, the witness must establish categorically (i.e., Yes or No) if there is a match.

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A significant body of scientific research has examined the comparative advantages of these two methods. In general, experimental evidence points to a ***sequential superiority effect***, that is, the SEQ method produces more accurate identifications than the SIM method does, under certain conditions (McQuiston-Surrett, Malpass, & Tredoux, 2006; Steblay, Dysart, Fulero, & L, 2001; Steblay, Dysart, & Wells, 2011). However, this general conclusion is still under debate (McQuiston-Surrett et al., 2006). More importantly, the performance gain as a result of the sequential superiority effect is rather modest, and the identification accuracy level remains less than perfect even with the SEQ presentation format.

In this research paper we present preliminary findings from the application of a new presentation format: Pairwise presentation of individuals, or what we call the pairwise (PAIR) format. The PAIR method presents two individuals at a time, and is based on the Analytic Hierarchy Process (AHP), a multi-criteria decision making methodology that is widely used in operations research (Saaty, 2001). Pairwise comparisons are the foundation of the AHP methodology, which has been validated as a highly effective tool for facilitating complex decision making through rational prioritization of human judgments. AHP also provides a wide array of quantitative tools such as inconsistency measurement to assess the level of eyewitness reliability in an objective manner. Because eyewitness identification can be conceptualized as a criterion-based decision making task (Ebbesen & Flowe, 2002; Meissner, Tredoux, Parker, & MacLin, 2005), the AHP methodology has the potential to enhance the eyewitness's decision making process in new ways.

We hope to contribute to the field of eyewitness identification research by applying the AHP methodology. In other words, our research question is:

RQ: How effective is the Analytic Hierarchy Process (AHP) methodology when applied to eyewitness identification?

2. Theoretical Background

For this research, we reviewed the extant literature on eyewitness identification as well as applications of the Analytic Hierarchy Process.

2.1 SEQ vs. SIM Line-ups

A considerable amount of empirical research has been conducted on ways to improve the eyewitness identification process. National Institute of Justice published a guide to eyewitness evidence (Technical Working Group for Eyewitness Evidence, 1999) under then Attorney General Janet Reno's directive: The SEQ method is recommended to law enforcement as the best practice. The SIM presentation method has received significant criticism in the scientific literature for both theoretical and empirical reasons. Theoretically, it is believed that the witness makes ***relative judgments*** by comparing each individual to each other before making a definitive decision with respect to an absolute reference (i.e., the criminal suspect recalled from memory). The SEQ method is believed to force the witness to make absolute judgments about individual suspects which in theory should produce more accurate identifications, and reduce the number of false positive identifications. Empirically, at least three meta-analyses of the scientific literature have confirmed the ***sequential superiority effect*** under certain conditions (McQuiston-Surrett et al., 2006; Steblay et al., 2001; Steblay et al., 2011). However, making systemic recommendations for the SEQ method based on the current literature may be premature because of methodological concerns (McQuiston-Surrett et al., 2006).

We believe that multi-criteria decision making methodologies such as AHP have the potential to offer another viable option for the construction of the identification line-up. As discussed below, AHP optimizes the making of complex decisions along chosen criteria through mathematical synthesis of a series of pairwise relative judgments. This well-established methodology from the operations research literature provides an alternative paradigm as well as diagnostic tools that could improve the eyewitness identification procedure in significant ways.

2.2 The Analytic Hierarchy Process (AHP)

AHP is a structured technique for making complex decisions, which often involve the ranking or prioritization of multiple, often competing, alternatives. At its core, AHP requires the decision to be modeled as a hierarchy where the decision goal is at the top of the hierarchy and the alternatives are at the bottom. For selection and prioritization problems, AHP enables the decision-maker to prioritize the alternatives, based on the decision-maker explicit or implicit criteria, and through a process of pairwise comparisons of the different decision elements[2]. The AHP may be appropriate for the eyewitness identification task if we conceptualize the eyewitness identification task as a decision making task.

2.3 Applying AHP to Eyewitness Identification

Eyewitness identification; or the process of selecting a criminal suspect out of a line-up of potential candidates can be modeled as a complex decision-making problem that involves the prioritization of the candidates. Applying the AHP methodology not only provides a structured approach to eyewitness identification, it also allows quantification of the quality of the identification in more nuanced ways.

Applying the AHP methodology to the eyewitness identification procedure entails two significant departures from the current paradigm. First, the AHP methodology requires the presentation of potential suspects in a pairwise (PAIR) fashion. Second, with each pair of suspects, the eyewitness would form a relative judgment on a ratio scale (i.e., between 1 to 9) with respect to the person recalled from memory. This is qualitatively distinct from the categorical format (i.e., Yes or No) of eyewitness responses in the current paradigm.

Given the track record of AHP in optimizing decision quality, we expect that the PAIR presentation format would increase the rate of correct identifications, and lower the rate of incorrect identifications. In other words, we proffer the following hypotheses:

H1: The rate of correct identifications is greater with the PAIR line-up than either SEQ or SIM line-ups.

H2: The rate of incorrect identifications is lower with the PAIR line-up than either SEQ or SIM line-ups.

3. Methodology

3.1 Participants

One hundred and two undergraduate students (six were male) participated in this experiment as part of their coursework with no material compensation. However, Participants who made correct identifications received $5 gift cards as rewards. The purpose of the rewards was to provide incentive for active and attentive participation in the experimental procedures.

[2] The reader is referred to the AHP literature for specific details on the method. See for example Saaty (2001) and Saaty (2008).

3.2 Materials

To ensure consistency with previous eyewitness identification studies, we requested for experimental materials from the R. C. L. Lindsay lab which has produced a great number of experiments on line-up format (McQuiston-Surrett et al., 2006). For this study, we used a 30-second video of a white male threatening the audience as the crime scene simulation, and six photo images pasted on powerpoint slides. One of the images was the culprit, while the other five were fillers of the same race and gender chosen based on overall similarity.

3.3 Experimental Design

Line-up presentation format constitutes the independent variable of the study, with three levels: SIM, SEQ, and PAIR. All line-ups were conducted with the culprit present. Two primary dependent measures were collected: Identification response (correct or incorrect), and self-reported confidence. With a between-subject design, participants were assigned to one of the three experimental conditions: SIM, SEQ, or PAIR.

3.4 Procedure

The overall procedure of the present study was designed based on best practices from the eyewitness identification literature. The experiment took place on two days over a 48-hour period: On Day 1, participants in groups of five to ten were told that the purpose of the study was to examine the mechanisms of visual processing. This was done to conceal the true purpose of the study, and to achieve a realistic simulation of witnessing a crime scene where people are typically not instructed a priori to provide memory recall at a later time. The participant filled out a demographic questionnaire, and watched the crime scene simulation video projected on a large screen in a dimmed classroom. The participant was then given a distracter task of estimating the length of the video, and told that he or she would answer some more questions two days later. The entire Day 1 procedure took roughly 15 minutes.

On Day 2, which was forty-eight hours later, the participant was instructed to identify the individual from the crime scene simulation video out of a series of photographs. During the instructions phase prior to identification, the participant was warned that the culprit may or may not be in the line-up and this warning was given in all three line-up conditions. The participant was asked to perform the experimental tasks individually without consulting other students. The participant also answered these three questions regarding confidence about recognizing the culprit (Dysart & Lindsay, 2001): (1) How clear a memory do you have for the face of the person you saw in the previous video? (2) How confident are you that you will be able to recognize the person you saw in the previous video? (3) How confident are you that you will realize the person you saw in the video is not in the line-up if you are shown a line-up where he is not present?

For the eyewitness identification procedure, the line-up photographs were projected onto a large screen in a dimmed classroom in one of three ways: simultaneously (i.e., the SIM condition), sequentially (i.e., the SEQ condition), or pairwisely (i.e., the PAIR condition). Only culprit-present line-ups were used in this study.

In the SIM condition, the participant viewed all six photographs in a 3x2 array for a duration of 60 seconds, and responded categorically (i.e., Yes or No) to each photograph. With each photograph, the participant also indicated the degree of confidence with the answer on a half-range scale (i.e., 50%-100%) (Weber & Brewer, 2006). See Appendix 1 for the answer sheet used in the SIM condition.

In the SEQ condition, the participant was shown each of the six photographs individually for 10 seconds each. The participant was never told the exact number of photographs to be shown. The answer sheet displayed space for eight ratings, although the experiment always ended after six photographs were

displayed. Like those in the SIM condition, the participant in the SEQ condition responded to each photograph categorically, and indicated the level of confidence with the answer on a 50%-100% scale. Similar to the previous case they had to indicate how confident they were about their judgment. See Appendix 2 for the answer sheet used in the SEQ condition.

In the PAIR condition, the participant received a ten-minute training session on performing pairwise comparisons using the ratio scale designed based on the AHP methodology. Participants were instructed to compare the photographs two at a time, and to indicate in each pair the likelihood of one photograph or the other as the culprit. Because the ratio scale already captured the participant's confidence level, the participant did not answer separate questions regarding confidence. Each participant made a total of 15 judgments for all possible pair combinations of the six photographs. See Appendix 3 for the answer sheet used in the PAIR condition.

4. Data Analysis and Results

4.1 Determining identification in the PAIR condition

Because the participant in the PAIR condition made a series of relative judgments on a ratio scale, the result, using the AHP methodology, is a set of priorities indicating the likelihood -from the eyewitness perspective- that each of the line-up individuals could be the "criminal;" they watched in the video the first day of the experiment. To calculate the priorities or each suspect, the judgments made by the participant in the paper questionnaire were entered into SuperDecisions, a freely available computer program that facilitates the calculation of the final priorities (SuperDecisions 2012). Next, the calculated eyewitness priority vector was translated into a set of "Yes" or "No" (whether the specific picture corresponds to the "criminal" or not) for each of the lineup suspects.

4.2 Base Results

Overall, our findings in the SIM and SEQ conditions are comparable to levels reported in the literature. 55% participants made correct identifications from SIM line-ups, and virtually the same proportion of participants made correct identifications from SEQ lineups. 36% participants made false identifications from SIM line-ups, compared to 23% in the SEQ condition, although the difference was not statistically significant. The PAIR condition produced a higher level of correct identifications (66%) although this proportion was no statistically higher than that of the SIM or the SEQ condition. The PAIR condition also produced a comparable level of false identifications to the SIM and SEQ conditions. These preliminary results of our study are shown in Table 1.

Table 1. Summary of Main Results

Condition	N	% Correct Identification	% False Identification
SIM	33	55 %	36%
SEQ	31	55 %	23%
PAIR	38	66 %	34 %

4.3. Results after participant screening based on logical inconsistency

Although performance of the PAIR line-up appears to be comparable to that of the other two conditions, the PAIR line-up method allows the computation of additional indices that are not available with the other two methods. One such index is the Coefficient of Inconsistency (C.I.), which captures the degree to

which the participant follows logical principles such as transitivity (i.e., if A is great than B, and B is greater than C, then A must be greater than C.) A smaller C.I. value indicates a stronger level of logical consistency. As a general rule of thumb, only judgments with C.I. less than or equal to 0.1 (C.I. $\leq$ 0.1) should be included in the mathematical model of prioritization in the AHP methodology.

The C.I. score was computed for each participant in the PAIR condition. In the context of eyewitness identification, a larger C.I. value suggests an eyewitness who may be unreliable due to poor encoding of the culprit, inability to access the encoded memory, or other external factors. Because data points with C.I. greater than .1 are routinely excluded from the AHP computation (Saaty, 2001), we followed this convention and excluded 20 participants with C.I. less than .1. This C.I.-screened condition (PAIR-CI) with a smaller sample now demonstrates a higher rate of correct identifications as shown in Table 2.

Table 2. Summary of Results after C.I.-based screening of the PAIR condition.

Condition	N	% of Correct Identifications	% False Identifications
PAIR-CI	18	83 %	17 %
SEQ	31	55 %	20%
SIM	33	55 %	38%

Given the generally accepted principle of the sequential superiority effect, our efforts for inferential analysis will focus on comparing the PAIR-CI condition to the SEQ condition. Our goal is to determine if the PAIR-CI condition produces better results than the already superior SEQ method. The correct identification rate in the PAIR-CI condition is significantly higher than the level in the SEQ condition (Z = 2.02, p =.04). The rate of false identifications, in contrast, is comparable across the two conditions (Z = 0.544, p = 0.5892).

In summary, our results provide preliminary support for the hypothesis that the rate of correct identifications is higher in the PAIR condition compared to SEQ. In addition, we have demonstrated that the C.I. measure is a reliable predictor of eyewitness identification performance, and it provides an objective method for screening out participants who logically inconsistent. However, findings with respect to the rate of false identifications are less conclusive.

5. Discussion

The line-up presentation format is one of the most important systems variables in the eyewitness identification literature (Wells et al., 2000) and has generated considerable debate in the scientific literature. The present research study, although quite preliminary in its present form, makes a significant contribution to the literature by offering a radically different presentation format, and moves the literature forward from its current focus on SEQ and SIM as the only two viable options.

In particular, the AHP methodology offers well-established tools and measures that facilitate the eyewitness in the difficult process of identifying the culprit. As we have demonstrated, AHP offers opportunities to improve the accuracy of eyewitness identification and tools to measure eyewitness reliability in an objective fashion. AHP is one of the best decision making methods available (Peniwati, 2007), and the most widely used methodology for multi-criterion decision making that involves selection (i.e., selecting an alternative out of several), prioritization, and ranking of alternatives.

One important contribution of the AHP methodology is the ability to estimate, in an objective way, the reliability of the eyewitnesses. The C.I. index, specifically, allows us to determine objectively if logical integrity of the eyewitness's ratings. Comparable measures are unavailable from conventional methods of line-up presentation.

5.1 Implications

Our results suggest that pairwise presentation of police line-ups, along with the AHP methodology, provide a viable alternative to current methods. Although this work is rather preliminary, it does offer significant implications for eyewitness identification research.

The most significant implication is perhaps with respect to the fundamental paradigm of the eyewitness identification research. Although numerous studies have examined sequential versus simultaneous presentation of the police line-up, this is the first study, to the best of the authors' knowledge, to offer a third alternative. Although the change in presentation format is rather incremental, significant progress can be achieved if researchers, policy makers and law enforcement figure out ways to effectively leverage the full array of tools and measures available with the AHP methodology.

5.2 Limitations and Future Research

While the use of students in lab settings always constitutes a source of potential concern in terms of external validity, this is common practice in eyewitness identification research (Wells et al., 2000). A more serious concern is the relatively small sample sizes that may have compromised the effect sizes. We will be more confident with our findings when large sample sizes are obtained.

6. Conclusion

In conclusion, our preliminary findings suggest that pairwise presentation of police line-ups along with the AHP methodology can lead to a higher rate of correct identifications, compared to the sequential method, and offer objective measures of eyewitness reliability.

Appendix 1. Response Sheet for the SIM condition (which is very similar to that for the SEQ condition)

In the **Identification** row please note "Yes" if you think that person is the target or "No" is he is not.

In the **Confidence** row please note how confident you are about your answer in the Identification.

This number should be between 50% to 100% confident.

	P1	**P2**	**P3**
Identification	Yes No	Yes No	Yes No
Confidence	50% _____ 100%	50% _____ 100%	50% _____ 100%

	P4	**P5**	**P6**
Identification	Yes No	Yes No	Yes No
Confidence	50% _____ 100%	50% _____ 100%	50% _____ 100%

Appendix 2. Response Sheet for the PAIR Condition

With respect to the person you saw in the video, which subject, P1 or P2, is more likely to be that person and to what degree?

P1	**P1 is extremely more likely than P2**		**P1 is very strongly more likely than P2**		**P1 is strongly more likely than P2**		**P1 is moderately more likely than P2**		P1 and P2 are **equally** likely/unlikely	**P2 is moderately more likely than P1**		**P2 is strongly more likley than P1**		**P2 is very strongly more likely than P1**		**P2 is extremely more likley than P1**	P2
PERSON 1	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**PERSON 2**

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