EYEWITNESS MEMORY: A FIELD STUDY OF VIEWING ANGLE, POSE, AND EYEWITNESS AGE

W. Burt Thompson
Niagara University

The present study investigated how different views of a target person are related to description accuracy and lineup identification performance. In a quasi-experimental design, participants viewed a target that was seen either at eye-level or from an overhead viewing angle, and in either a front or side pose. Participants described the target and were asked to view a lineup a few days later to attempt an identification. Viewing conditions were related to several aspects of participants' reports, including estimates of target distance and exposure time. Nearly all participants—including those who said they did not have a clear view of the target's face—predicted that they could recognize a photo of the target. Among participants who viewed a lineup several days later, accuracy was much lower than they had predicted, but performance was only weakly related to viewing angle or pose. Age differences in event description accuracy and lineup identification performance were small. Overall, information provided by older and younger adults was similar in its accuracy.

Key words: eyewitness memory, lineup, viewpoint, pose, adult age differences

Eyewitness testimony plays a role in tens of thousands of criminal cases each year. In the United State alone, eyewitness evidence led to the arrest of an estimated 54,000 people in 2017 [1]. But eyewitnesses can be wrong. For example, of the more than 350 convictions overturned by DNA evidence to date, erroneous eyewitness identification was a factor in more than 70% of the cases (Innocence Project, 2018). To help understand why such mistakes happen, researchers have studied a variety of situational variables, including how far the eyewitness was from the offender, how long the offender was in view, how good the lighting was, and whether the offender was wearing a disguise (Lindsay, Mansour, Bertrand, Kalmet, & Melsom, 2011; Wells, Memon, & Penrod, 2006).

The present study investigated two situational variables that have received relatively little attention in the eyewitness memory literature—the eyewitness's viewing angle, and the pose of the target person [2]. To illustrate viewing angle, imagine you witness

Author Notes: W. Burt Thompson, Department of Psychology, Niagara University.

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Correspondence concerning this article should be addressed to Burt Thompson, Department of Psychology, Niagara University, Lewiston, NY 14109-2208. E-mail: wbt@niagara.edu

an armed robbery. Like the victim, you are on the street and see the culprit at eye-level. Two other witnesses see the crime from their third floor hotel room, and so have an overhead view of the culprit. A plausible expectation is that the witnesses who had the overhead view will have more difficulty describing and identifying the robber. Another example comes from a crime well-known to psychologists, the 1964 murder of Kitty Genovese in Queens, New York (cf. Manning, Levine, & Collins, 2007). In that case, eyewitnesses saw portions of the attack from their apartments on the second, fourth, and seventh floors. In addition to viewing angle, the present study varied the pose of the culprit, which refers to whether the eyewitness sees the culprit from the front (directly facing the eyewitness), in profile from the side, or from some other position. Neither pose nor viewing angle has been investigated in an eyewitness field study. Both variables are important to study, however, because changes in viewing angle and pose can make it more difficult to see individual facial features, which in turn may reduce the ability of an eyewitness to describe and identify the culprit. Participants in the current study saw a target person at either eye-level or from an overhead viewpoint, and the target was seen either facing the participant or from the side. Participants described the target and were later asked to view a lineup to attempt an identification.

Lab studies have shown that both the recognition and matching of unfamiliar faces is more difficult when there are changes in viewing angle (e.g., Favelle, Palmisano, & Maloney, 2007; Thompson, Grattan, Rawding, & Buchholz, 2010). For example, Thompson et al. found that face-matching performance dropped from 66% for eye-level photos to 52% when the target faces were seen from an overhead viewing angle of 40 degrees. As for pose, recognition performance tends to drop when the pose of the face during encoding is different from the pose shown on the recognition test (e.g., O'Toole, Edelman, & Bülthoff, 1998; Stephan & Caine, 2007). Because the mugshots used in the lineups for the present study showed each person from the front, the front pose was expected to lead to better recognition than the side pose. Based on this prior work, participants in the best viewing condition (eye-level and front view) were expected to be most likely to provide accurate responses on the lineup task, while those with the poorest viewing conditions (overhead and side view) were expected to be least accurate.

In addition to viewing angle and pose, the current study examined adult age differences in eyewitness accuracy. Compared to studies of young adults and children, there have been relatively few studies with older adults. More eyewitness research with older adults is important for several reasons. As Bartlett & Memon (2007) point out, research with older eyewitnesses is needed to provide a base of empirical findings that will advance theoretical understanding of processes that affect eyewitness memory. In addition, because of stereotypes about memory in elderly adults, juries may give less weight to the testimony of older eyewitnesses. Therefore, it is important to establish whether younger and older eyewitnesses differ, and how large any differences might be.

Participants in the present study were asked to estimate the distance between themselves and the target and the amount of time the target was in view, because both of these variables can influence eyewitness accuracy (Bornstein, Deffenbacher, Penrod, & McGorty, 2012; Loftus & Harley, 2005). Prior research has found that people tend to underestimate distances, and that there are large individual differences in estimate accuracy (Lindsey, Semmler, Weber, Brewer, & Lindsay, 2008; Wiest & Bell, 1985; Witmer & Kline, 1998). Similarly, estimates of brief time intervals vary widely from person to person. However, unlike distance estimates, average duration estimates are often much longer than the actual duration of an event (e.g., Attard & Bindemann, 2014; Loftus, Schooler, Boone, & Kline, 1987; Yarmey, 1993; Yarmey & Yarmey, 1997). Findings similar to the results of these previous studies were expected in the current research.

Prior research has generally found that, compared to younger adults, older adults make more errors when attempting to identify a culprit in a lineup (Fitzgerald & Price, 2015; Searcy, Bartlett, & Memon, 1999; Shapiro & Penrod, 1986). However, not all studies have found that older adults are less accurate. For example, one recent study found no age differences for identification accuracy from either showups (i.e., single suspect identifications) or lineups (Key et al., 2015). In nearly all prior eyewitness studies that have compared younger and older adults, participants were not exposed to a live event, but instead watched a video (see Fitzgerald & Price, 2015). To provide information about the external validity of prior studies, a live event was used in the present study. In one field study in which participants saw a live event, there were no age differences in lineup performance (Lindsay et al., 2008). Another field study (Yarmey, 1993) found that older adults were as accurate as younger adults in their estimates of the target's height and weight, although younger adults were more accurate in describing some of the physical traits of the target (e.g., hair color). Similar results were expected in the current study. An additional factor to consider is that all of the targets in the present study were young adults. Face recognition studies have found an own-age bias—people tend to be better at recognizing faces of people from their own age group (Rhodes & Anastasi, 2012). Consequently, older adults in the present study were expected to have more difficulty identifying the target.

In summary, the present study assessed the extent to which differences in viewing angle, pose, and eyewitness age might affect eyewitness accuracy. The study procedures were similar to those used by Lindsay et al. (2008) to investigate the effect of distance on eyewitness identification accuracy. In a field setting, participants briefly observed a live target person either at eye-level or from an overhead viewpoint. Some targets were seen from the front, while others were observed from the side, in profile. Participants then provided a basic description of the target (e.g., age, height, weight), and estimated the distance to the target and the amount of time the target was in view. Several days later, participants were asked to view a lineup online and attempt to identify the target. Previous research suggests that both distance and duration estimates would vary greatly from participant to participant, and average duration estimates would be much longer than the actual target exposure duration. Target height was expected to be underestimated more from the overhead viewing angle than at eye-level, and based on prior lab research, the overhead viewpoint and side pose were expected to be associated with reduced lineup identification performance. In addition, participants with the overhead and side views were expected to exhibit less confidence in their ability to identify the target. The overall performance of younger adults was expected to be better than that of older adults, although the differences were expected to be relatively small.

METHOD

Participants and Design

A total of 311 participants were recruited and tested in public locations near Niagara University. Participants ranged in age from 18 to 81 (M = 39.1), 47% were male, and 81% indicated White for their ethnicity. The study used a 2 x 2 design, with viewing angle (eye-level, overhead) and target pose (front, side) as between-subjects factors. Assignment of participants to study conditions was not random because, in most locations, testing could be done either at eye-level or from the overhead view, but not both. Once a suitable location was found, the experimenters would typically test several consecutive participants in the same condition—front eye-level, for example—especially if there were many potential participants in the area. Thus, experimenters attempted to balance the need to test participants in all four conditions against the practical inconvenience of moving from one testing location to another. The experimenters were only partially successful in their attempts to test approximately the same number of participants in each study condition (see Table 1). Sixty-two percent of participants overall were tested in the front view condition. Because test locations with the correct overhead viewing angle were difficult to find, more participants (64%) saw the target person at eye-level than from overhead.

Lineups

To assess identification accuracy, a 6-person target-present lineup was constructed for each of the eight targets (i.e., a photo of the target along with five filler photos), with the position of the photos in each lineup determined randomly. Each filler fit the general description of the target. Target-absent lineups were also created by replacing each target's photo with a photo of another person who matched their general description. For fillers, people with a neutral emotional expression were taken from the Minear & Park (2004) face database. All lineups were composed of front view head-and-shoulder color photos. Whether a participant saw a target-present or target-absent lineup was determined randomly.

Procedure

All testing took place during daylight hours. The experimenters were eight undergraduate research assistants who worked in pairs to test participants. One of the experimenters in each pair recruited participants, while the other experimenter acted as the target person that was to be described and potentially identified. The target remained out of view (e.g., around the corner of a building) until needed. Once a participant had agreed to take part in the study, the recruiter signaled the target to step into view. The distance to the target on all trials was kept constant at 30 feet. Different locations were selected so that the target could be viewed at either eye-level or from an overhead viewing angle of 35 to 45 degrees. The 35-45 degree range was selected because it corresponds approximately to the viewing angle of a witness seeing a person from two to three floors above ground (assuming a viewing distance to the target of 30 feet). In the front pose condition, the target faced directly toward the participant. In the side pose condition, the target was seen in profile, facing 90 degrees away from the participant. Targets stayed in view for 12 seconds. The participants next provided their email address and demographic information about themselves. They then were asked to describe the sex, age, ethnicity, height, and weight of the target person. Finally, participants were asked if they had seen the target's face clearly, and if they thought they could recognize a photo of the target—both questions were answered either yes or no.

Two days after seeing the target, participants were emailed a link to the lab's website to view the lineup to which they had been randomly assigned (either target absent or target present). Twenty participants who did not have an email address were sent a printed version of the lineup task by post. The six lineup photos were presented together in a single row. The instructions for the lineup were: "Examine the photos and try to recognize the person you saw the other day. Note that the person you saw may or may not be shown in the photos." Participants could respond by selecting one of the six photos, or they could indicate that they were not sure ("I'm not sure if the person I saw is there") or that the target was not present ("The person I saw is not there"). Finally, all participants who chose one of the six photos were instructed to indicate how confident they were in their selection using a scale from 0% to 100%.

RESULTS

The number of participants tested in each condition is shown in Table 1. After a comparison of participant characteristics, the Viewing Angle x Pose results are presented, followed by age group comparisons. Data analysis was conducted in R (R Core Team, 2017). For continuous dependent measures analyzed with analysis of variance (ANOVA), effect sizes and their confidence intervals were computed with the R package MBESS (Kelley, 2007). For categorical measures analyzed using chi-square tests of independence, effect sizes and confidence intervals were obtained using the R package vcd (Meyer, Zeileis, & Hornik, 2015).

Participant Demographics

Participant demographics are summarized in the top section of Table 1. Because assignment to conditions was nonrandom, the characteristics of participants in each condition were examined for evidence of any major differences. Participant age was very similar across the four conditions, as the mean age ranged from 38.2 to 40.0 years. A Viewing Angle x Pose ANOVA revealed no important differences in average age (all ps > .50). The percentage of female participants in each group ranged from 43% to 58%, and a 3-way log-linear analysis (Sex x Viewing Angle x Pose) revealed no effects of note (all $p\text{s} \geq .10$). A 3-way log-linear analysis also revealed no important differences in the percentage of participants who indicated White as their ethnicity (all ps > .20), with percentages ranging from 71% to 83% in the four conditions. These data show that participants in the four conditions did not differ substantially in terms of age, sex, or ethnicity.

Table 1. *Summary of participant demographics, event description measures, and lineup identification performance, by pose and viewing angle. Brackets contain 95% confidence intervals.*

	Front				Side			
	Eye-level		Overhead		Eye-level		Overhead	
Participant demographics								
n	126		67		73		45	
M age	39.3	[36.0, 42.6]	40.0	[35.7, 44.2]	38.2	[34.3, 42.0]	38.6	[33.4, 43.8]
% female	58	[48, 66]	54	[41, 66]	49	[37, 61]	43	[28, 59]
% White	83	[75, 89]	80	[68, 89]	79	[68, 88]	71	[55, 84]
Event description								
M distance error (ft)	3.7	[.19, 7.2]	6.7	[1.2, 12.2]	3.3	[-1.0, 7.5]	13.4	[6.4, 20.3]
M exposure error (s)	18.4	[14.1, 22.7]	16.7	[10.4, 22.9]	29.1	[21.4, 36.8]	20.6	[12.8, 7.2]
M age error (years)	1.3	[1.0, 1.6]	2.0	[1.5, 2.6]	1.3	[.8, 1.8]	1.7	[1.0, 2.5]
M height error (in.)	-1.9	[-2.3, -1.5]	-2.4	[-2.9, -1.8]	-1.7	[-2.2, -1.1]	-2.1	[-2.8, -1.4]
M weight error (lb.)	-1.7	[-4.3, .8]	-3.7	[-7.9, .5]	-1.1	[-4.2, 2.1]	-1.2	[-6.7, 4.1]
Clear view? (% *yes*)	95	[90, 98]	88	[78, 94]	76	[65, 85]	69	[54, 81]
Recognize? (% *yes*)	94	[89, 97]	94	[85, 98]	93	[85, 97]	100	[91, 100]
Lineup performance								
n	60		33		37		14	
% completion	48	[39, 56]	49	[38, 61]	51	[40, 62]	31	[20, 46]
% correct	58	[46, 70]	55	[38, 70]	57	[41, 71]	70	[48, 85]
M choosing conf.	73	[65, 81]	73	[63, 83]	81	[75, 88]	77	[62, 92]
Sensitivity (*d'*)	2.23	[1.04, 3.43]	2.50	[1.13, 3.87]	1.84	[.87, 2.82]	not computed[a]	
Response bias (*c*)	1.03	[.43, 1.62]	.69	[0, 1.37]	.33	[-.16, .82]	not computed[a]	

Note. % completion = percentage of participants who completed the lineup task; % correct = percentage of responses that were correct (correct identifications or correct rejections); Clear view? = percentage of yes responses to the question, Did you have a clear view of what the person's face looked like?; Recognize? = percentage of yes responses to the question, Do you think that you can recognize a photo of the person?; *M* choosing conf. = mean confidence rating, made using a scale from 0% to 100%, of participants who chose one of the six lineup photos. [a]Due to the small sample size of 14, measures of sensitivity and response bias were not computed for the side-overhead condition.

Viewing Angle x Pose: Target and Event Description Accuracy

Table 1 summarizes, by viewing angle and target pose, how accurately participants described two key aspects of the event they witnessed: how far away the target person was, and how long the target was in view. Participants' estimates of the target's height and weight are also summarized in Table 1, along with whether participants said they had a clear view of the target's face, and whether they believed they would be able to recognize the target from a photo. Nearly all of the participants correctly described the ethnicity and sex of the targets, so those data are not discussed further.

Estimates of target distance . Each participant was asked to estimate the distance to the target person. The actual distance in each case was 30 feet. Eleven participants did not provide an estimate. Estimates ranged from 4 to 500 feet. Seven estimates that were either below 10 or above 100 were removed as outliers. For the remaining participants, the overall mean estimate was about 36 feet ($M = 35.7$, $Mdn = 30$, $SD = 20.0$). Although the mean was only 6 feet too far, many participants gave estimates that were relatively inaccurate—25% of the participants said it was 50 feet or more, while another 30% estimated it was 20 feet or less. For statistical analysis, estimates were converted to error scores by subtracting the actual distance of 30 feet from each estimate (e.g., an estimate of 20 was converted to an error score of -10). Table 1 presents a summary of these error scores. In general, estimates were too large, and the overhead side view produced the largest average error score. The Viewing Angle x Pose ANOVA showed a small main effect for viewing angle, $F(1, 290) = 5.62$, $p = .02$. When the target was viewed from above, the average distance error was greater in comparison to the eye-level condition (9.3 *vs.* 3.5), $d = .28$, 95% CI [.05, .51]. There was little evidence for a main effect of pose ($F = .76$, $p = .38$) or an interaction ($F = 2.00$, $p = .16$), although error scores were slightly higher in the overhead side condition.

Estimates of exposure duration. Participants were also asked to estimate how long the target person had been in view. The actual exposure duration was 12 seconds. Estimates ranged from 3 to 360 seconds. Eight outliers (below 5 or above 120) were omitted from the analysis, and 21 participants did not give an estimate. The remaining estimates had a mean of 36.0 s ($SD = 26.2$, $Mdn = 30$), three times the actual exposure duration. Like the distance estimates, the exposure estimates were converted to error scores by subtracting the actual exposure duration. Reflecting the tendency to overestimate, 24% of participants said the target was in view for at least 1 minute. In general, these data are consistent with previous research, with large individual differences and general overestimation of the length of time the target was in view. The Viewing Angle x Pose ANOVA showed that errors were greater when the target was seen from the side than the front (*M*s = 25.9 & 17.9), $F(1, 278) = 6.81$, $p = .01$, a moderate effect size, $d = .26$, 95% CI [.03, .49]. The effect of viewing angle was negligible ($F = 1.48$, $p = .22$), as was the interaction ($F = 1.06$, $p = .31$).

Estimates of target age, height, and weight. Participants were asked to judge the target person's age, height, and weight. Because there were eight targets, these estimates were converted to error scores by subtracting actual age, height, and weight from the estimates provided by the participants. For age, height, and weight, 8, 15, and 11 participants, respectively, did not provide estimates. Also, three age estimates that were more than 3 *SD* from the mean were omitted as outliers. The remaining estimates are summarized in Table 1.

In general, age estimates were very accurate, being wrong on average by less than two years ($M = 1.54$, $SD = 2.09$, $Mdn = 1.0$). Only 11% of participants provided age estimates that were wrong by 5 years or more. The Viewing Angle x Pose ANOVA uncovered only a small main effect for viewing angle—the mean error in estimated age was larger for participants who saw the target from overhead (1.9) than at eye-level (1.3), $F(1, 296) = 5.71$, $p = .02$, $d = .29$, 95% CI [.05, .53]. The main effect for pose and the interaction were both negligible (Fs < 1). Participants' average weight estimates were fairly accurate, with the overall mean error being about two pounds below the targets' actual weight ($M = -1.9$, $SD = 14.9$, $Mdn = -3.0$). However, 23% of the estimates were wrong by 20 pounds or more. For the weight errors, a Viewing Angle x Pose ANOVA showed no main effects and no interaction (Fs < 1). Estimates of height tended to be low, with the average estimate being 2 inches below actual height ($M = -2.0$, $SD = 2.3$, $Mdn = -2.0$). Participants whose height estimates were wrong by 4 inches or more constituted 35% of the sample. As expected, the overhead view led participants to underestimate height more than from the eye-level view (Ms = -2.3 & -1.8, respectively), but the difference was very small, $F(1, 292) = 2.57$, $p = .11$. There was no main effect for pose and no interaction (Fs < 1).

Clarity of view and predicating recognition. At the end of their initial interview, participants were asked two yes-no questions: (a) Did you have a clear view of what the person's face looked like? and (b) Do you think that you can recognize a photo of the person? These are the types of questions investigators use in actual cases to help them decide if an eyewitness might be able to identify the culprit. Nine participants did not answer the clarity of view question, and 14 did not answer the recognition prediction question. A three-way log-linear analysis (Yes-No x Viewing Angle x Pose) showed that only target pose was associated with participants' answers, $\chi^2(1) = 19.7$, $p < .001$. As expected, participants were more likely to say they had a clear view when the target was seen from the front (93%) than when seen from the side (74%), $d = .82$, 95% CI [.44, 1.20]. For the recognition prediction question, the log-linear analysis showed the differences between groups to be small, as 93 to 100 percent of participants in each condition said they could recognize a photo of the target person. Contrary to expectations, participants in the overhead and side view conditions were very likely to predict that they could recognize the target. This is an interesting result given that 26% of participants who saw the target from the side said they *did not* have a clear view of the target's face. In fact, of the 42 participants who said they did not get a clear view of the target's face, 37 (88%) still predicted that they could recognize the target, reflecting participants' high degree of confidence in their face recognition abilities.

Viewing Angle x Pose: Lineup Identification Accuracy

The lower portion of Table 1 presents a summary of lineup responses, including the proportion of participants who completed the lineup task, and measures of lineup performance.

Retention interval and lineup completion. Out of 311 participants, 144 (46%) submitted responses to the lineup. On average, participants who viewed the lineup did so about 5 days after seeing the target person ($M = 4.8$, $SD = 2.9$, $Mdn = 4$), and 85% responded within 7 days. The average retention intervals in the four conditions were very similar (all Ms between 4.6 and 5.5 days), and a Viewing Angle x Pose ANOVA showed all differences to be negligible (Fs < 1). Retention intervals of 2 to 7 days are realistic—actual eyewitnesses may see a lineup within a few days of the crime (Flowe, Mehta, & Ebbesen, 2011), although there can be an interval of several weeks or more (Horry, Memon, Wright, & Milne, 2012). A three-way log-linear analysis (Viewing Angle x Pose x Lineup Completion) showed that there were no important differences in the proportion of participants who completed the lineup task (all *p*s > .10). The lowest lineup completion rate was in the overhead side condition (31%), although the comparison with the eye-level front condition (48%) showed that the effect size was small, $\chi^2(1) = 3.04$, $p = .08$, $r = .15$, 95% CI [.00, .29].

Lineup performance measures. A basic measure of lineup performance is the overall percentage of correct responses—a combination of correct identifications from target-present lineups and correct rejections of target-absent lineups. Across all participants, 59% of lineup responses were correct, 53% correct for target-absent lineups and 67% correct for target-present lineups. A three-way log-linear analysis revealed no important differences among the four conditions (*p*s > .21).

As additional measures of lineup performance, the signal detection measures of sensitivity (*d'*) and response bias (*c*) were computed (cf. Mickes, Moreland, Clark, & Wixted, 2014). Based on the correct identification rate and the false identification rate, *d'* is a measure of how well participants discriminate targets from fillers, with higher values indicating greater discriminability. Response bias (*c*) indicates participants' tendency to identify the suspect as the target—values above 0 indicate a tendency toward conservative responding (i.e., deciding the suspect is not the target). Because participants responded to only one lineup, a separate *d'* and *c* cannot be computed for each participant. Instead, *d'* and *c* are computed at the group level. Also, because only 14 participants who had the overhead side view completed the lineup task, *d'* and *c* were not calculated for that condition. As a result, ANOVA could not be used to compare group performance—instead, a procedure described by Gourevitch & Galanter (1967) was used to make paired comparisons of *d'* and *c* among the three groups (Kaplan, 2009; MacMillan & Creelman, 2005).

Across all participants, the correct identification rate was .67, while the false identification rate was very low at .03. These values result in an overall *d'* of 2.38, 95% CI [1.71, 3.05]. The overall response criterion was somewhat conservative, $c = .76$, 95% CI [.43, 1.09]. Comparing conditions, the largest difference for sensitivity (*d'*) was between the overhead front view and the eye-level side view (2.50 *vs.* 1.84), but that difference was very small, $Z = .77$, $p = .44$. For response criterion (*c*), the largest difference was between the eye-level side and eye-level front views (1.03 *vs.* .33), but the difference was quite small, $Z = 1.77$, $p = .08$.

Table 1 also shows the mean confidence rating of participants who selected a photo from the lineup. The mean ratings of the four conditions were very similar. The main effect for viewing angle, and the pose by viewing angle interaction, were negligible (*p*s > .60). Thus, although participants with an overhead view were less likely to do the lineup task, those that did were just as confident in their responses as participants who saw the target at eye-level.

Participant confidence may also be reflected in *not sure* lineup responses. Lindsay et al. (2008) hypothesized that witnesses may be more likely to answer *not sure* as the distance between the target and the witness increases. Extending this idea to the current study, *not sure* responses may be more likely when the target is seen from an overhead viewing angle or in a side pose. However, the proportion of *not sure* responses varied little with viewing conditions (between 7% & 15% in all four condition), and a three-way log-linear analysis (Viewing Angle x Pose x Lineup Response) showed that all effects were negligible.

Table 2 summarizes the number and percentage of each type lineup response, by pose, viewing angle, and lineup type. Identification of an innocent suspect is generally considered to be the most serious type of error that can occur during a lineup procedure (identification of a filler is known to be an error). In general, suspect identifications were very accurate in all conditions. As the top row of Table 2 shows, only two participants identified an innocent suspect, and both were in the eye-level/side pose condition.

Table 2. *Number and percentage of lineup identification responses by pose, viewing angle, and lineup type*

	Front				Side			
	Eye-level		Overhead		Eye-level		Overhead	
	TA	TP	TA	TP	TA	TP	TA	TP
n suspect selection	0	15	0	10	2	13	0	6
n filler selection	12	3	11	1	9	0	3	0
n non-identification	14	7	5	1	5	5	4	0
n no decision	6	3	3	2	3	0	1	0
Total *n*	32	28	19	14	19	18	8	6
% suspect selection	0	54	0	71	11	72	0	100
% filler selection	38	11	58	7	47	0	38	0
% non-identification	44	25	26	7	26	28	50	0
% no decision	19	11	16	14	16	0	13	0

Note: TA: target absent lineup. TP: target present lineup

These data show that, although the lowest lineup completion rate was in the overhead side condition, rates were similar among the four viewing conditions. In terms of overall performance, 41% of the participants who chose to do the lineup task provided an incorrect response, although overall sensitivity was fairly good ($d' = 2.38$). The findings also indicate that the differences in the tested viewing angles and poses had little or no relationship to lineup performance—this conclusion, however, must be tempered by the fact that about half of the participants overall did not complete the lineup task.

Age Group Demographics

To examine age differences, participants were divided into three age groups of approximately equal size: younger than 25, 25 to 49, and 50 or older. This analysis involves 303 participants, because eight did not report their age. The top portion of Table 3 contains a summary of age group demographics. The percentage of female participants was somewhat lower in the youngest age group, although a chi-square test of independence revealed that the association was rather small, $\chi^2(2) = 5.44$, $p = .07$, $r = -.09$, 95% CI [–.20, .02]. For ethnicity, the 50+ group had a somewhat higher proportion of White participants compared to the other two groups, $\chi^2(2) = 4.39$, $p = .11$, $r = -.12$, 95% CI [–.23, .01]. These data indicate that, in terms of sex and ethnicity, the three age groups were fairly similar.

Age group comparisons: Target and Event description accuracy

Table 3 also summarizes each dependent measure by age group. For continuous measures (exposure time, target distance, age, height, weight), a one-way ANOVA was conducted to compare scores in the three groups. There was a small effect for the estimated age of the target, $F(1, 295) = 13.23$, $p < .001$, $\eta^2 = .04$, as the two older age groups overestimated the target's age about 1 year more than did the under-25 age group. Also, the oldest group of participants overestimated exposure duration more than the two younger groups, but again the difference was very small, $F(1, 277) = 2.18$, $p = .14$, $\eta^2 = .008$. For estimated distance, height, and weight, the differences between the age groups were negligible (Fs < 1, ps > .30). Chi-square tests of independence were conducted to compare the proportion of participants in each age group who answered *yes* to the view clarity and recognition prediction questions. As reflected in the small effect sizes listed in Table 3, the responses of the three age groups were very similar for both questions ($\chi^2 < 1.94$, ps > .37). These data indicate that older participants were nearly as accurate as younger participants at reporting basic information about the event they witnessed [3]. Like younger participants, older participants were very confident in their ability to recognize the target person.

Age group comparisons: Lineup identification accuracy

As shown in Table 3, a similar percentage of participants in each age group completed the lineup task. The percentage of correct responses (correct identifications and correct rejections) in the three age groups ranged from 55% to 64%. The oldest group of participants was the least likely to make a correct lineup decision, but the differences were very small. Mean confidence ratings in the three age groups were also very similar. As Table 3 shows, *d'* was lowest in the oldest age group, but again it was a small difference. Paired comparisons between age groups showed only negligible differences—the largest difference was between the 25-49 age group and the 50+ group, $Z = .48$, $p = .63$, 95% CI [-1.23, 2.03]. A similar result occurred for response bias (*c*), where paired comparisons showed that even the largest difference (<25 *vs.* 25-49) was relatively small, $Z = .66$, $p = .51$, 95% CI [-.54, 1.10].

Table 3. *Summary of participant demographics, event description measures, and lineup identification performance, by age group. Brackets contain 95% confidence intervals.*

	Age Group							
	< 25		25-49		50+		Effect size	
Participant demographics								
n	99		109		95			
M age	20.7	[20.3, 21.1]	37.1	[35.5, 38.7]	60.5	[58.7, 62.3]		
% female	43	[33, 53]	59	[49, 68]	54	[44, 64]		
% White	76	[66, 83]	78	[69, 85]	88	[80, 94]		
Event description								
Distance error (ft)	3.2	[-.5, 6.9]	8.4	[3.9, 12.7]	5.0	[1.1, 8.8]	$\eta^2 = .001$	[0, .02]
Exposure error (s)	19.4	[14.6, 24.3]	18.5	[13.5, 23.5]	24.8	[18.8, 30.8]	$\eta^2 = .008$	[0, .041]
Age error (years)	.8	[.5, 1.1]	2.0	[1.6, 2.4]	1.9	[1.4, 2.3]	$\eta^2 = .043$	[.01, .09]
Height error (in.)	-1.7	[-2.1, -1.2]	-2.3	[-2.7, -1.8]	-1.9	[-2.3, -1.4]	$\eta^2 = .001$	[0, .021]
Weight error (lb)	-1.4	[-4.6, 1.7]	-0.6	[-3.7, 2.4]	-3.5	[-6.3, -.8]	$\eta^2 = .003$	[0, .028]
Clear view? (% *yes*)	87	[79, 92]	82	[74, 88]	87	[79, 92]	$r = .003$	[-.11, .12]
Recognize? (% *yes*)	96	[90, 98]	96	[91, 99]	92	[85, 96]	$r = -.066$	[-.18, .05]
Lineup performance								
n	47		47		47			
% completion	.47	[.38, .57]	.43	[.34, .52]	.49	[.40, .59]	$r = .015$	[-.10, .13]
% correct	.57	[.43, .70]	.64	[.50, .76]	.55	[.41, .69]	$r = -.018$	[-.18, .15]
M choosing conf.	74	[66, 81]	76	[68, 84]	77	[69, 84]	$\eta^2 = .003$	[0, .054]
Sensitivity (*d'*)	2.36	[1.30, 3.41]	2.47	[1.22, 3.73]	2.07	[1.03, 3.11]	not computed[a]	
Response bias (*c*)	.57	[.05, 1.10]	.85	[.22, 1.48]	.73	[.21, 1.25]	not computed	

Note. % completion = percentage of participants who completed the lineup task; % correct = percentage of responses that were correct; Clear view? = Percentage of yes responses to the question, Did you have a clear view of what the person's face looked like?; Recognize? = Percentage of yes responses to the question, Do you think that you can recognize a photo of the person?; *M* choosing conf. = Mean confidence rating, made using a scale from 0% to 100%, of participants who chose one of the six lineup photos.
[a]Effect sizes were not computed for *d'* and *c* because the three age groups were compared using paired comparisons.

Table 4 summarizes lineup responses for each age group. As noted above, there were only two identifications of innocent suspects, one in the under-25 age group, and one in the 50+ age group. In sum, although the oldest group of participants had the lowest proportion of correct responses and the lowest *d'*, the association between age and lineup identification accuracy was negligible. Confidence ratings and decision criterion were also essentially unrelated to participant age.

Table 4. *Number and percentage of lineup identification responses by age group and lineup type*

	Age Group					
	< 25		25-49		50+	
	TA	TP	TA	TP	TA	TP
n suspect selection	1	16	0	13	1	13
n filler selection	13	2	10	0	12	2
n non-identification	9	3	11	6	8	3
n no decision	2	1	6	1	5	3
Total *n*	25	22	27	20	26	21
% suspect selection	4	73	0	65	4	62
% filler selection	52	9	37	0	46	10
% non-identification	36	14	41	30	31	14
% no decision	8	5	22	5	19	14

Note: TA: target absent lineup. TP: target present lineup

DISCUSSION

The current study was conducted to assess the extent to which changes in viewing angle and target pose might be associated with eyewitness accuracy for a live event in a field setting. Another main objective was to examine the relationship between the age of eyewitnesses and the accuracy of their reports. The major limitation of the study is that, due to its quasi-experimental nature, the findings do not permit causal inferences, and must instead be viewed as exploratory and correlational.

In general, event description accuracy and lineup accuracy were only weakly related to the different poses and viewing angles used in this experiment. The overhead view was associated with somewhat greater estimates of the distance to the target, as well as slightly higher estimates of the target's age, and errors in estimates of exposure time were larger when the target was seen in profile. Consistent with prior studies, estimates of exposure duration tended to be much too long. Contrary to prior research (e.g., Wiest & Bell, 1985), participants tended to overestimate rather than underestimate the 30-foot distance to the target. Although the overall mean estimate was very accurate (and the median estimate equalled the actual 30 foot distance), individual estimates were highly variable, with one in four participants overestimating the distance by 20 feet or more. These data are similar to those reported by Lindsay et al. (2008) for directly perceived distances of approximately 30 feet. As Lindsay et al. suggest, these findings indicate that courts should view an eyewitness's distance estimate with skepticism and seek corroborating evidence. This recommendation also applies to duration estimates.

Regarding participants' identification predictions, although participants were less likely to say they had a clear view of the target's face when it was seen from the side, most remained confident in their ability to recognize a photo of the target. The probability that a participant would follow through and complete the lineup task was not strongly related to viewing conditions—participants in the poorest viewing condition (overhead view, side pose) were only slightly less likely to complete the lineup task than participants in the best viewing condition (eye-level, front).

For those participants who completed the lineup task, changes in target pose and viewing angle were essentially unrelated to performance. This result was not expected because the side pose and overhead view provide less information about the target's appearance. Also, the lineup photos presented a front eye-level view of the target. Apparently, some participants who had a poorer view were still able to encode enough information about the target to perform as well on the lineup task as other participants.

The present study also found that participants were, as a group, overconfident in their ability to identify the target—94% of those who did the lineup task predicted that they could recognize the target, but only 59% of the lineup responses were correct. This finding is consistent with another field study (Cowan, Read, & Lindsay, 2014), which also found that participants' predictions of how well they would do on a lineup identification task were overly optimistic.

Regarding age differences, the accuracy of participants in the three age groups was similar for basic information about the witnessed event, although the youngest age group was slightly more accurate at estimating the target's age. Lineup performance was also very similar across the three age groups. These findings are similar to those reported in some prior field studies (Lindsey et al., 2008; Yarmey, 1993; Yarmey & Yarmey, 1997), in that age differences on some measures were absent or very small. The results are also consistent with those reported by Key et al. (2015), as lineup identification accuracy was similar for the three age groups. On the other hand, for the lineup task the general performance trend was consistent with prior studies (Fitzgerald & Price, 2015), with sensitivity (*d'*) and proportion correct being lowest among the oldest participants. However, the differences obtained in the current study were relatively small, and participants in all three age groups provided accurate information that would be useful to investigators of actual cases.

In conclusion, the different poses and viewing angles investigated in the present study were associated with how accurately participants described some aspects of the target and the witnessed event, although the effect sizes were relatively small. Description accuracy was very similar across the three age groups, and estimates of the distance to the target and exposure duration varied widely from participant to participant. One important result was that a substantial proportion of participants gave incorrect responses on the lineup task, despite the vast majority of them predicting they could recognize the target. It may be that eyewitnesses are unable, except perhaps in extreme cases, to use viewing conditions to predict performance on identification tests. Prior studies (e.g., Sauerland & Sporer, 2009) have found that confidence in the ability to identify a target is a poor predictor of actual lineup performance. Such findings are consistent with the opinion of Cutler and Penrod (1989), who concluded in their meta-analysis that "pre-lineup confidence, or confidence in the ability to identify a perpetrator, should not be considered in determining whether or not to subject a witness to a lineup test" (p. 652). The other main finding from the lineup task was that the accuracy of the oldest group of participants was somewhat lower, yet still similar to, that of younger participants. This outcome is in line with several prior studies (Key et al., 2015; Yarmey, 1993) which show that many older adults are capable of supplying accurate and useful eyewitness information. However, because relatively few studies with older adults have been conducted (especially field studies), additional research is needed to more firmly establish how variations in viewing conditions influence the accuracy of information provided by eyewitnesses of all ages.

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ENDNOTES

1. Based on a survey of American prosecutors, Goldstein, Chance, and Schneller (1989) estimated that eyewitness identification was the primary evidence against the suspect in 3% of the 2.58 million felony arrests in 1986, or about 77,400 total cases. Applying that 3% estimate to FBI crime statistics (1.8 million arrests for "Part I" offenses), the estimated number of such cases in the U.S. was approximately 54,000 in 2017.

2. Borrowing from aviation terminology (pitch, yaw, roll), vertical viewing angle is sometimes referred to as pitch. Pose refers to variations in the horizontal viewing angle from which a face is observed. The term pose is used in the current study to be consistent with previous face memory research on this variable (e.g., Lindsay et al., 2011; Shapiro & Penrod, 1986).

3. Instead of dividing participants into age groups, an alternate approach is to correlate participant age with the various event description outcome measures. This analysis produced the same pattern of results as the age group analysis. The Bayes factors reported below (Ly, Verhagen, & Wagenmakers, 2016) were computed using the "Summary Stats" module in JASP (JASP Team, 2018). There was a small positive association between participant age and errors in estimates of the target's age, $r(295) = .16$, $p = .006$, 95% CI [0.05, .27], $BF_{10} = 3.2$. Participant age was also weakly correlated with errors in exposure duration estimates, $r(277) = .11$, $p = .07$, 95% CI [-0.01, 0.22], $BF_{10} = 0.4$. The correlations for the other three measures were all very low: distance error ($r = .07$, $BF_{10} = 0.15$), height error ($r = .01$, $BF_{10} = .08$), weight error ($r = -.04$, $BF_{10} = 0.09$).

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