A DISTINCTIVENESS-DRIVEN REVERSAL OF THE WEAPON-FOCUS EFFECT

Curt A. Carlson and Maria A. Carlson
Texas A&M University – Commerce

The presence of a weapon during a crime can reduce the accuracy of eyewitness identification, known as the Weapon-Focus Effect (WFE). We hypothesized that the effect could be eliminated if the perpetrator has a distinctive feature on the face, based on research from the face processing literature. Participants (*N* = 600) watched a mock crime video from a first-person point-of-view in which a perpetrator appeared to assault them with either his fists or a beer bottle, or by pointing a shotgun at them. The perpetrator either had a distinctive feature (a large sports sticker) added to his face or not. After a few minutes spent on a distractor task, participants made an identification decision from a perpetrator-present or –absent simultaneous lineup. Overall, the probative value of a suspect identification was worst when the shotgun was present (replicating the WFE), but only if there was no distinctive feature. Adding the distinctive feature to the perpetrator's face reversed the WFE, both by increasing correct identification rate and decreasing false identification rate when the shotgun was present. This condition also yielded the highest confidence-accuracy correlation. We conclude with a discussion of the importance of perpetrator distinctiveness as an estimator variable in eyewitness identification research.

Keywords: eyewitness identification, weapon focus, distinctiveness, distinctive feature

Eyewitnesses often report that their attention frequently was drawn to a weapon if the perpetrator was holding one, particularly if it was being pointed at them. Several studies have provided evidence to support these anecdotes (e.g., Loftus, Loftus, & Messo, 1987; Saunders, 2009), identifying a weapon focus effect (WFE) signified by diminished processing of contextual details because of attention drawn to a weapon (see Fawcett, Russell, Peace, & Christie, 2011). This results in: (a) lower accuracy in recalling or recognizing contextual details, and, less typically, (b) worse eyewitness identification performance tested by a lineup. We focused on the latter finding, which, though not consistently found (e.g., Hulse & Memon, 2006; Kramer, Buckhout, & Eugenio, 1990; Pickel, 1998), has been shown via meta-analysis to have a small-to-moderate effect size (Fawcett et al., 2011; Steblay, 1992).

Much of the literature has focused on identifying the underlying theoretical causes of the narrowing of attention on the weapon, at first pointing toward arousal or stress (Easterbrook, 1959) and more recently switching to novelty or context irrelevance of the

Author Note: Curt A. Carlson (contact author) & Maria A. Carlson, Department of Psychology, Counseling, & Special Education, Texas A&M University – Commerce, Commerce, TX 75429, Phone: 903-468-8723, Fax: 903-886-5510, Email: curt.carlson@tamuc.edu

object, be it a weapon or not (e.g., Hope & Wright, 2007; Pickel, 1998, 1999). One aspect of this newer research is that it identified conditions in which the WFE is absent, such as when a weapon is expected (e.g., at a shooting range, Pickel, 1999). We conducted a novel study that continues in this vein, but from a different theoretical perspective. We hypothesized that if there is something particularly distinctive about the perpetrator's face, this could eliminate the WFE. Before describing this study, we first will provide some brief background of the WFE, followed by a discussion of perpetrator distinctiveness as an important variable in the field of eyewitness identification.

The Weapon Focus Effect

Two meta-analyses of the WFE concluded that it is of moderate size for contextual detail memory, and of smaller size in its effect on eyewitness identification from a lineup (Fawcett et al., 2011; Steblay, 1992). Because our focus in the present study is on eyewitness identification, we only will describe studies that included a lineup as a test of recognition memory for the perpetrator's face. We found 13 such studies (Cutler & Penrod, 1988; Cutler, Penrod, & Martens, 1987a, b; Cutler, Penrod, O'Rourke, & Martens, 1986; Hulse & Memon, 2006; Kleider & Goldinger, 2001; Kramer et al., 1990; Loftus et al., 1987; Maass & Kohnken, 1989; O'Rourke, Penrod, Cutler, & Stuve, 1989; Pickel, 1998, 1999; Shaw & Skolnick, 1994). For example, Loftus et al. (1987) had participants view a slide sequence depicting a customer walking up to a cashier in a fast-food restaurant. In the critical set of four slides, the customer either hands the cashier a check or "pulls a gun" on the cashier (p. 57). Participants eventually viewed a 12-person perpetrator-present lineup, resulting in marginally more correct identifications of the perpetrator by those in the check condition than in the gun condition. This marginal effect likely was due to low sample size ($N = 36$), but Loftus et al. found a significant WFE on correct identification rate in their second experiment with more participants ($N = 80$).

Further research continued to explore the WFE, but we found only five studies (Cutler & Penrod, 1988; Cutler et al., 1987a, b; Cutler et al., 1986; O'Rourke et al., 1989) using both a perpetrator-present and a perpetrator-absent lineup (tested between-participants). If only one type of lineup is presented, for instance a perpetrator-present lineup, and if the resultant correct identification rate is affected by the presence of a weapon during the crime, this could be due to the weapon's influence on actual eyewitness accuracy or just a criterion shift. For example, the presence of a weapon could make eyewitnesses simply less likely to choose from a lineup, perhaps because they know that they did not get a good look at the perpetrator due to their attention focused on the weapon. It is only when combining correct identification rate from perpetrator-present lineups with false identification rate (of an innocent suspect) from perpetrator-absent lineups into an overall diagnosticity measure that a mere criterion shift can be ruled out. We took this approach in the present study.

Another aspect of the present study was to utilize a realistic-looking mock-crime video rather than a slide sequence in order to increase external validity, following O'Rourke et al. (1989). They expanded the WFE in at least two other important ways: (a) they generalized it across a wider age range (18-74), and (b) they explored potential interactions across a number of variables, such as perpetrator disguise and lineup instructions. Their mock-crime video featured a store clerk robbed by a man with a handgun. Participants in the handgun condition had lower overall identification accuracy (correct and false identification rate combined) than those who did not see the handgun.

More recent research on the WFE has found an interaction with the misinformation effect (Saunders, 2009), generalized it to children (Davies, Smith, & Blincoe, 2008; Pickel, Narter, Jameson, & Lenhardt, 2008), and further explored Pickel's (1998) "unusualness hypothesis" that states that it is not the arousing nature of a weapon that causes the WFE, but rather the attention-grabbing nature of any particularly unusual object in a certain context (e.g., Hope & Wright, 2007; Pickel, 2009). Our goal was not to continue with these lines of research, but rather to set up a scenario that likely would replicate the WFE, and assess a potential interaction with perpetrator distinctiveness that we hypothesized would eliminate it.

Perpetrator Distinctiveness

Wells (1978) categorized factors important to eyewitness identification as either system or estimator variables. System variables are those that the criminal justice system can manipulate after a crime has occurred, with the goal of increasing the reliability of eyewitness identification decisions. Examples of such variables are how the eyewitness is interviewed after the crime, instructions prior to the lineup, whether or not the lineup administrator is aware of which member is the suspect, and how the lineup is conducted (e.g., simultaneous or sequential presentation of members). System variables have received the bulk of attention in the extant literature, and for good reason. However, a relative dearth of research has focused on "estimator" variables that only can be estimated by those in the criminal justice system post hoc. Examples of such variables include the conditions during the crime (e.g., amount of light, presence of a weapon), characteristics of the eyewitness (e.g., poor eyesight), and characteristics of the perpetrator (e.g., race, gender).

One estimator variable in particular that has received very little attention until recently is perpetrator distinctiveness (Carlson, 2011; Carlson & Gronlund, 2011). Distinctive people are remembered better than nondistinctive people (e.g., Cutler & Penrod, 1995; Shapiro & Penrod, 1986), a finding that Carlson and Gronlund applied to eyewitness identification. They found an interaction between holistic ratings of perpetrator distinctiveness and the likelihood of a sequential lineup advantage (e.g., Lindsay & Wells, 1985). This advantage was found only when there was evidence that participants used recollection to recall a distinctive perpetrator, and used that information to correctly reject a perpetrator-absent lineup. This resulted in a reduction in the false identification rate, which increased overall eyewitness identification accuracy. Following up from this study, Carlson (2011) manipulated the presence of a distinctive facial feature (either a scar, mole, or black eye) on faces previously rated as holistically distinctive or nondistinctive. He provided further support for the importance of perpetrator distinctiveness, and the rare nature of the sequential lineup advantage (see Carlson, Gronlund, & Clark, 2008; Gronlund, Carlson, Dailey, & Goodsell, 2009; Gronlund et al., under review), by finding the advantage only when the perpetrator had a distinctive facial feature.

Kleider and Goldinger (2001) also conducted a study involving distinctiveness of a target individual, focusing on the race (African-American) of the target in the context of two people of either the same or another race (Caucasian). They expected that the distinctiveness of the target would draw attention away from the contextual individuals, making recognition memory for these latter individuals worse. They drew a parallel with the weapon focus literature, arguing that a distinctive individual could draw attention away from contextual details in a similar fashion as a weapon during a crime. Their results pointed not toward a general distinctiveness effect, but rather a racial distinctiveness effect. They found evidence for attention drawn differentially toward the African-American target if in the presence of Caucasian rather than African-American confederates, and this led to worse lineup performance when attempting to identify the Caucasian individuals. However, in one experiment the target was a Caucasian individual with distinctive red hair. Lineup performance in this case did not differ from control (a Caucasian individual with nondistinctive hair). Kleider and Goldinger did not present a weapon in any of their experiments to assess a potential interaction between target distinctiveness and the WFE. Essentially, this was our goal.

The Present Study

The facial distinctiveness literature informs us that attention will be drawn to a distinctive person (Ryu & Chaudhuri, 2007), but the weapon-focus literature usually finds evidence that attention is drawn to a weapon if it is clearly visible. We hypothesized that the WFE will be attenuated (if not eliminated entirely) if a distinctive feature is added to a perpetrator's face. Kleider and Goldinger (2001) pointed toward target race (standing out from a context of members of another race; see Hunt, 2003, for a definition of distinctiveness involving a target standing out from context) as the locus of their findings. They did not find an effect for distinctive target hair, but the present study involved a distinctive feature on the perpetrator's face, rather than his hair. Attention tends to be drawn to the external features of unfamiliar faces (e.g., Ellis, Shepherd, & Davies, 1979; Young, Hay, McWeeny, & Flude, 1985), so it might not come as a surprise that changing hair color would not have as powerful of an effect on attention (because attention already was differentially focused on the hair and other external features). By drawing attention to the unfamiliar perpetrator's face rather than exterior features, we expected that the weapon would not draw as much attention, with the ultimate result of an attenuated or even eliminated WFE. To address the issue of schema consistency (e.g., Loftus & Mackworth, 1978; Pickel, 1999), we included two weapon conditions: (a) schema-inconsistent (shotgun), and (b) schema-consistent (beer bottle).

METHOD

Participants

Six hundred undergraduates enrolled in psychology courses at one of two Midwestern U.S. universities participated in the present experiment for course credit. Though no demographic information was taken, the participant pool overall contained mostly Caucasians in their late teens or early 20s, and between 60-70% were female.

Materials/Stimuli

The first author recorded the mock-crime video with a handheld camcorder. It begins showing a blank television screen on a wall along with miscellaneous media equipment, as if seen from a person seated on a couch a few feet across the room. The first person point-of-view (POV) then stands up, turns about 45 degrees to the right and walks out of the room through a door a few feet away. The POV then walks across another room for about 10 feet, past a set of stairs (on his left, going down to the first floor of the house), turns 90 degrees to the left and enters a hallway. At the end of the hallway, about 10 feet away, a man can be seen leaning against a railing on the POV's right-hand side of the hallway (revealing only the right profile of the man's body). He is shown either: (a) drinking from a beer bottle, (b) with his arms hanging over something on his shoulders (a shotgun, but this cannot be determined from the initial distance), or (c) with nothing, just leaning with his hands on the railing. The man's face cannot be seen clearly at this point, but as the POV approaches within seven feet of the man, he turns to face the POV, approaches quickly, and either appears to: (a) hit the POV with his fists, (b) hit the POV with the beer bottle held in his right hand (see Kramer et al., 1990, Experiment 1), or (c) point the shotgun at the POV. In one version of each video, the perpetrator has no distinctive feature on his face, and in the other, a large black letter "N" (representing a sports team) that stretches across his entire right cheek. In all conditions, the perpetrator is seen for about eight seconds, including two to three seconds for the assault. Previous research has found a WFE with such short weapon/perpetrator exposure (Fawcett et al., 2011). After the assault, the POV turns around 180 degrees, runs about five feet, turns around the corner to his right and goes down the stairs to the first floor. At the base of the stairs, the POV turns 90 degrees to the right and exits through the front door of the house about 15 feet away. At this point, the video ends.

We took a "mug shot" of the perpetrator (without the added feature) a few days after the mock-crime was recorded. His clothes were different and his hair had grown slightly compared to how he looked in the video. Before selecting mug shots of foils to accompany this photo in our lineups, we first wrote a basic description of the perpetrator similar to what an eyewitness could produce after a crime (Caucasian male, late 20s or early 30s, about 6' tall, 215-240lbs, slightly balding with very short light-colored hair). Two research assistants independently searched the Florida Department of Corrections Inmate Database for faces that matched this description, and we narrowed down to those that best looked like the perpetrator. Five of these mug shots were presented as foils in a perpetrator-present lineup, and another six were presented in the perpetrator-absent lineup. In other words, we chose foils that both matched the description and matched the perpetrator's face in order to create fair lineups. Finally, a group of 20 participants watched the mock-crime video, worked on a word-search puzzle for five minutes, then viewed the perpetrator-absent lineup. They were told to choose who they thought was the perpetrator (they had to choose). The face selected most often became our designated innocent suspect.

In the experiment, each participant viewed one of four different types of lineup: (a) perpetrator-present with no lineup member having the distinctive feature on his face (because the perpetrator had no feature in their video condition), (b) perpetrator-absent lineup with no one having the distinctive feature, (c) perpetrator-present with all lineup members having the same distinctive feature (the large black letter “N”) on their right cheek just as the perpetrator had on his right cheek in the video, or (d) a perpetrator-absent lineup with all members having this feature. In other words, if the perpetrator had the distinctive feature in the mock-crime, we replicated it across all lineup members (rather than removing or concealing it), based on recent research indicating that replication improves eyewitness identification performance over concealment (Zarkadi, Wade, & Stewart, 2009). The feature was Photoshopped onto the perpetrator’s mug shot just like it was for all foils so that the perpetrator would not stand out of the lineup (as perhaps he would if we simply used a mug shot of him with the feature already on his face). Finally, we collected all data with the E-prime program (Schneider, Eschman, & Zuccolotto, 2002).

Procedure

Each session involved one participant or a small group of two to four participants. After random assignment of each participant to one of the experimental conditions, an experimenter seated them each in a cubicle with desk and computer. After signing an informed consent, the experimenter read the brief instructions to them while they read along on their computer screen:

> This is a brief experiment that has you take part as an eyewitness to a crime. In a moment, you will see a video from a first-person point of view. In other words, you should watch the video as if you are the person experiencing what is happening. It only lasts a few seconds, so you must pay very close attention to what happens. There will be no audio in the video.
>
> The video was shot last winter break. Imagine that you were at a friend’s house watching a football game. Your team won, but there were also people there who were rooting for the other team. The video will start with you looking at the TV after it was turned off after the game ended. You are very happy about your team’s win, and decide to walk out of the room and taunt a guy who was there rooting for the other team.

After asking for any questions, the video started automatically on each participant’s computer screen, and lasted 30 seconds in each condition. No audio was played with the video. After the video, a screen instructed participants to work on the word-search puzzle on their desk until a red screen appeared to tell them to stop. Participants worked on the word-search puzzle for five minutes then returned their attention to the computer screen for the lineup instructions, which read:

> In a moment, you will be presented with a lineup containing six men. The perpetrator from the video may or may not be present. Take as much time as you need to decide whether or not to choose someone if you think he is the perpetrator. Enter the number (1-6) of the person who you think is the perpetrator, or, if you do not think he is present, enter ‘n’ for ‘none of the above.’

They then viewed a simultaneous lineup (perpetrator-present or perpetrator-absent) with two rows of three faces each. After their decision, they indicated their confidence on a 1-7 Likert-type scale (1 = Not at all confident, 7 = Extremely confident). Finally, they read a debriefing screen and left. All participants finished the experiment in less than 20 minutes.

Design

This experiment featured a 3 (no weapon, beer bottle, or shotgun) x 2 (distinctive feature or not) x 2 (perpetrator-present or perpetrator-absent lineup) factorial design. There were 50 participants in each cell of the design.

RESULTS AND DISCUSSION

Correct and False Identification Rates

The three measures of interest were correct identification rate (CIDR) for the perpetrator, false identification rate (FIDR) for the designated innocent suspect, and an overall accuracy measure, probative value (PV), defined as the conditional probability: CIDR/(CIDR + FIDR) (e.g., Carlson & Gronlund, 2011; Clark, Howell, & Davey, 2008). All reported *p*-values are two-tailed. We begin with a description of the CIDR results (Figure 1). A logistic regression analysis was conducted to predict CIDR using type of weapon, presence of the distinctive feature, and the interaction of these two variables as predictors. A test of the full model against a model containing only the constant was statistically significant, indicating that the predictors, as a set, reliably distinguished between correct identifications and misses, χ^2 (5, N = 300) = 15.37, p = .009 (see Table 1 for model coefficients and test statistics). There was an effect of the weapon condition, χ^2(1, N = 300) = 6.15, p = .046; feature condition, χ^2(1, N = 300) = 6.89, p = .008; and an interaction between the two, χ^2(1, N = 300) = 11.64, p = .003. When no distinctive feature was present, the shotgun condition produced lower CIDR than the beer bottle condition, χ^2(1, N = 100) = 6.00, p = .01, but there was no difference between the no weapon condition and either shotgun or beer bottle condition (see Kramer et al., 1990). Adding the distinctive feature to the perpetrator's face reversed the WFE found for the shotgun condition, χ^2(1, N = 100) = 4.24, p = .04. Interestingly, adding the feature had the opposite effect on the beer bottle condition, reducing CIDR, χ^2(1, N = 100) = 7.10, p = .01. The feature had no effect when neither shotgun nor beer bottle were present.

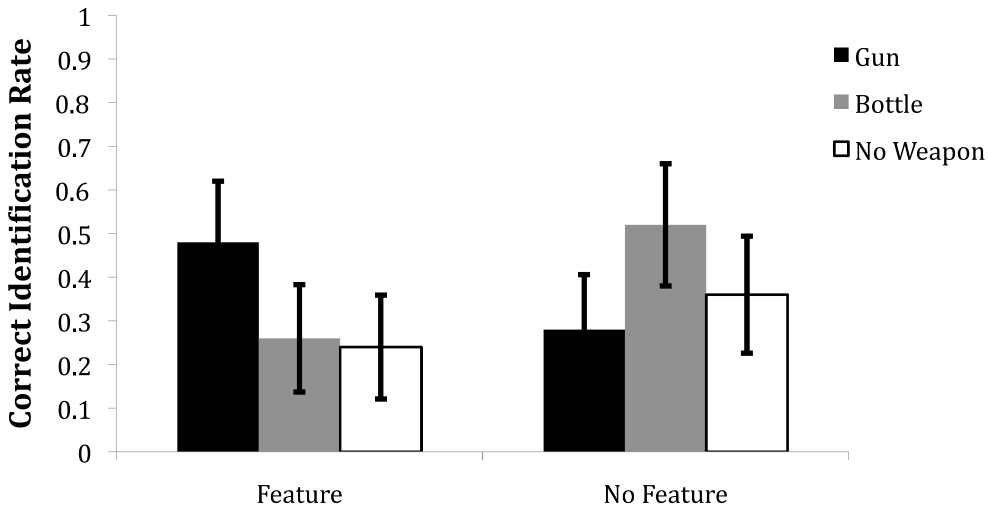

***Figure 1*. Correct identification rate with bars representing 95% confidence intervals.**

Table 1
Logistic Coefficients for Qualitative Predictors of Correct Identification Rate (CIDR)

Predictor	Logistic Coefficient	Chi-Square	*p* value
Feature	-1.13	6.89	.008
Gun	-1.02	5.85	.015
No Weapon	-0.66	2.57	.108
Feature * Gun	1.99	10.90	.001
Feature * No Weapon	0.55	0.79	.374
Intercept	0.08	0.08	.777

Note: Beer Bottle condition not referenced because used as constant.

A separate logistic regression model for FIDR was statistically significant, indicating that the predictors, as a set, reliably distinguished between false identifications (of the innocent suspect) and all other decisions, χ^2 (5, N = 300) = 13.31, p = .02 (see Table 2 for model coefficients and test statistics). As for CIDR, there was an effect of the weapon condition, $\chi^2(1, N = 300) = 6.64$, $p = .03$; feature condition, $\chi^2(1, N = 300) = 7.27$, $p = .007$; and an interaction between the two, $\chi^2(1, N = 300) = 10.54$, $p = .005$. When the perpetrator did not have the distinctive feature, the shotgun condition produced higher FIDR than the beer bottle condition, $\chi^2(1, N = 100) = 5.83$, $p = .02$, but there was no difference between the no weapon condition and either shotgun or beer bottle condition. Adding the distinctive feature did not affect the no weapon condition, but the mirror-image of the CIDR patterns arose for both shotgun, $\chi^2(1, N = 100) = 3.51$, $p = .06$ (marginal), and beer bottle conditions, $\chi^2(1, N = 100) = 7.89$, $p = .01$ (Figure 2). In other words, adding the feature increased FIDR for the beer bottle condition, and decreased FIDR for the shotgun condition. This created an advantage for the shotgun condition over the beer bottle condition when the perpetrator had the distinctive feature, $\chi^2(1, N = 100) = 5.20, p = .02$.

Table 2
Logistic Coefficients for Qualitative Predictors of False Identification Rate (FIDR)

Predictor	Logistic Coefficient	Chi-Square	*p* value
Feature	1.42	7.27	.007
Gun	1.24	5.45	.019
No Weapon	0.33	0.33	.566
Feature * Gun	-2.32	10.43	.001
Feature * No Weapon	-1.02	1.94	.164
Intercept	-1.02	20.96	< .001

Note: Beer Bottle condition not referenced because used as constant.

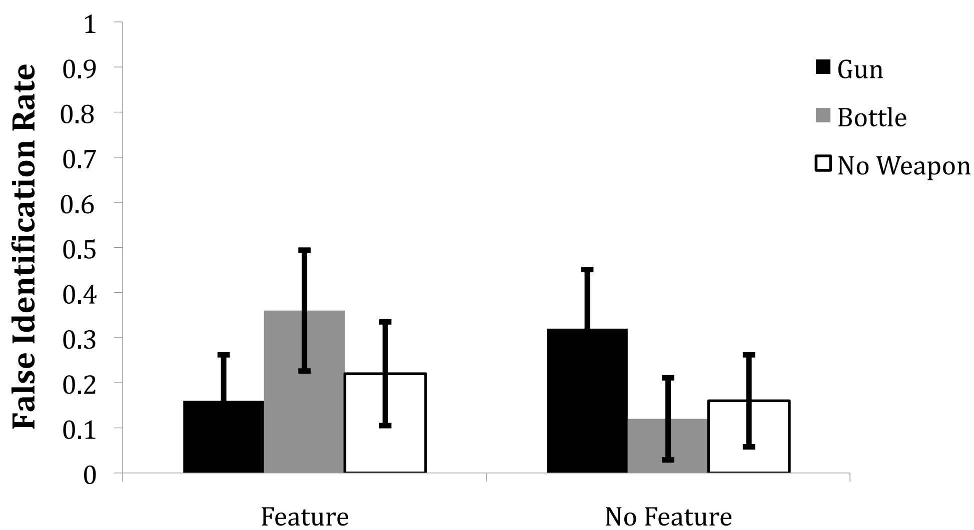

***Figure 2*. False identification rate with bars representing 95% confidence intervals.**

Combining CIDR and FIDR into an estimate of PV revealed several conclusions (Figure 3): (a) the WFE was replicated in the no feature condition, such that participants performed well above chance when no shotgun was present, but performance dropped to chance in the presence of the shotgun; (b) the distinctive feature dropped performance in the beer bottle and no weapon condition to chance; and conversely, (c) the feature increased performance well above chance for the shotgun condition.

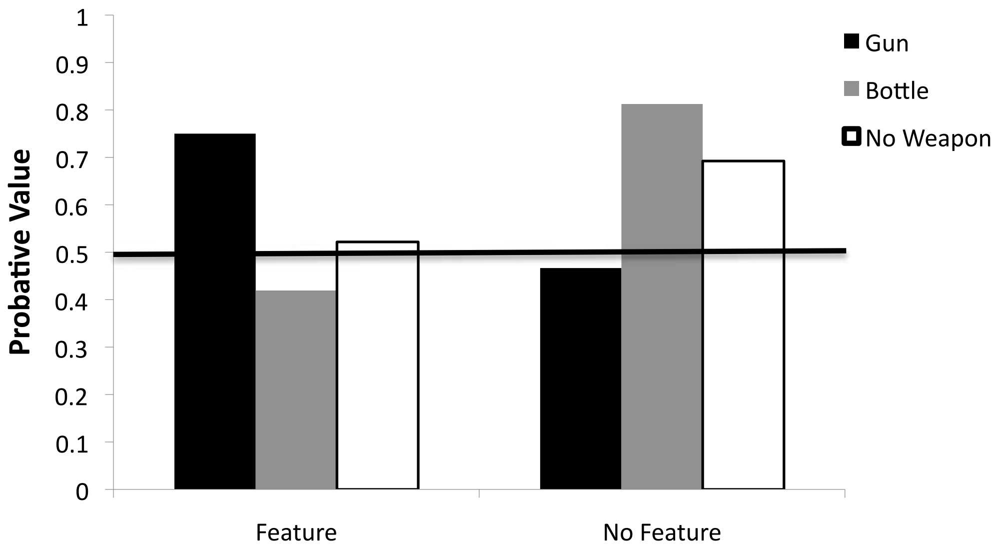

***Figure 3*. Probative value of eyewitness identification decisions, represented by the conditional probability: Correct ID rate/(Correct ID rate + Fals ID rate). The horizontal line represents chance performance.**

Why did PV not increase in every condition with the addition of the distinctive feature? The answer might come from the fact that all lineup members also had the distinctive feature (based on recommendation by Zarkadi et al., 2009), meaning that the feature itself was not diagnostic of guilt. In other words, if all that was remembered about the perpetrator's face was the distinctive feature, this could lead to worse lineup performance compared to the no feature condition. In fact, we did find that correct ID rate was lower in the feature condition (.25) compared to the no feature condition (.44), $\chi^2(1, N = 100) = 7.99$, $p = .005$, when no shotgun was present. Also, false ID rate was higher in the feature condition (.29) compared to the no feature condition (.14), again when no shotgun was present, $\chi^2(1, N = 100) = 6.67$, $p = .01$. This corresponds with findings by Carlson (2011), who found that correct ID rate decreased, and false ID rate increased, for simultaneous lineups (as used in the present experiment) when a distinctive feature was added to the target/perpetrator's face. However, he found this only for target faces previously rated as holistically distinctive. To determine whether or not this could apply to our perpetrator, we presented his face with a 1-7 distinctiveness scale to an independent group of 10 participants. Sure enough, he was rated as highly distinctive ($M = 5.50$, $SD = 1.18$).

Confidence

Figure 4 portrays participants' confidence across conditions after correct identifications (there were no differences in confidence after correct rejections of perpetrator-absent lineups).

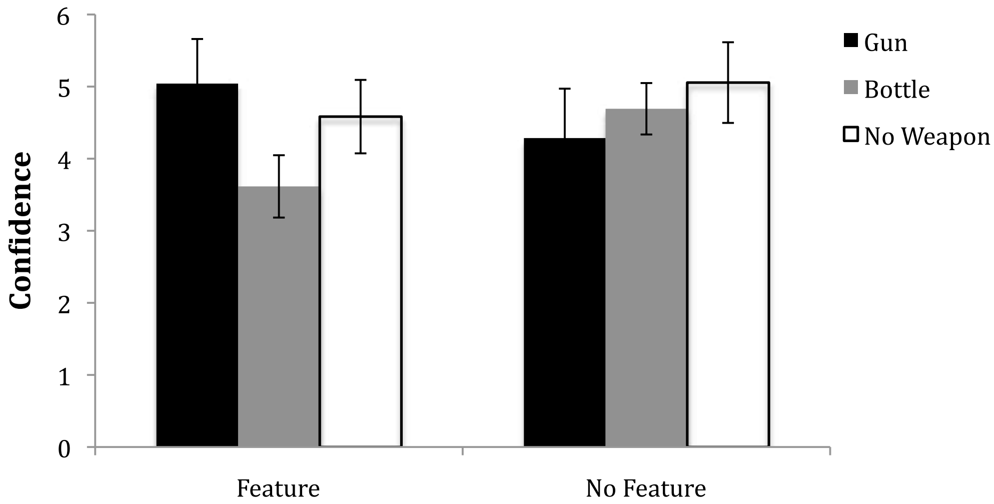

***Figure 4*. Confidence after correct identifications, with bars representing 95% confidence intervals.**

There was no effect of weapon or feature, but there was an interaction, $F(2, 104) = 5.56$, $p = .01$. Adding the distinctive feature did not change confidence when no weapon was present, but it had opposite effects for shotgun versus beer bottle conditions, marginally increasing confidence for the former, AWS $t'(35.8) = 1.96$, $p = .05$, and decreasing confidence for the latter, AWS $t'(18.7) = 2.73$, $p = .01$. Therefore when the distinctive feature was present, these results mimic the results for correct identifications: when the shotgun was present, participants were correct more often, and were highly confident in those decisions, compared to the beer bottle condition. This pattern led us to explore confidence-accuracy correlations with the next set of analyses. [1]

Confidence and accuracy are moderately correlated in eyewitness identification studies, at least for choosers (e.g., Brewer & Wells, 2006; Sporer, Penrod, Read, & Cutler, 1995). Figure 5 depicts these correlations across conditions, both for perpetrator-present (correct ID versus not) and perpetrator-absent (correct rejection versus not) lineups. Beginning with perpetrator-present lineups, the no weapon-no feature condition yielded a correlation ($r = .23$, ns) similar to those found in previous studies under similar conditions (e.g., Brewer & Wells, 2006). Adding the distinctive feature to the perpetrator's face did not change this confidence-accuracy correlation (from .23 to .17, Fisher's r-to-z transform = 0.30, ns). For the beer bottle condition, adding the feature reversed the confidence-accuracy correlation, from .35 to -.15, $z = 2.50$, $p = .01$. In contrast, adding the distinctive feature greatly increased the confidence-accuracy correlation for the shotgun condition, from $r = .03$ (ns) to $r = .49$ ($p < .001$), $z = 2.45$, $p = .01$. The results for perpetrator-absent lineups were somewhat more straightforward. When no feature was present, all correlations were positive, with the strongest occurring for the beer bottle condition ($r = .28$, $p = .04$). Adding the feature reduced the strength (numerically, though not significantly), and in some cases also changed the sign, of the correlation for all conditions.

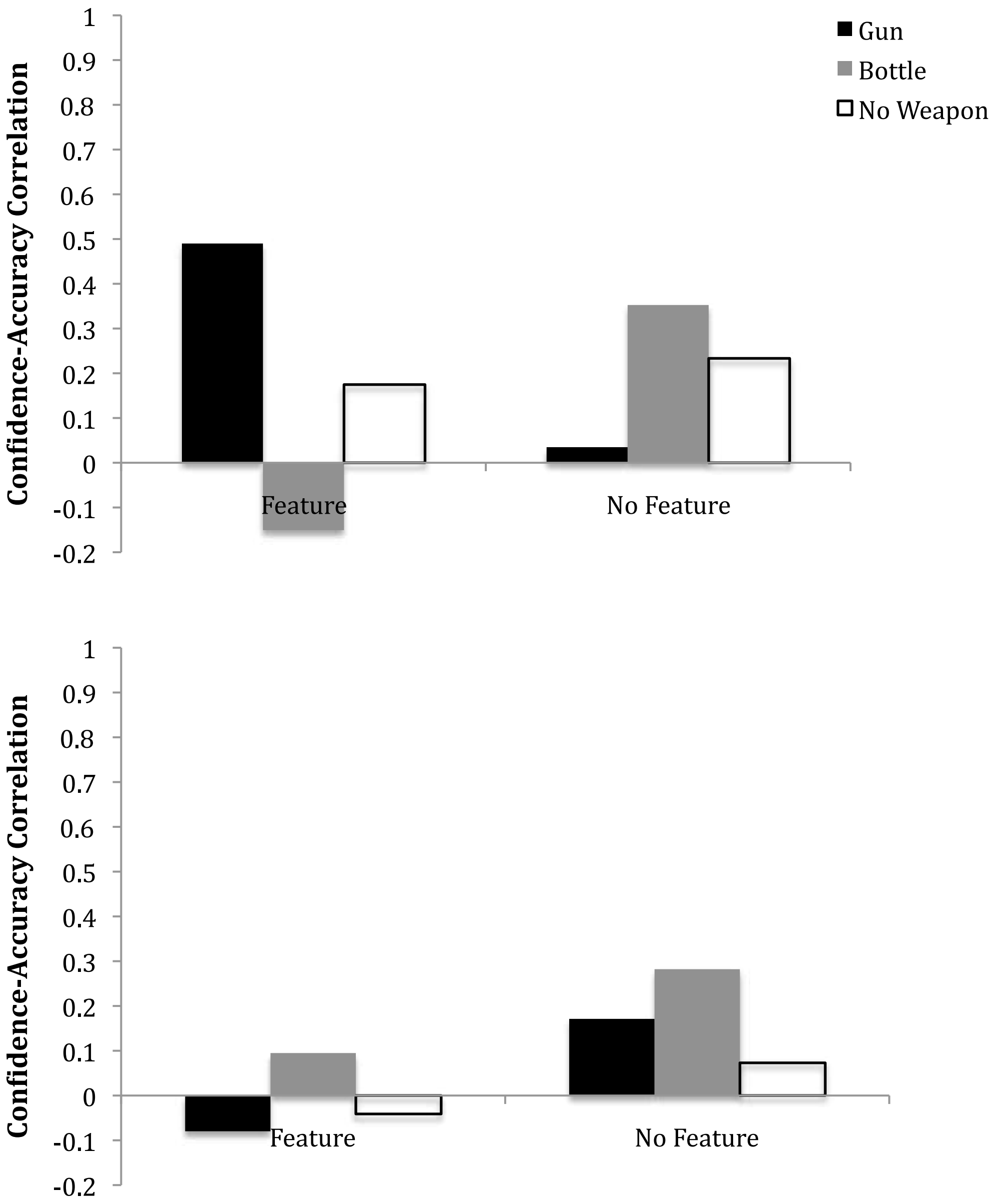

***Figure 5*. Confidence-accuracy correlations, for perpetrator-present lineups (top graph) and perpetrator-absent lineups (bottom graph). Accuracy was defined as correct identification (or not) for top graph, and correct rejection (or not) in bottom graph.**

In sum, participants' confidence was most positively correlated with their accuracy from perpetrator-present lineups when the perpetrator had a distinctive feature and held the shotgun. It is interesting that this corresponds with participants' CIDR advantage in this condition as well. Not only were they more accurate, they also were better calibrated. For target-absent lineups, participants' decision to correctly reject was more calibrated with their confidence when the perpetrator did not have the distinctive feature, regardless of weapon presence.

General Discussion

We replicated the weapon focus effect (WFE) with a large experiment ($N = 600$) relative to others in the WFE literature (range of $N = 32$ to 261) [2], also revealing an important interaction between presence of a weapon and the distinctiveness of the perpetrator. After viewing a realistic mock crime video from a first person point-of-view, participants were most accurate (and highly confident) when a shotgun was present if the perpetrator had a distinctive feature on his face. When the feature was not present, the WFE replicated. There was no WFE when a beer bottle was used as a weapon, which partially addresses the need for more research on schema-consistent objects being used in a schema-inconsistent manner (e.g., for assault), as called for by Fawcett et al. (2011). In sum, in a single experiment we demonstrated conditions in which the WFE is powerfully present as well as completely reversed. This large contrast was driven by a single factor: the presence of a distinctive feature on the perpetrator's face.

Why did we find the WFE in the no feature condition, whereas it has not consistently been found with previous research (e.g., Hulse & Memon, 2006; Kramer et al., 1990)? One possible reason is that prior studies did not consistently include a perpetrator-absent lineup with a designated innocent suspect to be able to calculate a reasonable measure of PV. In the present study, we did not find a WFE with only correct ID rate or only false ID rate. Rather, it was only when combining the two into an overall accuracy measure that it became clear that individuals in the shotgun condition were performing at chance, and far below the other conditions (Figure 3).

Other researchers have successfully eliminated the WFE (e.g., Pickel, 1999; Pickel, Ross, & Truelove, 2006). For example, Pickel (1999) found the WFE in the form of lower veridical recall of contextual details of the crime, and eliminated it by making the weapon schema-consistent. This was accomplished in her first experiment by presenting the weapon in the context of a shooting range rather than a sports stadium; in her second experiment, by showing a priest with the gun rather than a police officer. We eliminated the WFE without having to change the context. In both our distinctive feature and no distinctive feature conditions, the shotgun was clearly out of context, as it would not be expected at a football game-watching party. However, we found the WFE for the no feature condition, and a weapon advantage in the feature condition.

Now we turn to our key finding regarding the interaction between our schema-inconsistent object, the shotgun, and the presence of the distinctive feature on the perpetrator's face. What could be the mechanisms driving an increase in eyewitness identification accuracy when both a shotgun and such a distinctive feature are present? We speculate that there could be an additive effect on attention when these both are present, increasing overall attention. In our video, the shotgun can be seen before the distinctive feature. Perhaps attention increases and focuses on the weapon, and then shifts to the perpetrator's face when the distinctive feature becomes evident. Why then would participants not focus exclusively on the feature rather than the face, leading to chance lineup performance, as when no shotgun was present? There appear to be at least two possibilities: (a) the presence of the shotgun could have increased overall attention, such that when it was focused on the face, it was powerful enough to encode the feature as well as the face as a whole, or (b) the presence of the shotgun could have drawn attention away from the distinctive feature, reducing its distraction from encoding the face more naturally. Future research should test these hypotheses utilizing eye-tracker or other physiological or behavioral data to determine where attention is focused, and also should include additional memory measures to assess the extent of these potential attentional influences on memory.

There are additional weaknesses to the present study, three of which we focus on here. First, it is only a single experiment, meaning that the reader should exercise caution before generalizing our results to other conditions or situations. In particular, our findings should not be applied directly to real world situations (though we speculate about this below), especially because we could not replicate (nor did we want to, due to ethical constraints) the kind of fear and stress inherent to real eyewitness situations involving a weapon. Additionally, our participants were college students, primarily female, Caucasian, and from the Midwest. Further research should include a more diverse group of participants to better generalize to eyewitnesses. Second, we did not manipulate facial distinctiveness with a natural feature (e.g., a crooked nose). Rather, we utilized a large black "N" to create a strong manipulation even with a brief presentation of the perpetrator (i.e., so that the feature would be highly noticeable). We determined that something as subtle as a black eye, scar, or mole (see Carlson, 2011; Zarkadi et al., 2009) would not be as noticeable. Third, we did not manipulate lineup presentation (simultaneous versus sequential), even though recent research indicates that it interacts with perpetrator distinctiveness (Carlson, 2011; Carlson & Gronlund, 2011). We wanted to include this manipulation, but we also desired a full factorial design to maximize power, and it would have required another 600 participants to test sequential lineups. This was not feasible with our participant pools.

This experiment contributes several elements to the literature (beyond those already mentioned) to outweigh these limitations. First, no WFE studies (and very few eyewitness identification studies in general) have presented a mock-crime recorded from a first-person point-of-view, and we did so to increase the realism of our findings for victims. Some researchers have identified a lack of ecological validity in studies of eyewitness identification as a particularly important issue when it comes to crimes involving a weapon (e.g., Cooper, Kennedy, Hervé, & Yuille, 2002; Wagstaff, MacVeigh, Boston, Scott, Brunas-Wagstaff, & Cole, 2003). Second, much of the previous evidence for the WFE was derived from the same mock-crime video (Cutler & Penrod, 1988; Cutler et al., 1987a, b; Cutler et al., 1986; O'Rourke et al., 1989); we replicated the effect using a different video with a different perpetrator. Finally, this study is the only one from the WFE literature to test a full factorial design with a perpetrator-present and a perpetrator-absent lineup. Others (Cutler & Penrod, 1988; Cutler et al., 1987a, b; O'Rourke et al., 1989) have utilized a fractional factorial design, possibly to avoid the need for large numbers of participants. The present study included 50 participants per cell for reasonable power (Aldrich & Nelson, 1984), whereas those studies used only about five participants per cell. Fractional factorial designs have significant weaknesses, particularly involving the interpretation of interactions (Box, Hunter, & Hunter, 2005).

CONCLUSIONS AND IMPLICATIONS

Eyewitness identification researchers are starting to reach reliable conclusions for such estimator variables as stress and retention interval between crime and lineup (Deffenbacher, 2008). However, several potentially important estimator variables have received little to no research attention. We argue that the distinctiveness of the perpetrator, including the presence of a particular distinctive feature, is an important estimator variable, as it can influence system variables. For example, the sequential lineup might yield higher eyewitness accuracy compared to the simultaneous lineup if the perpetrator is distinctive (Carlson, 2011; Carlson & Gronlund, 2011). The present study expanded the findings concerning perpetrator distinctiveness further by showcasing a powerful interaction with another important estimator variable, the presence of a weapon during a crime.

Before we speculate about some potential applications of this result, we again reiterate that this was just a single experiment, which greatly limits generalizability. We encourage the reader to temper the following recommendations with this knowledge. Police could utilize information about perpetrator distinctiveness when interviewing eyewitnesses after a crime. If the eyewitness description of the perpetrator includes something distinctive about his face, police could anticipate the beneficial use of a sequential lineup (Carlson, 2011). If they mention that the perpetrator held a gun, the present study suggests that police perhaps should not abandon the idea of presenting a lineup, thinking that eyewitness attention toward the weapon must have left their memory weaker for the perpetrator's face. Rather, based on our results, even if there was a weapon during the crime, as long as there was something distinctive about the perpetrator's face, this could lead to the counterintuitive result of a better eyewitness decision from the lineup. Future research addressing the concerns we raise above should come closer to confirming this for police.

REFERENCES

Aldrich, J. H., & Nelson, F. D. (1984). *Linear probability, logit, and probit models.* Beverly Hills, CA: Sage.

Behrman, B. W., & Davey, S. L. (2001). Eyewitness identification in actual criminal cases: An archival analysis. *Law and Human Behavior, 25,* 475-491. doi:10.1023/A:1012840831846

Box, G. E. P., Hunter, J. S., & Hunter, W. G. (2005). *Statistics for Experimenters: Design, Innovation, and Discovery* (2nd ed.). Hoboken, New Jersey: Wiley-Interscience.

Brewer, N., & Wells, G. L. (2006). The confidence-accuracy relationship in eyewitness identification: Effects of lineup instructions, foil similarity, and target-absent base rates. *Journal of Experimental Psychology: Applied, 12,* 11-30. doi:10.1037/1076-898X.12.1.11

Carlson, C. A. (2011). Influence of a perpetrator's distinctive facial feature on eyewitness identification from simultaneous versus sequential lineups. *Applied Psychology in Criminal Justice, 7*, 77-92.

Carlson, C. A., & Gronlund, S. D. (2011). Searching for the sequential lineup advantage: A distinctiveness explanation. *Memory, 19,* 916-929. doi:10.1080/09658211.2011.613846

Carlson, C. A., Gronlund, S. D., & Clark, S. E. (2008). Lineup composition, suspect position and the sequential lineup advantage. *Journal of Experimental Psychology: Applied, 14,* 118-128. doi:10.1037/1076-898X.14.2.118

Clark, S. E., Howell, R. T., & Davey, S. L. (2008). Regularities in eyewitness identification. *Law and Human Behavior, 32,* 187-218. doi:10.1007/s10979-006-9082-4

Cooper, B. S., Kennedy, M. A., Hervé, H. F., & Yuille, J. C. (2002). Weapon focus in sexual assault memories of prostitutes. *International Journal of Law and Psychiatry, 25,* 181-191. doi:10.1016/S0160-2527(01)00107-8

Cutler, B.L., & Penrod, S.D. (1988). Improving the reliability of eyewitness identification: Lineup construction and presentation. *Journal of Applied Psychology, 73,* 281-290. doi:10.1037/0021-9010.73.2.281

Cutler, B. L., & Penrod, S. D. (1995). *Mistaken identification: The eyewitness, psychology, and the law*. New York, NY: Cambridge University Press.

Cutler, B. L., Penrod, S. D., & Martens, T. K. (1987a). The reliability of eyewitness identification: The role of system and estimator variables. *Law and Human Behavior, 11,* 233-258. doi:10.1007/BF01044644

Cutler, B. L., Penrod, S. D., & Martens, T. K. (1987b). Improving the reliability of eyewitness identification: Putting context into context. *Journal of Applied Psychology, 72,* 629-637. doi:10.1037/0021-9010.72.4.629

Cutler, B. L., Penrod, S. D., O'Rourke, T. E., & Martens, T. K. (1986). Unconfounding the effects of contextual cues on eyewitness identification accuracy. *Social Behaviour, 1,* 113-134.

Davies, G. M., Smith, S., & Blincoe, C. (2008). A 'weapon focus' effect in children. *Psychology, Crime & Law, 14,* 19-28. doi:10.1080/10683160701340593

Deffenbacher, K. A. (2008). Estimating the impact of estimator variables on eyewitness identification: A fruitful marriage of practical problem solving and psychological theorizing. *Applied Cognitive Psychology, 22,* 815-826. doi:10.1002/acp.1485

Easterbrook, J. A. (1959). The effect of emotion on the utilization and organization of behavior. *Psychological Review, 66,* 183-201. doi:10.1037/h0047707

Egan, J. P. (1958). *Recognition memory and the operating characteristic*. USAF Operational Applications Laboratory Technical Note, No. 58-51, ii, 32.

Ellis, H. D., Shepherd, J. W., & Davies, G. M. (1979). Identification of familiar and unfamiliar faces from internal and external features: Some implications for theories of face recognition. *Perception, 8,* 431-439. doi:10.1068/p080431

Fawcett, J. M., Russell, E. J., Peace, K. A., & Christie, J. (2011). Of guns and geese: A meta-analytic review of the 'weapon focus' literature. *Psychology, Crime & Law, 17,* 1-32. doi:10.1080/1068316X.2011.599325

Florida Department of Corrections Inmate Database (2012). Retrieved from http://www.dc.state.fl.us/ActiveInmates/search.asp

Gronlund, S. D., Carlson, C. A., Dailey, S. B., & Goodsell, C. A. (2009). Robustness of the sequential lineup advantage. *Journal of Experimental Psychology: Applied, 15,* 140-152. doi:10.1037/a0015082

Gronlund, S. D., Carlson, C. A., Neuschatz, J. S., Goodsell, C. A., Wetmore, S., Wooten, A., & Graham, M. (accepted). Showups versus lineups: An evaluation using ROC analysis. *Journal of Applied Research in Memory and Cognition*.

Hope, L., & Wright, D. (2007). Beyond unusual? Examining the role of attention in the weapon focus effect. *Applied Cognitive Psychology, 21,* 951-961. doi:10.1002/acp.1307

Hulse, L. M., & Memon, A. (2006). Fatal impact? The effects of emotional arousal and weapon presence on police officers' memories for a simulated crime. *Legal and Criminological Psychology, 11,* 313-325. doi:10.1348/135532505X58062

Hunt, R. R. (2003). Two contributions of distinctive processing to accurate memory. *Journal of Memory and Language, 48,* 811-825. doi:10.1016/S0749-596X(03)00018-4

Kleider, H. M., & Goldinger, S. D. (2001). Stereotyping ricochet: Complex effects of racial distinctiveness on identification accuracy. *Law and Human Behavior, 25,* 605-627. doi:10.1023/A:1012706323913

Kramer, T. H., Buckhout, R., & Eugenio, P. (1990). Weapon focus, arousal, and eyewitness memory: Attention must be paid. *Law and Human Behavior, 14,* 167-184. doi:10.1007/BF01062971

Lindsay, R. C. L., & Wells, G. L. (1985). Improving eyewitness identifications from lineups: Simultaneous versus sequential lineups presentations. *Journal of Applied Psychology, 70,* 556–564. doi:10.1037/0021-9010.70.3.556

Loftus, E. F., Loftus, G. R., & Messo, J. (1987). Some facts about 'weapon focus.' *Law and Human Behavior, 11,* 55-62. doi:10.1007/BF01044839

Loftus, G. R., & Mackworth, N. H. (1978). Cognitive determinates of fixation location during picture viewing. *Journal of Experimental Psychology, 4,* 565-572. doi:10.1037/0096-1523.4.4.565

Maass, A., & Kohnken, G. (1989). Eyewitness identification: Simulating the 'weapon effect'. *Law and Human Behaviour, 13,* 397-408. doi:10.1007/BF01056411

Metz, C. E. (1978). Basic principles of ROC analysis. *Seminars in Nuclear Medicine, 8,* 283-298. doi:10.1016/S0001-2998(78)80014-2

O'Rourke, T. E., Penrod, S. D., Cutler, B. L., & Stuve, T. E. (1989). The external validity of eyewitness identification research: Generalizing across subject populations. *Law and Human Behaviour, 13,* 385-395. doi:10.1007/BF01056410

Pickel, K. L. (1998). Unusualness and threat as possible causes of 'weapon focus.' *Memory, 6,* 277-295. doi:10.1080/741942361

Pickel, K. L. (1999). The influence of context on the 'weapon focus' effect. *Law and Human Behaviour, 23,* 299-311. doi:10.1023/A:1022356431375

Pickel, K. L. (2009). The weapon focus effect on memory for female versus male perpetrators. *Memory, 17,* 664-678. doi:10.1080/09658210903029412

Pickel, K. L., Narter, D.B., Jameson, M. M., & Lenhardt, T. T. (2008). The weapon focus effect in child eyewitnesses. *Psychology, Crime & Law, 14,* 61-72. doi:10.1080/10683160701391307

Pickel, K. L., Ross, S. J., & Truelove, R. S. (2006). Do weapons automatically capture attention? *Applied Cognitive Psychology, 20,* 871-893. doi:10.1002/acp.1235

Ryu, J.J., & Chaudhuri, A. (2007). Differences in attentional involvement underlying the perception of distinctive and typical faces. *Perception, 36,* 1057-1065. doi:10.1068/p5751

Saunders, J. (2009). Memory impairment in the weapon focus effect. *Memory & Cognition, 37,* 326-335. doi:10.3758/MC.37.3.326

Schneider, W., Eschman, A., & Zuccolotto, A. (2002). *E-Prime user's guide*. Pittsburgh, PA: Psychology Software Tools.

Shapiro, P. N., & Penrod, S. (1986). Meta-analysis of facial identification studies. *Psychological Bulletin, 100,* 139-156. doi:10.1037/0033-2909.100.2.139

Shaw, J. I., & Skolnick, P. (1994). Sex differences, weapon focus and eyewitness reliability. *Journal of Social Psychology, 134,* 413-420.

Sporer, S. L., Penrod, S. D., Read, J. D., & Cutler, B.L. (1995). Choosing, confidence, and accuracy: A meta-analysis of the confidence-accuracy relation in eyewitness identification studies. *Psychological Bulletin, 118,* 315-327. doi:10.1037/0033-2909.118.3.315

Steblay, N. M. (1992). A meta-analytic review of the weapon focus effect. *Law and Human Behavior, 16,* 413-424. doi:10.1007/BF02352267

Valentine, T., Pickering, A., & Darling, S. (2003). Characteristics of eyewitness identification that predict the outcome of real lineups. *Applied Cognitive Psychology, 17,* 969-993. doi:10.1002/acp.939

Wagstaff, G. F., MacVeigh, J., Scott, L., Brunas-Wagstaff, J., & Cole, J. (2003). Can laboratory findings on eyewitness testimony be generalized to the real world? An archival analysis of the influence of violence, weapon presence, and age on eyewitness accuracy. *Journal of Psychology, 137,* 17-28. doi:10.1080/00223980309600596

Wells, G. L. (1978). Applied eyewitness testimony research: System variables and estimator variables. *Journal of Personality and Social Psychology, 36,* 1546–1557. doi:10.1037/0022-3514.36.12.1546

Wixted, J. T., & Mickes, L. (2012). The field of eyewitness memory should abandon "probative value" and embrace Receiver Operarting Characteristic analysis. *Perspectives on Psychological Science, 7,* 275-278. doi:10.1177/1745691612442906

Young, A. W., Hay, D. C., McWeeny, K. H., & Flude, B. M. (1985). Matching familiar and unfamiliar faces on internal and external features. *Perception, 14,* 737–746. doi:10.1068/p140737

Zarkadi, T., Wade, K. A., & Stewart, N. (2009). Creating fair lineups for suspects with distinctive features. *Psychologial Science, 20,* 1448-1453. doi:10.1111/j.1467-9280.2009.02463.x

ACKNOWLEDGMENTS

This research would not have been possible without the help of excellent graduate and undergraduate research assistants in the Applied Cognition Laboratory. Dawn Weatherford and Sarah Dailey helped with data collection and, more importantly, acted as coordinators of the lab and its research assistants. Another graduate student, Natalie Saladino, helped research the weapon focus effect literature. And many thanks to several undergraduate research assistants, who undertook the majority of data collection and some initial work with stimuli, in alphabetical order: Sydney Cole, Jeremy Forshee, Kenneth Hoon, Jessica Mayberry, Amanda McAdams, Lindsey Reed, and Travis Thorpe. Thanks also to Scott Gronlund and his OU Memory Lab for help with data collection. His graduate student Colton Perry, in particular, helped orchestrate this collaboration. Finally, we thank Ben Chavet for serving as our perpetrator.

ENDNOTES

[1] A promising movement just beginning in the eyewitness identification literature is to use confidence and accuracy measures to construct Receiver Operating Characteristic (ROC) curves (Egan, 1958) to accurately portray differences among conditions based on accuracy across shifting response criteria (e.g., Wixted & Mickes, 2012; Gronlund et al., under review). However, one disadvantage of this technique is the need for a large number of data points per cell of the design (minimum 100 recommended by Metz, 1978). We obtained half of this number in the present study, which was sufficient for our logistic regression analyses, but not for construction of stable ROCs.

[2] The size of this single experiment was comparable to archival datasets analyzed in the literature (e.g., $N = 671$ from Behrman & Davey, 2001; $N = 640$ from Valentine, Pickering, & Darling, 2003).

Received 4/12
Accepted 6/12

Carlson, C.A., & Carlson, M.A. (2012) A distinctiveness-driven reversal of the weapon-focus effect. [Electronic Version]. *Applied Psychology in Criminal Justice, 8*(1), 36-53.