Contextual Influences on Detecting the Presence of a Firearm

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by

Ashley L. Bogar

Major Professor: Benjamin Barton, Ph.D.

Committee Members: Annette Folwell, Ph.D.; Todd Thorsteinson, Ph.D.

Department Administrator: Todd Thorsteinson, Ph.D.

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Authorization to Submit Thesis

This thesis of Ashley L. Bogar, submitted for the degree of Master of Science with a Major in Psychology and titled "Contextual Influences on Detecting the Presence of a Firearm," has been reviewed in final form. Permission, as indicated by the signatures and dates below, is now granted to submit final copies to the College of Graduate Studies for approval.

Major Professor:	____________________________ Benjamin Barton, Ph.D.	Date: ____________
Committee Members:	____________________________ Annette Folwell, Ph.D.	Date: ____________
	____________________________ Todd Thorsteinson, Ph.D.	Date: ____________
Department Administrator:	____________________________ Todd Thorsteinson, Ph.D.	Date: ____________

Abstract

Research examining use of firearms by law enforcement has largely focused on issues such as racial bias or conditions of cognitive load or stress. The present study takes a more foundational approach by examining use of firearms as a problem of basic perception. Detection of firearms was examined within the framework of environmental factors and contextual influences, and compared performance between participants with and without law enforcement training. The sample comprised twenty law enforcement officers and twenty individuals drawn from the local community. Each participant completed a firearm detection task, during which reaction times and signal detection indices were recorded. Slower reaction times and greater overall accuracy of detection was predicted among participants with law enforcement training. Results suggest a pattern of greater detection accuracy by law enforcement participants, as well as expand the understanding of factors underlying the decision-making process involved in the use of deadly force.

Vita

Ashley L. Bogar

Department of Psychology
and Communication Studies
University of Idaho
Moscow, ID
83844-3043

Phone: 208-596-5199
Email: ashbogar@gmail.com

Education:

2015 M.S.
University of Idaho
Major: Psychology, emphasis in Human Factors
Thesis Title: "Contextual Influences on Detecting the Presence of a Firearm"

2011 B.S.
University of Idaho
Major: Psychology

Publication:

Schwebel, D. C., Barton, B. K., Shen, J., Wells, H., Bogar, A., Heath, G. & McCullough, D. (2014). Systematic review of behavioral interventions to improve child pedestrian safety: A meta-analysis. *Journal of Pediatric Psychology*, *39*, 826-845.

Professional Memberships:

- Human Factors & Ergonomics Society (University of Idaho chapter)

Research Assistant Experience:

- Decision Making Lab
  - University of Idaho
  - Supervising professor: Dr. Todd Thorsteinson
- Idaho Child Safety Lab
  - University of Idaho
  - Supervising professor: Dr. Benjamin Barton

Teaching Assistant Experience:

- University of Idaho
  - Introduction to Psychology – Dr. Shannon Welch
  - Survey of Contemporary Psychology – Dr. Traci Craig
  - Developmental Psychology – Dr. Benjamin Barton
  - Psychology of Emotion – Dr. Shannon Welch and Dr. Benjamin Barton
  - Personality and Social Development – Dr. Benjamin Barton

Professional Service:

- University of Idaho – Promotion and Tenure Committee (Department of Psychology and Communication Studies - Fall 2013 to Spring 2015)
- University of Idaho HFES Chapter Secretary (2013)

Selected Honors and Awards:

- *Spirit of Trio* Award (2011)

Community Service:

- 2013 – Volunteer for the Humane Society of the Palouse
- 2012-2013 – Volunteer for Officer Lee Newbill Safety Fair in Moscow, Idaho
- 2012 – Volunteer for National iCount effort in Moscow, Idaho
- 2011-2012 – Assisted with the Safe Routes to School effort in Moscow, Idaho

Additional Skills and Qualifications:

- Applied Science Laboratories (ASL) D6 Desktop Mounted eye tracking system
- Tobii Studio 3.2 eye tracker
- User Experience research
- Adobe Photoshop

Human Factors Courses:

- Ergonomics/Biomechanics
- Human Computer Interaction
- Usability: UX Design II – Advanced Techniques
- Human Factors in Engineering Design
- Sensation and Perception
- Research Methods
- Advanced Research Methods
- Safety Research
- Engineering Psychology
- Advanced Human Factors

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Dedication

For my son, Preston Cruz. I love you infinity times infinity, Monkey.

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Introduction: Contextual Influences on Detecting the Presence of a Firearm

In the early morning of February 4th, 1999, several New York police officers confronted Amadou Diallo in a poorly-lit doorway to his building. Diallo matched the description of a suspect known to be armed. Diallo did not comply with orders to show his hands and, when he produced a wallet from his jacket, officers mistakenly identified the object as a handgun. Officers fired more than forty shots, approximately half of which struck Diallo.

Use of deadly force by members of law enforcement occurs for a variety of reasons. The frequently cited case of Amadou Diallo serves as an example of how a confluence of factors, such as racial bias, emotional status, and cognitive load, surround decisions to use deadly force (Correll, Park, Judd, & Wittenbrink, 2002). In spite of such knowledge, detection of a weapon has received little attention as a contextual problem of perception and decision making. Human perceptual factors, variation in reaction in relation to training, and contextual influences such as expectations prior to encountering a person (aside from racial bias) are all important to consider. The human ability to detect a stimulus and to quickly differentiate between whether a stimulus is threatening or neutral, as well as contingencies in which such detection occurs, have received little attention in the literature.

Factors Surrounding Detection of Firearms

Racial Bias. Racial bias is a dominant theme in previous research on police-involved shootings. Several studies demonstrated that the ethnicity of the person shown in stimuli in laboratory simulations was related to use of force decisions (Correll et al., 2002; Correll, Park, Judd, Wittenbrink, Sadler, & Keesee, 2007; Greenwald, Oakes, & Hoffman, 2003; Payne, 2001). General results indicated race of the target can affect one's perceptual sensitivity in discriminating a weapon from a harmless object as well as affect their bias to respond as if a weapon is present. General results indicated Black targets were shot at more than White targets, and a greater readiness to shoot in both civilians and law enforcement was present when the target was Black. However, when compared to civilians, law enforcement officers were less likely to display racial bias (Correll et al., 2002; Correll et al, 2007; Greenwald et. al, 2003; Payne, 2001). Racial bias is indeed a factor in detection of a firearm or in decisions to use force, but also should not be considered consistent across all individuals employed in law enforcement and across all agencies. Thus, racial bias is perhaps not one cross-cutting factor that should be considered when approaching the problem of detection of firearms from a more basic level.

Other research has moved beyond simple examination of response according to racial status. For example, one recent study examined the mediating role of context and found an increase in danger cues resulted in a reduction of bias when making the decision to shoot (Correll, Wittenbrink, Park, Judd, & Goyle, 2011). Another study examined the ethnic prototypicality of individuals depicted in stimulus images and found an influence on decisions to shoot (Ma & Correll, 2011). Participants showed no general racial bias, but did show changes in judgment as the prototypicality (the degree to which an individual physically represents a member of his/her racial group) of the person in the stimulus image increased, especially if the person was White. Decisions to use deadly force are clearly contextually dependent and should not be evaluated simply on the basis of the ethnicity or race of the individual being encountered.

Cognition and Emotion. The priming influences of emotion or cognitive load also have been examined. For example, in one study officers watched a nine-minute police-relevant FBI training video showing actual footage of a routine traffic stop that resulted in the death of a police officer (Kleider, Parrott, & King, 2009). Physiological indices were obtained while officers viewed the video. Results indicated working memory capacity among officers was reduced when participants were placed under threat, illustrating an influence of physiological arousal on cognitive processes. Anxiety also has been found to push officers toward a greater likelihood of shooting (Nieuwemhuys, Savelsbergh, & Oudejans, 2011). A video-based test required participants to shoot or not shoot at quickly appearing suspects who were holding either a gun or no gun. The level of anxiety was manipulated based on whether or not a "shoot-back canon" was on or off that would fire small plastic bullets at the participants. Results indicated anxious officers tend to respond based on threat-related expectations rather than more objective visual information relevant to the task. The presence of an elevated level of cortisol, which is linked to stress and anxiety, has also been found to influence shoot versus no shoot decisions (Akinola & Mendes, 2011). Overall, emotional and cognitive statuses appear to play roles in use of deadly force; roles that are perhaps contingent on the expectancy the officer has regarding the person he or she will encounter.

Training. Law enforcement training for use of deadly force is another important factor to consider. However, there is no research that specifically examines firearm training received by law enforcement officers and the potential influence of training on performance. Thus, further research is needed to understand the influence of training on decisions to use deadly force.

Context of Encounters with Citizens. The potential influence of context is a final important factor that should not be overlooked. The concept of selective perception highlights the potential bias a person may form prior to an event based on their expectations, previous experience, and emotional state. Expectations, which comprise details about suspect behavior and also officer emotional status, frame encounters with individuals when responding to calls. Baumann and DeSteno (2010) found that participants were likely to identify an object as a firearm when under time pressure and angry. However, when time pressure was removed, participants were less likely to assume that an individual was holding a firearm. Thus, contextual influences have been acknowledged as important in the literature, but have not been explicitly or extensively examined.

Recent Research

Research examining detection of firearms among law enforcement officers as a basic process based on human perceptual tendencies is sparse. Barton, Kovesdi, McCullough, and Bishop (2014) compared detection time and accuracy between law enforcement and non-law enforcement participants in the framework of Signal Detection Theory. Researchers predicted law enforcement officers would be significantly faster when detecting an object in the hand of a person, which would be consistent with prior research (i.e., MacLeod & Dunbar, 1988) and more accurate when differentiating whether the object was a firearm or a neutral object. All participants were very quick to correctly detect a firearm. Contrary to expectations, law enforcement officers were significantly slower than novice participants when presented with images of individuals holding neutral stimuli (e.g., a cell phone or wallet) or no object at all. Overall, accuracy for detecting whether a firearm was present was greater with law enforcement officers than non-law enforcement participants.

Aims and Hypotheses

The study examined a small sample of law enforcement officers and a comparison group drawn from the community. One set of hypotheses concerned reaction times in response to stimuli and accuracy in signal detection measures. Based on the previous study (Barton et. al, 2014), law enforcement (LE) participants were expected to exhibit slower reaction times when presented with neutral stimuli but greater accuracy than novices. In terms of Signal Detection Theory, participants overall were expected to respond correctly most of the time, with the LE group showing a greater number of hits, fewer misses, and potentially a slight increase in false alarms. The role of contextual factors that may influence reaction times within varying environmental conditions were also examined. LE officers were expected to be more sensitive to high versus low expectancy scenarios.

Chapter 1: Methods

Sample

The sample comprised 40 adults (*M* = 39.25 years, *SD* = 8.96, 38 males, 2 females). Half of the sample comprised individuals from local law enforcement agencies, with experience ranging from 1 to 28 years (*m* = 11.35, *sd* = 9.36). LE participants (*n* = 20, 19 males, 1 female) ranged in age from 25 to 56 years old. Non-law enforcement (non-LE) participants were matched by sex and age, and were recruited from the local community. The sample was predominantly Caucasian (with 1 Alaskan native) due to the demographic composition of the surrounding area, and no participants were excluded based on ethnicity. Six of the participants had military experience (4 LE, 2 Non-LE), two of whom were involved in active combat (both LE). Thirty eight participants (97.4%) had previous experience with firearms (20 LE, 18 Non-LE), and five were certified as firearms instructors (all LE). Of the total participants, seventeen (10 LE, 7 Non-LE) played video games on a regular basis ranging from 1 to 28 hours a week (*M* = 7.51, *SD* = 8.16), and twelve (7 LE, 5 Non-LE) regularly played first person shooter games, such as *Halo, Battlefield, Call of Duty* and *Titanfall*. The university's Institutional Review Board approved the study (see Appendix 1).

Measures

Materials and Creation of Stimuli. The stimuli comprised 32 digital photographs of sixteen Caucasian males producing objects from various locations on their person. Two photos were taken per individual; one with a firearm and one with a neutral object. Each of the 32 photographs were used twice; paired once with a scenario, and once without (see Appendix 2). Photographs were categorized by stimulus type as either firearm or neutral object present. In firearm present photographs, an individual was holding a Smith & Wesson Shield semi-automatic pistol. Neutral photographs showed an individual producing either a cell phone or wallet. Individuals who were photographed were allowed to use their own cell phone or wallet. All individuals stood in a relaxed posture with neutral facial expressions.

Photographs were counterbalanced by stimulus type and location from which the person's hand emerged. Each stimulus type (i.e., firearm or neutral object) appeared in 50% of the photos. Locations from which the individual's hand emerged were varied between the front pocket of a hoodie or backpack. Both of these locations appeared the same number of times (32) across stimulus photographs and were balanced by stimulus type (see Table 1).

Visual Acuity. The Snellen Index was used to measure visual acuity. The test comprises an eye chart placed on a wall 20 feet from the participant. Participants read aloud from each line on the chart until an error occurred. Scores were based on the last line completed without error. The corresponding line number was documented and used for statistical purposes. For example, 20/20 vision is equivalent to an 8 on the Snellen index. Higher scores indicate greater visual acuity. All participants exhibited scores within the normal range (M = 8.45, SD = 1.50).

Scenarios. Sixteen scenarios commonly encountered by LE officers were developed through discussion between a member of law enforcement and the researcher. The scenarios read aloud by the experimenter served as priming stimuli from which a participant may form expectations prior to viewing the stimulus images. Of the sixteen, half represented "high" expectancy scenarios, while the other half represented "low" expectancy scenarios (i.e., primes high versus low chance of a firearm being present). See Appendix 2 for a list of scenarios used in the study. Sixteen scenarios with equal high and low expectancies were distributed across thirty-two of the image pairs. Each scenario was used twice; paired once with a firearm image, and once with a neutral image. The remaining thirty-two image pairs were presented without a scenario, thus no expectancy would be present (see Table 1).

Detection task. The detection task was based on the change blindness paradigm (Rensink, 2005) and was presented using a graphical experiment builder program called OpenSesame. Following previous research (Barton et al., 2014), stimulus images were paired with background-only photos to form sets of image pairs. The task comprised a total of 64 trials (i.e., 64 image pairs) divided into eight blocks of eight image pairs that included scenes with varying backgrounds and stimulus pictures. As in previous research (Barton et al., 2014), image durations for each trial were 800 milliseconds of a background image followed by a 200 milliseconds black mask screen, and finally 1000 milliseconds of the stimulus image (Figure 1). The stimulus presentation ended after a response had been selected or the stimulus image had been displayed for 1000 milliseconds. Data output showed "timeout" if the participant failed to respond within the 1000 milliseconds timeframe.

Participants were told to view each image pair and to quickly make a decision regarding presence of a firearm. Participants were prompted with a brief instruction screen before each image pair indicating the key press procedure. After viewing instructions, participants began the task by pressing the "space" bar when the researcher said "go." Once they viewed the stimulus image, they indicated whether there was a firearm in the image by pressing the "z" key for firearm, and the "/" forward-slash key for a neutral object like a phone or wallet. Half of each block (4 image pairs) was primed with scenarios, alternating from beginning to end amongst all eight blocks (i.e. blocks 1, 3, 5, 7 started with scenarios, and 2, 4, 6, 8 ended with scenarios). Participants were prompted to listen to each scenario being read aloud and then press the space bar after the researcher said "go." Participants were allowed two practice trials before data collection.

Several measures were derived from the key press procedure. A reaction time (RT) was recorded for each trial, defined as the time in seconds from the onset of the trial to the time the participant enters a key press decision. Signal Detection Theory (SDT) concerns the state of the world versus a participant's perception of the state of the world. SDT measures are derived by the participants' responses and are based on their perception of whether a stimulus is present or not. SDT indices include: hits (correctly detecting a stimulus when present), correct rejections (responding correctly that a stimulus is not present), misses (responding incorrectly when the stimulus is present), false alarms (responding that a stimulus is present when one actually is not present).

Finally, scores for sensitivity and bias were derived from the SDT data. The parametric metric d' is typically used to measure sensitivity, and C measures response bias. However, because d' assumes both distributions to be normal, the present study used transformed measures A' and B" due to non-normal distributions of hits, misses, false alarms, and correct rejections. Nonparametric SDT measures can be more appropriate for measuring sensitivity and response bias where sample size is limited or distributions are not normal (Grier, 1971; Stanislaw & Todorov, 1999). Figure 2 illustrates the combined areas to form these measures. Scores for A' range from .5 to 1, with .5 indicating chance level and 1 indicating maximum discrimination.

Pilot Testing

A small sample of four participants were collected in order to test measures and procedures. Feedback was solicited to identify issues with the protocol or stimulus materials.

Procedure

The study was conducted in one session per participant. First, the informed consent process was initiated. Then, participants reported demographic age, sex, military/law enforcement/firearms experience or training, and involvement in activities (e.g., video game experience) that may enhance ability to discriminate between a firearm or other object. Participants' names were not referenced on the demographic form. Following these initial steps, participants completed an assessment of visual acuity and the detection task.

Chapter 2: Analyses

Analyses proceeded in several steps. First, data generated in the firearm detection task were examined for distributional characteristics and outliers using scatter plots and descriptive statistics. One case (Non-LE; male) was determined to be an outlier (i.e., ± 3 SD beyond the mean). The participant's SDT performance was atypical, suggesting the participant did not understand the instructions. The participant's data were excluded from all analyses. Second, a series of repeated-measures ANOVAs were conducted to examine group differences and differences across the various factors in the detection task. Third, signal detection data were examined using ROC plots and a series of ANOVAs.

Chapter 3: Results

Differences by Group, Stimulus, and Scenario within the Detection Task

Descriptive statistics for all variables are reported in Table 1. Mean reaction times are represented in Figures 5, 6, and 7. Reaction times were compared in a LE (2) X firearm (2) X scenario (3) repeated-measures ANOVA. Recall that no levels of expectancy were present when no scenarios were present (see Table 1). Levels of scenario were defined as scenario present/high expectancy, scenario present/low expectancy, and no scenario/no expectancy.

Three main effects were of interest: those for LE, firearm, and scenario. No statistically significant main effect was found for LE, F (1. 37) = .93, p > .05, partial η^2 = .03. On average, participants with LE experience produced shorter reaction times in the firearm condition as compared to non-LE participants, although the difference was not statistically significant. A statistically significant main effect was found for the presence of a firearm, F (1, 37) = 45.55, p < .01, partial η^2 = .55. Participants in both groups had slower reaction times in the condition in which no firearm was present. A statistically significant main effect was found for scenario, F (2, 74) = 6.81, p < .01, partial η^2 = .16. Bonferroni follow-up tests indicated average reaction time was significantly longer in the scenario with high expectancy condition as compared to scenario with low expectancy. Average reaction time was not significantly different in either level of scenario with expectancy as compared to no scenario. No statistically significant interactions were found between any factors included in the analysis.

Signal Detection

Descriptive statistics for all signal detection indices (hits, correct rejections, false alarms, and misses) are reported in Table 2. Next, measures for sensitivity and bias were calculated and are represented in figures 3 and 4 by ROC plots depicting overall detection accuracy between levels of experience. Figure 3 shows performance between LE by scenario. Noticeably, LE showed a higher rate of hits (around 95%) as well as greater less variability in detection and response accuracy, which is determined by the area under the curve. Performance of participants with no LE experience had a lower rate of hits (roughly 86-90%) and a less consistent performance between conditions of scenario. Figure 4 represents performance between LE by expectancy levels within scenario. This ROC curve reveals the same pattern of performance, with LE consistently outperforming non-LE with a higher rate of hits and greater response accuracy overall. Both groups showed a reduction in accuracy when primed with high expectancy scenarios. Performance was best among LE when primed by a low expectancy scenario, while non-LE performed best in the no scenario condition (see Table 2 & Figures 3 and 4).

Finally, the indices were examined across levels of experience in a series of four ANOVAs testing LE (2) X each of the (4) SDT indices (hits, correct rejections, false alarms, and misses). A statistically significant difference was found for LE for hits, F (1, 37) =14.03, $p < .05$, partial $\eta^2 = .28$, and misses, F (1, 37) = 5.63, $p < .05$, partial $\eta^2 = .13$. Overall, participants with LE experience showed more hits and fewer misses. No significant difference was found for correct rejections, F (1, 37) = .09, $p > .05$, partial $\eta^2 = .00$, and false alarms, F (1, 37) = .90, $p > .05$, partial $\eta^2 = .02$. Overall, participants responded correctly most of the time, but those with LE experience consistently showed greater detection ability and accuracy.

Chapter 4: Discussion

The purpose of this study was to examine the relationship between contextual factors and performance within a firearm detection task between law enforcement participants and a comparison sample. Participants with law enforcement experience were expected to exhibit slower reaction times but greater overall accuracy, consistent with previous research (Barton et. al, 2014). Overall, participants were expected to respond correctly most of the time, with LE showing a greater number of hits, fewer misses, and a slight increase in false alarms. LE participants were also expected to be more sensitive to levels of expectancies within scenarios. Results for reaction time and accuracy suggest different contextual factors do play a role in overall performance across groups.

Analyses of the reaction time and signal detection data indicated LE participants' performance exceeded that of non-LE participants in a number of ways. First, LE participants demonstrated a trend for faster reaction times overall, regardless of the condition. Second, participants with LE experience showed a significant pattern of more hits and fewer misses, and third, greater sensitivity (accuracy) when compared with non-LE participants' performance.

Contrary to expectations, LE participants, on average, showed faster overall reaction times throughout all conditions as illustrated in Figures 5, 6, and 7. Consistent with previous research by Barton et al. (2014), overall reaction times were significantly shorter when participants were presented with stimuli containing a firearm. Neutral objects in stimuli were linked to a trend for slower reaction times among participants, whereas such stimuli were linked to significantly slower reaction times in the previous study by Barton et al. (2014), In particular, LE participants were significantly slower when shown neutral images. The use of different stimulus materials by each study may have played a role in contrasting results due to differences in stimulus creation and presentation carrying the potential to affect the task (Barton et. al, 2014). In a real life scenario, everyone would be expected to respond to a firearm faster because of its potentially dangerous nature. Basic object detection can happen rather quickly, however, the dynamics of a real life situation can delay both detection time and accuracy.

A significant main effect was found for scenario and the patterns of mean differences suggest an interesting trend as seen in Figure 6. LE reaction times were slightly increased when presented with scenarios. Perhaps the nature of police work and familiarity with similar scenarios being dispatched affords a higher need to consider the scenario and its possibilities more thoroughly, resulting in a slightly slower reaction time. Previous research has not been done using scenarios, therefore this study's results cannot be examined against previous research. However, results of the present study highlight the need for a better understanding of contextual factors that may prime officers' perception. Law enforcement are primed by dispatch calls on a regular basis, so it is possible their sensitivity to the demands of changing scenarios may be more heightened. In general, both groups tended toward slower reaction times when presented with a high expectancy scenario (see Figure 7). These results suggest context plays an influential role in time of detection. Scenarios presenting a high expectancy primes participants to expect a firearm and may lead a participant to take longer to react when there is no firearm due to possible cognitive dissonance.

As expected, analyses of signal detection indices show all participants responded correctly most of the time, with LE participants showing a significantly greater number of hits and fewer misses. Consistent with previous research (Barton, et al., 2014), results indicate a pattern of greater overall accuracy amongst LE participants.

The ROC plots shown in Figures 3 and 4 graphically represent the difference in performance between groups. Group performance by scenario is represented in Figure 3. These ROC plots highlight the performance of both groups with LE participants showing a distinct pattern of greater overall performance, with a higher rate of hits and increased detection and response accuracy, represented by the area under the curve. Non-LE participants show a lower rate of hits and less consistency in their responses. The ROC curve shown in Figure 4 representing performance between LE by conditions of expectancy reveals the same pattern of performance, with LE participants consistently outperforming non-LE participants. A reduction in accuracy was exhibited by both groups when primed with high expectancies, which supports the hypothesis that context does have an effect on performance. LE performed best overall when primed by a low expectancy scenario, while non-LE performed best in the no scenario condition. Both plots show LE performance to be noticeably better than that of the non-LE sample. Not only do the plots suggest a higher level of accuracy for LE, they also suggest greater overall consistency in performance. The pattern of performance may be explained by the nature of police work and officers' tasks to identify objects in the hands of others on a frequent basis. Therefore, LE participants may be more sensitive to the task of differentiating between a threatening object and a neutral object. Another explanation may include the possibility that LE officers are simply more acclimated to the heightened physiological arousal involved in detection of a threatening object, which may allow them a greater ability to process information under distress. The level of accuracy could also be due to training and experience officers receive with firearms. Although the non-LE participants had firearm experience, perhaps the levels are incomparable.

Although data suggests reaction time is important, differences in reaction times between groups were not found. However, these results are of less importance than what the signal detection indices captured. Significant results for signal detection indices suggest LE participants were able to execute their decisions more accurately. In general, the ability to detect a threatening stimulus quickly is important, especially when there are potentially deadly repercussions. However, being quick to react carries far less practical significance than accurately executing the decision. LE participants' reaction times ranged from 20-50 milliseconds faster when compared to non-LE participants. Though this is not a substantial amount of time, this small amount of time may be all it takes for an officer to gain control of a deadly situation. While the results of this study show LE participants were not significantly faster, the accuracy of their reaction exceeded that of participants with no LE experience.

Practically speaking, these results raise interesting points for law enforcement. Evidence to suggest officers are more accurate than average citizens is reassuring. Unlike a typical citizen, LE officers do not necessarily have a choice in whether they become involved in a threatening situation or not. The nature of law enforcement brings a call to act; therefore evidence suggesting they react better than most is positive. Most citizens do not have to worry about their daily decisions having life threatening consequences. Not only are officers forced to make these difficult decisions frequently and under pressure, results from this study indicate they are doing so with greater detection ability and accuracy. Not only do these results extend previous research, but they cast a positive light on the abilities of law enforcement officers. Results provide a greater insight into the abilities of officers and the level of complexity that goes into situations involving use of deadly force.

Limitations

Several limitations of this study bear mentioning. First, any single study includes a trade-off between different types of validity. A controlled laboratory environment provides an increase in internal validity at the expense of external validity, affording the opportunity to more precisely target and measure aspects of performance underlying real-world detection of firearms. However, a gap necessarily exists between simulated performance and real-world performance, therefore a lab study can make results slightly less generalizable. The trade-off between internal and external validity can be solved across a succession of studies, should this line of research be continued. Second, LE was recruited from only local agencies. One must be cautious in generalizing results from any particular agency to other law enforcement environments. Third, the use of sixteen specific scenarios represents only a small slice of potential experiences that can be encountered by a law enforcement officer. Given the dynamic nature of police work, capturing all possible encounters would be nearly impossible. However, the researcher attempted to include a list of more common and realistic encounters, thus providing more ecological validity. Fourth, a controlled visual search task on a computer is distinctly different than an uncontrolled environment. The dynamic nature of an encounter between two or more individuals is not fully represented by the use of static images in a change blindness paradigm. Finally, several sampling characteristics may present as limitations. The smaller sample size may not fully allow demonstration of the underlying relationships between variables, however, several barriers exist to obtaining a sample of law enforcement participants. Also, both sub-samples had firearm experience that may have influenced their performance on the detection task.

Future Directions and Conclusions

Further exploration is needed to better understand the underlying variables that influence detection ability such as more dynamic scenarios and influential environmental factors such as position and number of stimuli, and light levels. Suggestions for future research include the use of more dynamic situations while using eye tracking to better understand how visual search is related to cognitive processing. Another suggestion includes examining physiological measures to get a better sense for how bodily reactions affect performance.

Use of deadly force by members of law enforcement occurs for a variety of reasons. Basic human ability to detect and quickly differentiate between stimuli is part of the foundation of decision making leading to use of deadly force. Thus, examining differences between trained and untrained individuals is an important step toward understanding susceptibility to error in decision making. The present study involves a conceptual shift by focusing on abilities of the viewer rather than primarily on characteristics of the person depicted in the stimulus. Research on more basic factors should not be overlooked and must be considered in order to understand higher-level factors such as race and emotion. The present study extends such examination by focusing on the impact of variation in environmental factors between LE and non-LE, as well as takes a step forward in filling the gap in the literature in regards to contextual influences on firearm detection.

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Table 1. Counterbalancing of stimuli

Scenario (32)		**No Scenario (32)**
High Expectancy	**Low Expectancy**	**No Expectancy**
8 firearm	8 firearm	16 firearm
8 neutral	8 firearm	16 neutral
Note: 32 image pairs each used twice (paired once with a scenario, once without) for a total of 64 trials. Neutral objects equally balanced between phone and wallet. All images counterbalanced by source of object: hoodie or backpack.		

Table 2. Means and (standard deviations) for all variables across factors.

Reaction Times

	Firearm	No Firearm	Scenario: No Expectancy	Scenario: High Expectancy	Scenario: Low Expectancy
LE	725.43 (53.11)	787.30 (58.92)	750.20 (51.62)	787.45 (88.85)	735.94 (64.03)
Non-LE	761.73 (125.10)	810.02 (108.30)	787.19 (108.50)	792.32 (117.73)	776.73 (132.80)
All	743.58 (15.25)	798.66 (13.86)	768.69 (13.49)	789.88 (16.64)	756.33 (16.56)

Signal Detection Indices

	Hits	Correct Rejections	False Alarms	Misses
LE	29.50 (1.91)	22.55 (6.51)	4.80 (4.18)	1.15 (.81)
Non-LE	25.42 (4.46)	22.00 (4.59)	3.63 (3.47)	2.53 (2.46)
All	27.46 (.55)	22.28 (.91)	4.22 (.62)	1.84 (.29)

Note. N = 39.

Figure 1. Schematic representation of the change blindness task. Presentation A will be displayed for 800ms followed by a 200ms mask. Then, presentation A’ will be displayed for 1000ms. Presentation A’ will disappear after 1000ms.

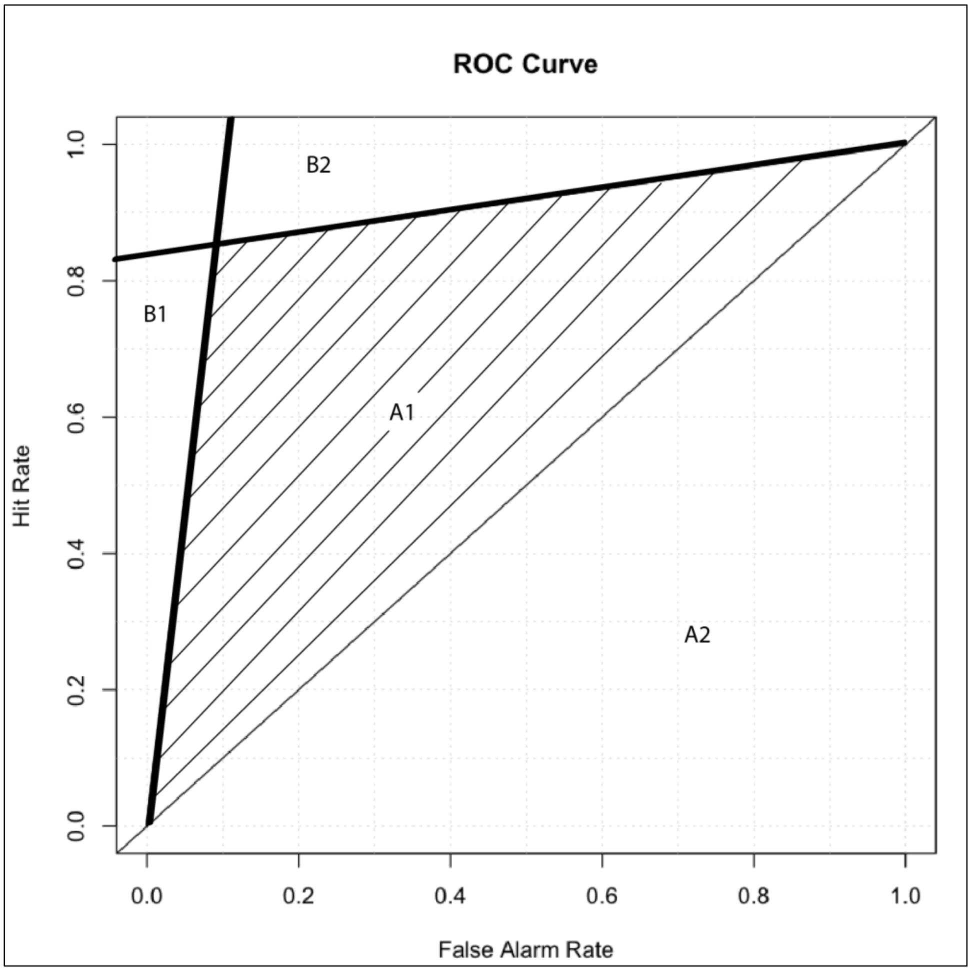

Figure 2. ROC curve to denote nonparametric measures
A’ as (A1 + A2) and B” from areas B1 and B2.

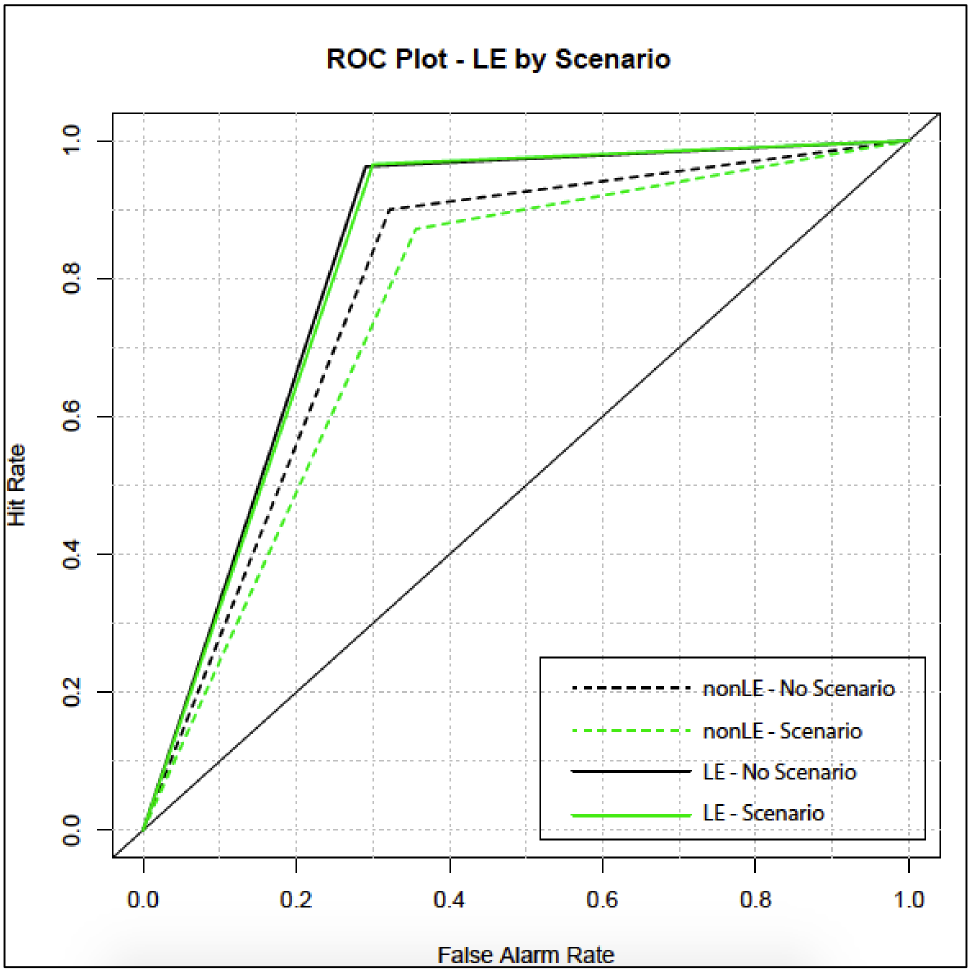

Figure 3. ROC curve showing results for levels of experience by scenario.

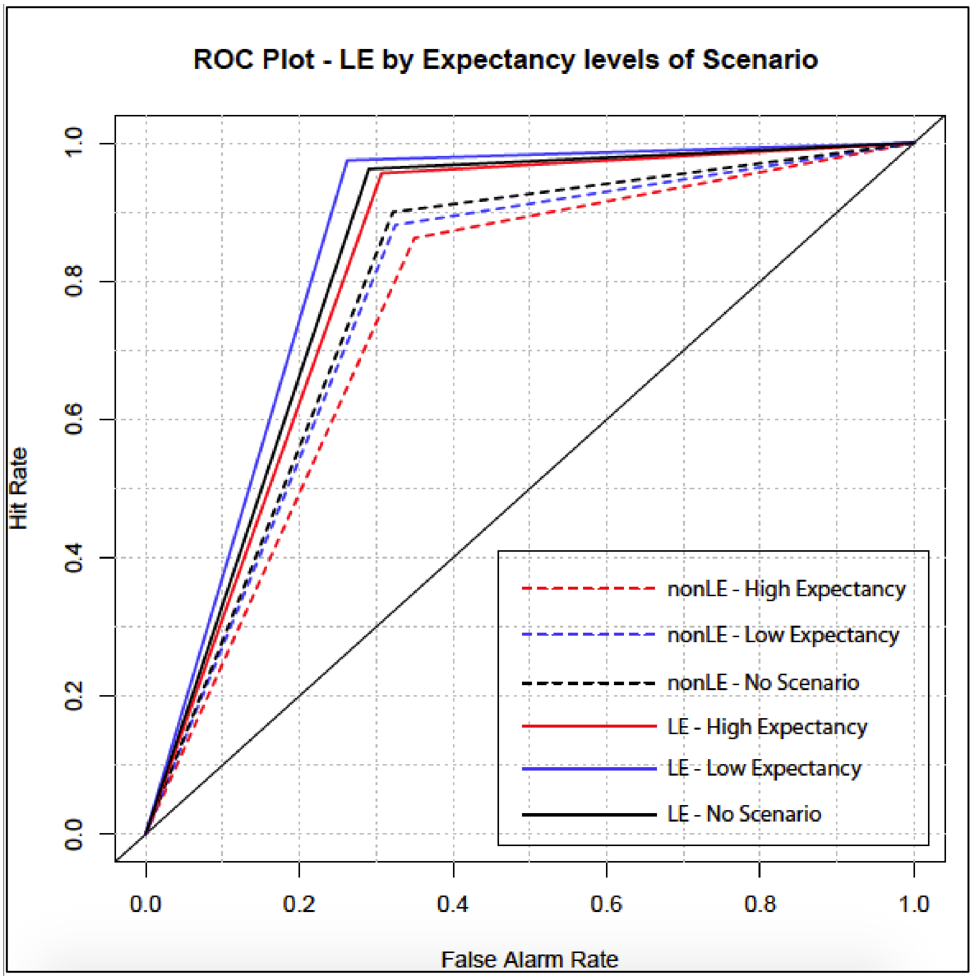

Figure 4. ROC curve showing results for levels of experience by expectancy levels within scenario.

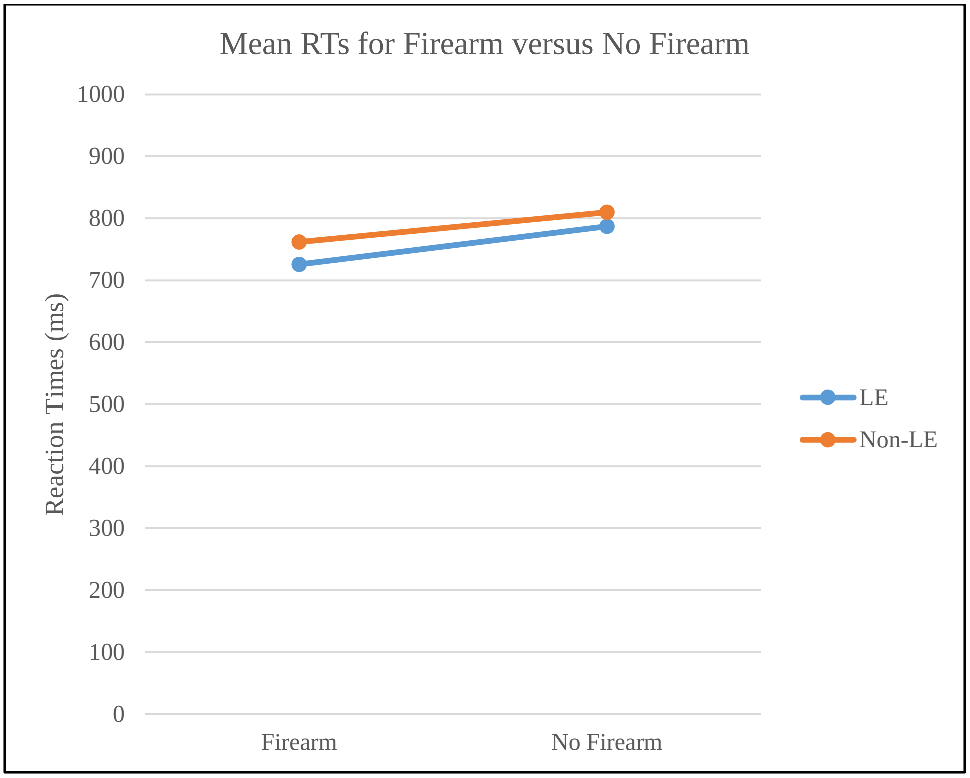

Figure 5. Mean reaction times for Firearm versus No Firearm.

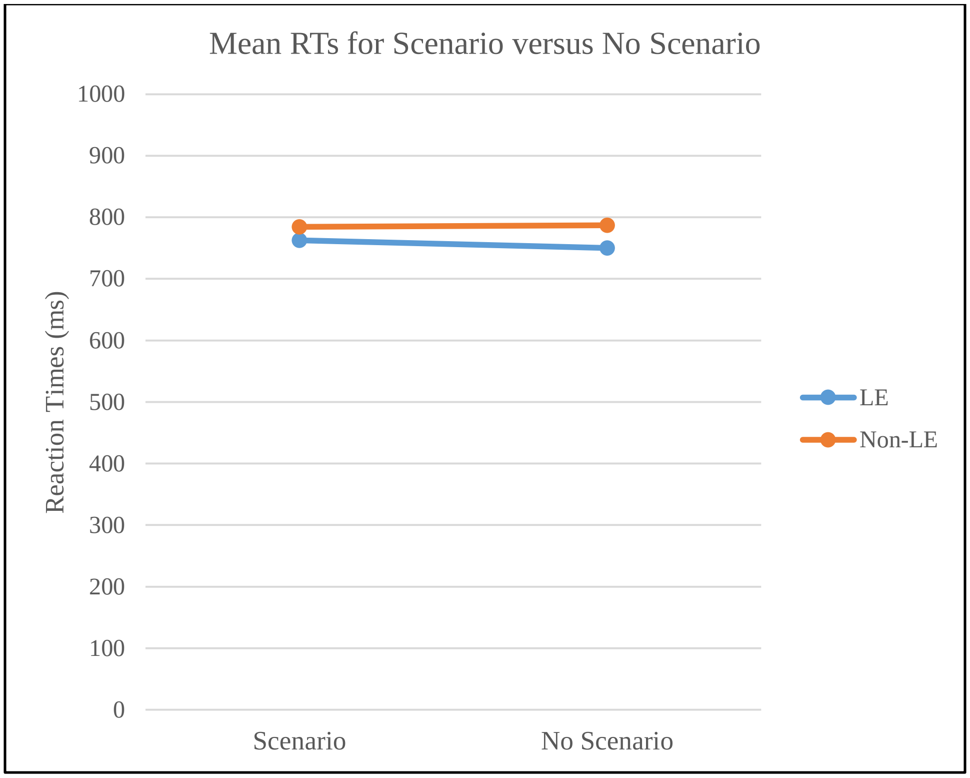

Figure 6. Mean reaction times for Scenario versus No Scenario.

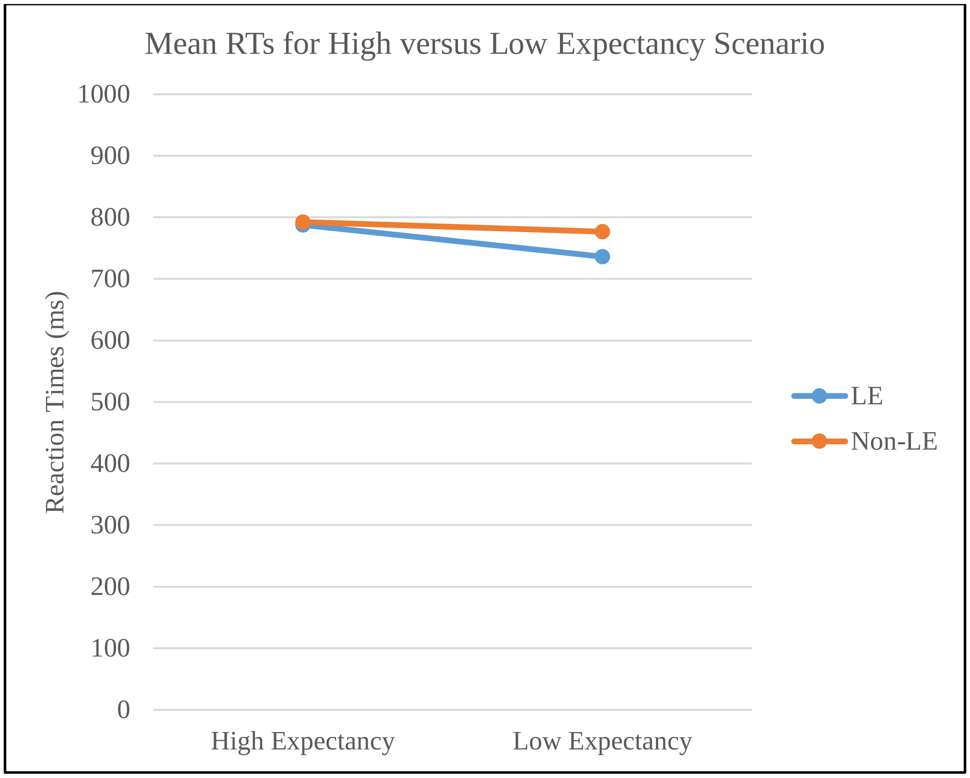

Figure 7. Mean reaction times for High versus Low Expectancy Scenario.

Appendix 1: IRB form

University *of* Idaho
Office of Research Assurances
Institutional Review Board
875 Perimeter Drive, MS 3010
Moscow ID 83844-3010
Phone: 208-885-6162
Fax: 208-885-5752
irb@uidaho.edu

To: Benjamin Barton

From: Traci Craig, Ph.D.,
Chair, University of Idaho Institutional Review Board
University Research Office
Moscow, ID 83844-3010

Date: 8/25/2014 8:32:25 PM

Title: Contextual Influences on Detecting the Presence of a Firearm

Project: 14-379
Approved: August 25, 2014
Renewal: August 24, 2015

On behalf of the Institutional Review Board at the University of Idaho, I am pleased to inform you that the protocol for the above-named research project is approved as offering no significant risk to human subjects.

This study may be conducted according to the protocol described in the application without further review by the IRB. As specific instruments are developed, each should be forwarded to the ORA, in order to allow the IRB to maintain current records. Every effort should be made to ensure that the project is conducted in a manner consistent with the three fundamental principles identified in the Belmont Report: respect for persons; beneficence; and justice.

This IRB approval is not to be construed as authorization to recruit participants or conduct research in schools or other institutions, including on Native Reserved lands or within Native Institutions, which have their own policies that require approvals before Human Participants Research Projects can begin. This authorization must be obtained from the appropriate Tribal Government (or equivalent) and/or Institutional Administration. This may include independent review by a tribal or institutional IRB or equivalent. It is the investigator's responsibility to obtain all such necessary approvals and provide copies of these approvals to ORA, in order to allow the IRB to maintain current records.

As Principal Investigator, you are responsible for ensuring compliance with all applicable FERPA regulations, University of Idaho policies, state and federal regulations.

This approval is valid until August 24, 2015.

Should there be significant changes in the protocol for this project, it will be necessary for you to submit an amendment to this protocol for review by the Committee using the Portal. If you have any additional questions about this process, please contact me through the portal's messaging system by clicking the 'Reply' button at the top of this message.

Traci Craig, Ph.D.

Appendix 2: Scenarios

High Expectancy Scenarios

1. A vehicle prowl is reported to be in progress. You are the first officer in the area. You notice a car door open. As you approach the vehicle, you encounter this person…

2. While on patrol, you are checking on a closed business that has recently been burglarized. You find this person near the door behind the business…

3. You are dispatched to a domestic in progress. Dispatch informs you there are firearms in the home. As you approach the residence, this person emerges from the front door...

4. You arrive at a burglary in-progress. Dispatch has informed you it was called in by a neighbor and the owners are thought to be out of town. You encounter this person outside the back door…

5. You are dispatched to a residence where there is a person who called saying they are thinking of killing themselves. The person is reported to be on their front porch with a handgun. When you arrive, you see the following person…

6. You are at a local motel to arrest a man with a warrant. You spot him outside his room…

7. You are dispatched to a local store where a man was spotted shoplifting by the store employees. His description matches that of a known local criminal who often carries weapons. You arrive and confront this man…

8. You respond to a report of a fight that has just occurred outside a local bar. The bouncer reported one of the men may have had a handgun. You arrive and see this man…

Low Expectancy Scenarios

1. A homeowner has reported a person in their backyard. You arrive on-scene and find this person standing in the backyard…

2. While on patrol, you are walking through a park and see this person sitting on a picnic table…

3. You are dispatched to a domestic in progress. Dispatch informs you there are no firearms in the home. As you approach the residence, this person emerges from the front door...

4. A homeowner has reported a possible burglary. Dispatch informs you the owner is outside the residence. You arrive and encounter this person on the front lawn…

5. Someone called dispatch to report a man in the parking lot of a local restaurant. The man is reportedly behaving strangely. When you arrive, you see the following person…

6. While you are on patrol, you spot a person you suspect may have a warrant for his arrest. You exit your patrol car and start talking with this man…

7. You are dispatched to a local store where a man was spotted shoplifting by the store employees. You arrive and confront this man…

8. You respond to a report of a fight that has just occurred outside a local bar. The two parties are reportedly separated and walking away from the bar. You arrive and see this man…