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Throwing a chair could save officers' lives during room entries

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Abstract

Law enforcement officers are sometimes required to perform building searches and room entries to search for, or apprehend, suspects. There have been several instances where officers have been shot while performing a room entry. To date, no research has sought to study methods to improve officer safety while performing room entries. Therefore, the purpose of this research is to assess the efficacy of utilizing everyday objects as a distraction device to slow the reaction speed of hostile suspects and give law enforcement officers a time advantage. The research utilizes a 1×2 experimental design with random assignment to conditions. A sample size of 113 is utilized to conduct the study. Data are presented using both a Bayesian and Frequentist style of analysis. The research suggests that law enforcement officers can slow suspect reaction times by deploying basic distraction techniques. The process of slowing suspect reaction time may save officer lives by allowing the officer to enter and assess the room while the suspect is distracted. The data utilized in this experiment and analyses can be accessed through email with the corresponding author.

Keywords

Policing, room entry, tactics, experimental design, reaction time

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On 10 March 2015, Deputy U.S. Marshal Josie Wells was shot and killed while trying to arrest a fugitive at a Baton Rouge, Louisiana motel. The suspect was shot by members of the arrest team (Officer Down Memorial Page, 2016).

Deputy U.S. Marshal Wells' death illustrates the dangers that police officers face when serving arrest warrants or conducting searches of buildings that may contain hostile suspects. One of the most dangerous times during these searches is when officers transition from the area they occupy to a new space, such as when officers are outside of a motel room and then move inside (Blair and Martaindale, 2013). This transitioning process (often referred to within the policing community as a room entry) is dangerous for two reasons. First, the officer is not able to see the entire room until he or she enters. Therefore, the officer does not know if a suspect is in the room or where the suspect is located. The entering officer must scan the room, detect the suspect, determine if the suspect is a threat, and then decide on the appropriate action to take (such as shooting or giving verbal commands). Second, the suspect knows where the police officer(s) must enter the room (i.e. the door). This allows the suspect to position him- or herself in a way that allows him or her to fire immediately as officers enter the room. Both realities place police officers at a distinct disadvantage when conducting room entries.

Is there something simple that can be done to increase the safety of police officers when they conduct room entries? This article attempts to answer this question by testing whether throwing a chair into a room before

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entering provides enough of a distraction to slow a suspect's reaction time.

Literature review

Use of force

Policing is an inherently dangerous profession. In 2015, 14,281 police officers were assaulted on the job and injured (Federal Bureau of Investigation (FBI), 2016). Furthermore, 41 police officers were feloniously killed in 2015. Despite the danger inherent in the job, police officers are rarely required to use force. Durose et al. (2007) suggested that force was used in only 1.6% of all police–civilian encounters. Of course, when force is used, the risk of injury to both officers and suspects increases (Kaminski et al., 1999; Smith and Petrocelli, 2002; Strote and Hutson, 2006; Williams, 2008).

Police use of force, particularly deadly force, has been thrust into the public eye following several high-profile police shootings including, but not limited to, those of Michael Brown, Walter Scott, and Akai Gurley (Associated Press, 2016). FBI data from 2011 to 2015 indicate that there are, on average, 439 justified homicides by police officers per year, ranging from 404 to 471 (FBI, 2016). The FBI dataset does not include non-lethal shootings or unjustifiable homicides. In addition, other unofficial collections of police shootings have identified numerous incidents not recorded in the FBI data. For example, the *Washington Post* (2016; People shot and killed by police this year) collected data from news reports, public records and original reporting, and found a total of 990 people shot dead by the police in 2015. This number is more than double the 442 justifiable homicides recorded in the 2015 Uniform Crime Reporting (UCR) data. The *Washington Post* collection captures many fatal police shootings that UCR data do not.

Although police officers are sometimes called upon to use lethal force during their jobs, this is rare. However, because the result of this use of force can have a devastating impact on the officers, suspects, and communities involved, it is critical that officers receive validated training on the use of lethal force and that research be conducted to improve this training. One such area of research utilized to improve law enforcement use of force outcomes is that of reaction time. The relevant literature regarding reaction time research is discussed.

Reaction time research

There are three common types of reaction time experiments (Luce, 1986). Simple reaction time studies feature only one stimulus and one response (e.g. press the button when the light turns on). Selective response studies require the participant to respond to only some types of stimuli and ignore others (e.g. press the button when you see a red light, but not when you see a green light). Participants in this type of study must react to the relevant stimulus and inhibit their response to the irrelevant. Choice reaction time experiments require the participant to give a specific response to a specific stimulus (e.g. press the right button when you see the red light and the left button when you see the green light). The room entry situation is a choice reaction time problem for the officer. The officer must enter the room, detect the stimulus (e.g. the suspect with a gun), and then choose a response (e.g. shoot, give commands or withdraw). The suspect can respond to this entry as a choice reaction time problem, a simple reaction time problem, or a selective response problem. A suspect who treats the situation as a choice reaction time problem, must see the officer entering the room and then make a decision (e.g. shoot, surrender, run). A suspect who treats the entry as a simple reaction, will simply fire at the first thing that enters through the door. A suspect who treats it as a selective response problem, must confirm that it is a police officer entering through the door (e.g. disregard any distraction items) and wait to fire at the officer when he or she enters.

Generally, reaction time increases with the complexity of the task (Brebner and Welford, 1980; Luce, 1986). Reaction times are fastest in simple reaction time studies and slowest in choice reaction time experiments. This would suggest that suspects who had already decided to fire at any officer that comes through the door would have a reaction time advantage because the officers would be reacting to a choice problem, whereas the suspects are reacting to either a simple or selective situation.

Including distractions, such as irrelevant flashing lights, has also been found to increase reaction times (Evans, 1916; Welford, 1980). This presumably occurs because the subject's attention is diverted from the task at hand to the distraction. To react to the relevant stimulus, participants must disengage their attention from the distraction, move their eyes back into position for the task, and then re-engage the task (Posner and Petersen, 1990). We expect this process to play out when a chair is thrown into the room before the officer enters.

Other recent research suggests that separate systems may handle reactive and intentional movements. Welchman et al. (2010) used pairs of participants and instructed the first (the reactor) to respond when the second (the initiator) began to push a series of buttons. The researchers found that the reactor executed the physical movements of the task 10% (21 ms) faster than the initiator. It appears that the physical movement of reaction is faster. However, the difference in the speed of the physical movements was dwarfed by the more than 200 ms that reactors took to start their physical movements. Thus, the actor usually wins because most of the reaction time process is taken up by processing what is happening and then preparing the reaction. Although there is an expansive body of research on reaction times in general, there is substantially less research on police reaction times.

Police-related reaction time research

Lewinski and Hudson (2003a) found that the average reaction time for police officers to pull the trigger of a gun in response to a light was 0.31 s. Three-quarters of that time (0.23 s) was taken up with processing and one-quarter (0.08 s) with the actual physical motion of moving the finger from the resting position and firing. This was consistent with other reaction time research, which found that reaction times to simple visual tasks were around 0.20–0.30 s (Eckner et al., 2010; Welchman et al., 2010). In a more complex scenario, where officers had to process information from a number of lights in different rows when making the decision to shoot, the reaction time almost doubled to 0.56 s (Lewinski and Hudson, 2003b). This was also consistent with general reaction time research, which indicates that complexity slows reaction time (Brebner and Welford, 1980; Luce, 1986). It is also important to note that the more complex scenario produced a number of shooting errors. Nine percent of officers shot when they should not have and 4% did not shoot when they should have (Lewinski and Hudson, 2003b).

Blair et al. (2011) reported an experiment that examined the ability of police officers to react to a suspect who threatened them with a gun. In this experiment, the suspect stood with a gun held by his or her side, or head. The officer's gun was out and aimed at the suspect, and the officer proceeded to give the suspect commands to put the gun down. In some of the conditions, the suspect complied and put the gun down; in others, the suspect raised his or her gun and attempted to shoot the officer. When this occurred, the officer was instructed to attempt to shoot before the suspect shot. Blair et al. (2011) found that suspects fired on average 0.01 s faster than officers. This difference was not significant and suggested a very small effect size for the difference in reaction times. This was despite the fact officers already having their guns pointed at the suspects.

When the Blair et al. (2011) exchanges were coded as wins (officer fired first), losses (officer fired last), or ties (both fired at the same time), officers were found to have fired first in only 39% of trials. This was despite the officers being highly experienced tactical (SWAT) operators and the suspects being inexperienced college students. Blair et al. argued that this occurred because the officer must see the suspect start to move, interpret the action as either compliant or hostile, choose to shoot if the action is hostile and then shoot, whereas the suspect has already decided on a course of action and simply executed the action. Although pointing the gun at the suspect shortened the physical part of the officer's responses, mental processing of the suspect's actions still took longer than the suspect's physical action of moving the gun into a firing position and shooting.

Another series of studies examined the ability of officers to shoot before suspects during room entries (Blair and Martaindale, 2013). In these studies, highly experienced tactical (SWAT) police officers performed a variety of room entry techniques with college students playing the role of hostile suspects. The officers knew that there would be a hostile suspect in the room during each run and where the suspect would be located. This eliminated much of the decision-making process that occurred in the study reported by Blair et al. (2011). The officers simply had to enter the room, detect the suspect, and then shoot. It took the officers an average of 0.55 s to complete this process. Suspects took an average of 0.59 s to fire when the officer entered the room. This 0.04 s advantage on the part of the officers was not statistically significant. Additionally, the suspects' reaction times were not normally distributed. A few of the participants took an extraordinarily long time to fire. When the runs were coded based upon who fired first, Blair and Martaindale (2013) found that officers fired first in only 43% of the runs. This was despite reaction during the study being a simpler task than it would be in real life. During an actual room entry, officers would need to make an assessment about whether the suspect was hostile, whether to shoot, and then shoot. This process would further slow the officer's reaction time. In the study, the officers knew they would be facing a hostile suspect and that no real harm or legal action would result from their actions. This made the decision to shoot much easier.

Gaining an advantage

Both general research on reaction times and police-specific research suggest that officers are at a reaction time disadvantage when conducting room entries. This has been recognized by the policing community (particularly the SWAT community) for some time. SWAT teams have developed a variety of techniques to help them gain an advantage when conducting room entries. One of the best known is the use of flash bangs. Flash bangs create a concussion, loud noise, and bright flash to disorient the occupants of a room. This device appears to be effective, but cannot be reasonably used in many room entry situations. For example, patrol officers cannot reasonably throw flash bangs into every room of a building while conducting a search triggered by the activation of a burglar alarm for at least four reasons. First, flash bangs are not generally carried by patrol officers; second, flash bangs are expensive; third, they can cause damage to the building; and fourth, they can cause injuries to innocent people in the building.

We, therefore, sought a more generally available, less expensive, less damaging, and less dangerous alternative. After discussions with many police officers, we decided to use a chair as a distraction device. The chair was selected to represent any medium-sized object (e.g. throwable) that an officer might encounter in the environment that he or she is searching, including fire extinguishers, boxes, and books. Specifically, we wanted to assess if deploying an everyday distraction device would slow suspects' reaction times.

Both traditional scholarly models and applied decision-making models can be utilized to explain how we expected the distraction technique to work. For the purposes of guiding this research, we utilized two models—the salience, effort, expectancy, and value (SEEV) model and the observe, orient, decide, and act (OODA) loop.

SEEV stands for salience, effort, expectancy, and value (Wickens & McCarley, 2007). Salience refers to the attention-capturing properties of objects (e.g. shapes, sounds). Effort refers to factors that inhibit someone from adjusting their attention (e.g. distance, head movements). Expectancy examines the likelihood of seeing an event or object at a particular location. Lastly, value refers to the perceived importance of directing attention to a particular event or object. The SEEV model is used to predict where an individual will focus his or her visual gaze to aid in decision-making.

The computational model for the SEEV model of attention is $P(AOI) = S + Ex + V - Ef$. That is, the probability of an individual directing attention to an area of interest (AOI) is determined by the attributes of the item (salience or S), plus the perceived expectancy of visualizing an item (Ex), plus the value of directing one's attention to the item (V). The model then subtracts the effort (Ef) required to direct the individual's attention to the item.

In terms of this study, the AOI for the participants is the doorway through which the law enforcement officer enters. The chair is thrown through the AOI, which makes it highly likely that the suspect will see it. There will be high expectancy because the suspect expects to see the officer come through the AOI. The chair is also moving and large, which increases its salience. In addition, because the chair is thrown through an area where the suspect's gaze is already oriented, little effort is needed to focus attention upon it. Finally, the chair should initially be perceived as a potentially high-value item, but when the suspect realizes that it is just a chair, the suspect should devalue the chair and return his or her gaze to the doorway. We predict that the chair will be successful in pulling the suspect's attention away from the doorway, but that the duration of this attention will be short because the suspect will quickly perceive that the chair is just a chair and return his or her gaze to the doorway.

Much SEEV research is concerned with vehicle and/or flight safety (Horrey et al., 2006; Horrey and Wickens, 2004; Wickens et al., 2008). Horrey et al. (2006) utilized the SEEV model to assess the way drivers allocate their attention to driving while interacting with in-vehicle technology (IVT), such as a navigation system or cell phone. For this experiment, the IVT was a computer screen displaying a phone number. Researchers altered the amount of time and frequency of which the phone number was displayed. Horrey et al. (2006) found that drivers could maintain lane position and utilize more visual scans to the outside world when less salience, expectancy, and value was placed on the IVT. However, during conditions where the IVT was given elevated levels of salience, expectancy, and value, drivers were less efficient at maintaining lane position (Cohen's $d = 1.1$) and spent 10% more time focusing on the IVT than looking to the outside world compared with the cases where the IVT was less prominent (Cohen's $d = 0.7$). In other words, during conditions where the IVT was more prominently displayed, drivers did not perform as well. The authors then performed a second experiment wherein they increased the complexity of the IVT by requiring drivers to process information from the string of numbers, rather than just recite the numbers on the computer screen. Horrey et al. (2006) found that participants made more errors in keeping within the lane when the IVT tasks were more difficult (Cohen's $d = 1.2$).

While the SEEV model is used in vehicle safety research to give researchers a computational model to assess driver attention, the law enforcement community has long utilized the OODA loop to describe the decision-making and reaction time processes performed by law enforcement officers (Blair et al., 2011; Boyd (The essence of winning and losing—unpublished lecture notes); Howe, 2005). The OODA loop is meant to explain any interaction that occurs in a competitive environment, and has been used to explain the competitive process in environments as diverse as sports and business decision-making. Boyd argues that all people utilize this process and that the person who moves fastest through the loop will ultimately disorient their opponent and win the encounter.

OODA stands for observe, orient, decide, and act. At the beginning of the encounter, the person must first observe what is happening. Officers entering a room must move into the room allowing them to see what is in it. Next, they must orient that information. They must place what is seen in the context of the situation. If the person is armed, is that normal for this situation? Is the person's behavior threatening? This orientation process gathers as much pertinent data as possible to utilize in the decision phase. The next phase involves deciding which action to take (e.g. shoot, back out of the room, or give commands to drop the gun), and finally officers act based on this decision. The process is a loop; therefore, officers start the loop again by observing the results of their actions and the suspect's reactions.

While the officer is moving through the loop, the suspect is moving through his or her own loop; however, because of the suspect's situation, that loop may be shorter. The suspect must observe the officer as he or she enters the room; however, because the suspect has placed him- or herself where the door is visible and that is the only point of concern, the suspect has less to observe, so the suspect may start the observe process faster. Next, the suspect must orient to seeing the officer enter. In the scenario we used, participants were told that they had just shot someone and then run into a building to hide from the police. They did not want to be arrested, and were instructed to shoot any police officer who entered the room. There was little to consider and only one decision option (shoot). This should have made the orienting and decision processes faster. Finally, they had to act (shoot). This is one area where the officer may have an advantage in both our study and in the field. Police officers have received formal firearms training and many suspects have not.

Because the suspect should have an advantage in moving through the loop, the officer must do something to disrupt the suspect's loop if the officer is to win. Our principle research question was: Can an everyday object be utilized to distract a potentially hostile suspect while a law enforcement officer conducts a room entry? In this study, that something was to throw a chair into the room. Our hope was that this would force the suspect to execute an OODA loop on the distraction. That is, the suspect would observe the distraction, orient that in this situation the distraction was irrelevant, decide to stop paying attention to the distraction, and finally act by returning his or her attention to the door.

Our hypotheses were as follows:

H1: Throwing the chair through the doorway will pull the suspect's gaze away from the doorway; whereas participants in the control condition will keep their gaze on the doorway until the officer enters.

H2: The reaction time of the participants in the chair condition will be slower than the reaction time of the participants in the control condition.

Method

Design

The study utilized a 1×2 independent groups design with random assignment to conditions. The two conditions included: (1) a control, in which no distraction technique was utilized; and (2) an experimental condition, in which a chair was thrown into the room as a distraction technique. Because the design incorporated random participant assignment to conditions, the participants were blind to which condition of the experiment they were assigned.

Sample

Participants were recruited from introduction to criminal justice classes at a large southwestern university by offering course credit for participation. The target sample was 50 participants per condition for a total sample of 100. This would give an approximate power of 0.80 to detect effects of a moderate size within the t-distribution ($d = 0.50$; Cohen, 1988). We oversampled to ensure that we maintained adequate power in case we lost any recruited participants to attrition or equipment failure. A total of 113 people completed the experiment; owing to technical issues, data on all 113 participants were not always available. Where data were lost is noted below. Sixty-six (57%) of the participants were male; 43% were Hispanic, 40% Caucasian, 15% African American, and 2% Asian.

Procedure

All procedures used in the study were reviewed and approved by the university's Institutional Review Board. This experiment took place at a secure law enforcement training facility. Participants were granted access to the facility to participate in the study. Following the signing of the consent form, a vision tracker was placed on the participant and calibrated. The vision tracker (version: Mobile Eye-Tracking Laboratory) was procured from Positive Science, LLC. The cameras record at 30 frames per second (fps) (0.03 s of data specificity; i.e. a new frame is visible every 0.03 s). The vison tracker consisted of an eyeglasses frame with two small cameras. One camera faced the participant's eye and captured pupil movement. The second camera faced forward and captured the participant's point of view. The cameras were connected by a cable to a laptop on the participant's back. The included software (i.e. Yarbus) allowed researchers to sync the two camera videos and superimpose a small dot where the participant was looking based on pupil orientation in relation to the forward-facing camera.

Participants were told that they were playing the role of a murderer that had just killed someone and then run into a building to hide from the police. Participants were also told that the police were searching for them, and they should shoot the police when the officer entered the room. The participant was placed in the blind corner of the room facing the doorway through which the officer would enter (see

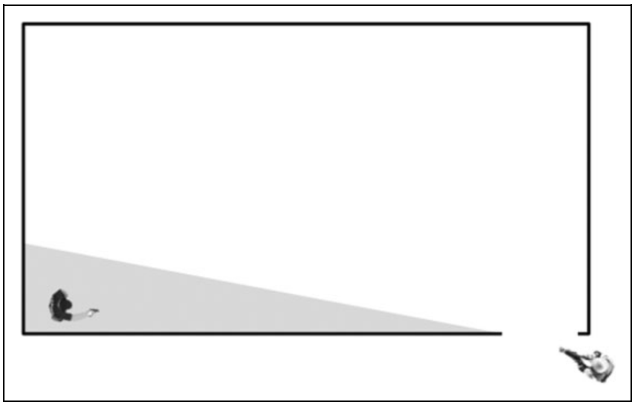

Figure 1. Blind corner diagram.

Figure 1). The light gray triangle represents the roughly 15% of the room that constitutes a blind corner. In this area, the officer cannot see the suspect without entering the room. The participant was then given a training pistol loaded with one force-on-force round. These are primer powered, soap rounds that are fired from an actual pistol, travel at approximately 300 fps, and leave a colored soap mark when they hit. Participants were instructed to fire this round so that they were familiar with how the pistol worked, and we were certain they could operate it. The experimenter then reloaded the pistol and left the room.

As the experimenter left the room, he left the door open and declared the scenario "hot". This was the cue to the member of the research team playing the role of the officer (officer) that he could now perform the entry procedure. In the control condition, the officer simply made entry into the room and fired a single blank round at the suspect. In the chair condition, a lab assistant threw the chair perpendicularly through the doorway at least 10 ft into the room. The room is 25 ft wide, so there was approximately 15 ft for the chair to travel after impacting the floor. The officer immediately made entry behind the chair. The lab assistant was simulating the second officer that would normally be present when officers search buildings. This officer would normally enter the room after the first, but in this study, the lab assistant stayed outside the experiment room as the study was designed to test the first shot.

The entering officer was equipped with a blank gun because the eye tracker equipment worn by the suspects did not allow the suspect to wear the protective headgear needed to ensure safety when using the force-on-force rounds. Both the officer and participant had a single round to fire. Once both had fired, the lab assistant called cease fire. Both the officer and participant then placed their firearms on the ground.

The lab assistant then recorded whether the entering officer was hit by the participant's shot and conducted a final calibration of the eye tracker before dismissing the participant. An additional camera placed perpendicular to the officer and participant also recorded the entire room during the entry. This camera was utilized as a back-up if the researchers needed an additional viewpoint to determine and/or verify room entry or shot times.

Results

Analysis plan

We utilized a Bayesian framework for analysis of the data. Bayesian analysis begins with an initial belief about the distribution of the phenomenon in question, known as a prior distribution. The program then updates this based on new data. In an experimental design, the new data are those collected to test the research hypotheses. The updated distribution is known as a posterior distribution and represents credible parameter estimates based on the combination of the observed data and the prior distribution.

Researchers can select the prior distribution based on prior knowledge of the phenomenon. In the case of the analyses reported here, we chose weakly informative priors because of the lack of research available to inform our initial beliefs more strongly. These weakly informative priors allowed the current data to strongly influence our posterior distributions. That is, the parameters of the posterior distributions in these analyses were almost completely the result of the current data. This process allows findings in this article to act as the prior distribution for future analysis.

The Bayesian approach also allowed us the ability to use models that were appropriate to the data structure. Using an appropriate data structure avoids many of the assumptions of traditional frequentist models (such as normal distributions and equal variance, which our data violated) or the kludges that are used when these assumptions are violated.

Unlike traditional frequentist statistics which produce p values that are used as part of the Null Hypothesis Significance Testing (NHST) paradigm, Bayesian analysis does not produce p values. In the place of p values, we report 95% credible intervals for means and effect sizes. These intervals represent the 95% most likely values for the relevant parameter (mean or effect size) given the prior and the data. We consider 95% credible intervals of effect sizes that do not contain 0 as indicative that it is unlikely that the observed differences between means is 0 in the population. This is quite similar to how frequentist confidence intervals are interpreted. Although there are distinctions between Bayesian credible intervals and frequentist confidence intervals, discussing these differences is beyond the scope of this article (see Kruschke, 2015 for a detailed discussion). For readers who prefer more traditional analyses, we include frequentist tests for each of the Bayesian models in the endnotes.

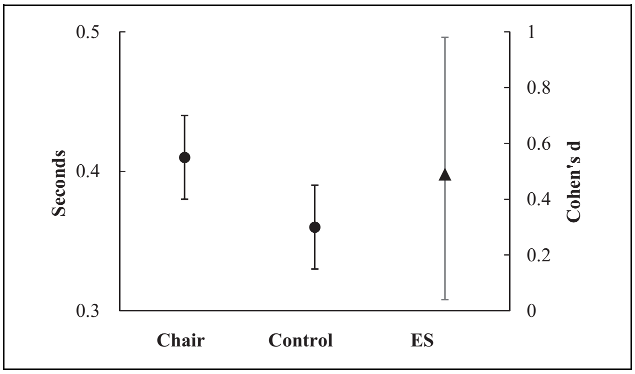

Figure 2. Suspect reaction times and effect size.

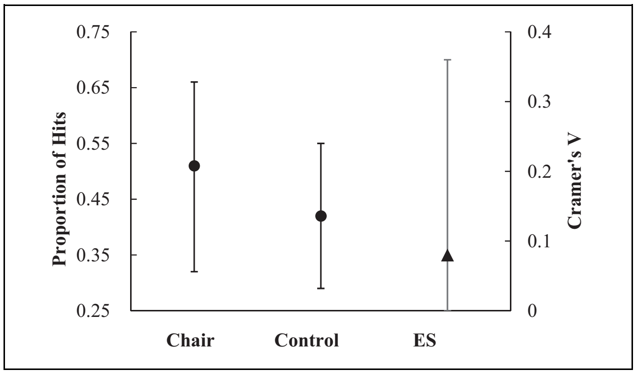

Figure 3. Difference in proportions: shot accuracy. ES: Effect Size.

Furthermore, two coders were utilized to ensure interrater reliability. One coder completed 100% of cases, whereas the reliability coder coded 20% of cases to ensure adequate interrater reliability. Throughout the article, these interrater reliability statistics are reported via an intraclass correlation (ICC) coefficient.

Gaze pull

Gaze pull was assessed using data from the vision tracker. The first camera on the tracker (the scene camera) recorded the suspect's general field of view, and the second camera (the eye camera) recorded the orientation of the pupil. Software then combined both images to produce a composite. This composite image showed the scene that the participant was observing, with a mark showing exactly where the eye was focused. Thus, it was possible to see exactly what the suspect was looking at and for how long.

Gaze behavior

Suspect gaze behavior was assessed using a dichotomous variable (i.e. suspect's gaze left the door/not leave the door). Fifty-seven of the 59 participants (97%) in the chair condition moved their gaze away from the door to track the chair when it was thrown into the room. None of the control condition participants moved his or her gaze away from the door before the officer entered. Throwing the chair was clearly effective at drawing the participants' gaze away from the doorway. *Hypothesis 1* was supported.

Participants in the chair condition had their gaze pulled away from the door for an average of 0.34 s (95% CI 0.30, .37). That is, for approximately one-third of a second the participants were not focusing their vision on the door. A high degree of interrater reliability was found for this variable (intraclass correlation coefficient (ICC) = 0.985; 95% CI 0.955, 0.995; $p < 0.001$).

Suspect reaction time

Suspects in the chair condition shot at the chair in 21 of the 58 chair runs. One of the suspects in the control condition failed to fire. These runs were removed from further reaction time analysis. A high rate of interrater reliability was found for this variable (ICC = 0.995; 95% CI 0.989, 0.998; $p < 0.001$). In the control condition, the suspect reaction time averaged 0.36 s (95% CI 0.32, 0.40). Reaction time in the chair condition averaged 0.41 s (95% CI 0.38, 0.43). The observed difference in means (0.05 s; 95% CI 0.01, 0.10) suggested a moderate effect size for the impact of throwing the chair on suspect reaction time (Cohen's d = 0.49; 95% CI 0.04, 0.98) that was not attributable to random assignment error (see Figure 2)[1]. *Hypothesis 2* was supported by the data.

Suspect accuracy

Although not part of the primary research question, participant accuracy was also captured and is discussed next. As previously mentioned, the participants were armed with a force-on-force training gun. If the participant's shot struck the officer, it was recorded as a hit. Hit data were not recorded in five cases due to an issue with the camera placed in the room (three were in the control condition and two in the test condition). Additionally, we removed cases in which the participant fired at the chair before the officer entered the room to avoid skewing the hit data. In the remaining cases, officers were hit 17 of 33 times when the chair was thrown, for a proportion of 0.51 hits to misses (95% CI 0.35, 0.68). Officers were hit 22 of 53 times in the control condition, for a proportion of 0.42 hits to misses (95% CI 0.29, 0.55). The resulting proportions and confidence intervals are presented in Figure 3. As seen, the 95% credible intervals overlap almost fully. The difference in proportions was 0.10 (95% CI –0.11, 0.30). These differences suggest any observed effect for throwing a chair may be attributable to random assignment error. Throwing the chair did not have a large impact on suspect accuracy if it had any effect at all (Cramer's $V = 0.08$, 95% CI 0, 0.36)[2].

Discussion

We found that throwing a chair into a room consistently distracted a suspect's attention away from the doorway. This distraction also slowed the suspect's reaction time to an officer entering the room by an average of 0.05 s. Although this seems like a very small difference, previous research has suggested that 0.05 s could be critical in allowing officers to fire first. For example, Blair et al. (2011) found that the difference in reaction times when the officer had his gun pointed at a suspect and the suspect moved to fire at the officer was a non-significant 0.01 s in favor of the suspect (Blair et al., 2011). Gaining 0.06 s could be the difference between life and death for an officer conducting a room entry.

Additionally, about one-third of the suspects fired at the chair before officers entered the room. We considered these to be wins for the entering officer as the suspect's first shot would miss the officer. During the time taken for the suspect to realign his or her weapon, the officer would have had an opportunity to shoot the suspect. Future iterations of this line of research will allow the suspect to fire multiple rounds to flesh out this issue further.

It is important to note that this is not the complete picture. For the sake of experimental control, we made the scenario simplistic. Several situational variables could have been manipulated to make the scenario more complex for the participant. We could have added multiple officers, altered the room lighting, or placed suspects behind concealment or cover to name only a few possibilities. All these would have obstructed the view or increased the complexity of the decision-making process for the participant. Given the well-established finding in the reaction time literature that complexity increases reaction time (Brebner and Welford, 1980; Luce, 1986; Posner and Petersen, 1990), we would expect these changes to slow participants' reaction times. We also only considered the suspect side of the exchange. Future research should examine the effects on distraction techniques on both officers and suspects.

Our findings highlight how dangerous room entries are to the entering officers. Throwing a chair into the room allowed our entering officers to encounter suspects with slower reaction times, but this advantage was moderate and, in many cases, the suspect would still be able to fire even if the officer fired first.

The danger the room entries pose is supported by the fact that every year several officers are killed while conducting them. Many officers insist that they have conducted hundreds or even thousands of room entries and never had a negative result; therefore, their techniques and tactics are sound. They may be correct. However, we believe there is a feedback problem. When conducting a room entry, the vast majority of suspects that officers encounter simply do not attempt to fight the police. No matter what techniques or tactics were used, the suspect simply surrenders. Thus, the tactics may appear to be sound, but we cannot be certain whether they would work if the suspect had fought. It is only those rare cases where the suspect attempts to fight that we receive feedback about the effectiveness of tactics. Too often, this feedback suggests that the tactics are ineffective. Unfortunately, the evidence of this ineffectiveness is injured and dead officers.

Limitations

As with all research, this study is not without limitations. We purposely make this study simple to parse out differences while trying to limit the number of confounding variables. For instance, we only gave the suspect a single shot. Although having multiple shots would not impact the initial reaction time data, multiple shots may have impacted the accuracy data by limiting the suspect to a single shot. Furthermore, the suspects were equipped with the vision tracker. When wearing the vision tracker, the participant is unable to have adequate safety equipment to allow for the officer to fire a projectile. For this reason, we were unable to capture officer accuracy. Lastly, the vision tracker records data at 30 fps. This results in a 0.03-s level of data specificity (i.e. each frame of video occurs every 0.03 s). Higher-speed camera systems would allow for a more precise level of measurement; however, the current vision tracking technology does not allow for the increased speeds. Even with recording at 30 fps, the difference between conditions was great enough to show a moderate effect.

Future research

Further research into this and other tactical policing issues is clearly needed. For instance, while the current research was focused on the suspects' ability to perform, we need to assess officers' ability to making a decision effectively and correctly while performing a distraction enabled room entry. These future endeavors entail, at minimum, further exploration of physiological analysis, vision tracking, decision-making, shot accuracy, and response latency as they relate to room entries. Furthermore, future iterations of this study need to be completed to assess physiological stress on suspect performance. In the meantime, we would encourage officers to understand that room entries are dangerous and that other options (such as waiting for the suspect to leave his or her house or calling for a negotiator) should be utilized when possible. If the officer must conduct a room entry, throwing a chair or other plainly visible object might save the officer's life.

Endnotes

1. For those who prefer traditional (frequentist) statistical testing, we include the following analysis. A Shapiro–Wilk normality test indicated that the suspect reaction times violated the normality assumption ($W = 0.93, p < 0.001$). We then conducted a boxplot and observed three outliers in the data. All these outliers were participants who were extremely slow in their reaction times. Two were in the control condition and one in the experimental condition. These points were removed, and another normality test was conducted. This test was not significant ($W = 0.98$, $p = 0.10$) suggesting that the normality assumption was not violated when the outliers were removed. A *t*-test was then conducted to examine the differences between means with the outliers removed. This test was significant (t – equal variances not assumed $_{(85.22)} = 2.85$, $p < 0.01$; 95% CI 0.02, 0.09) and suggestive of a moderate effect size for the effect of throwing the chair on suspect reaction time (Cohen's $d = 0.61$; 95% CI 0.18, 1.04).
   Some might prefer to deal with non-normality using a non-parametric test. A Mann–Whitney *U*-test is one appropriate non-parametric test for the suspect reaction times in this study. This test was significant ($U = 1361$, $p < 0.05$) and suggestive of a moderate effect size (Cohen's $d = 0.66$).
   These tests, then, are consistent with the Bayesian results. If anything, the Bayesian results are somewhat more conservative. The Bayesian results also have the added benefit of being derived from a logically consistent framework and providing an answer to the question that was actually asked, as opposed to proof that the always false null point estimate was in fact false and then committing the logical fallacy of transposing the conditional to claim that the research hypothesis is true.
2. Here again we offer a more traditional statistical test for those that are more comfortable with frequentist statistics. A test of the proportions of hits comparing the experimental and control groups was not significant ($X^2 = 0.47, p = 0.49$; 95% CI –0.14, 0.34) and suggestive of a small effect for throwing chair (Cramer's $V = 0.10$; 95% CI, 0, 0.33).

Conflict of interest

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