Abstract

Gun crime is a growing concern in society.  Law enforcement works to confront gun violence by surveillance monitoring.  Research by Sweet and Meissner (2015) showed that law enforcement officers and laypersons are no better than chance at spotting suspicious behaviors or weapons.  In this study, researchers applied behavioral cues from Sweet and Meissner and integrated them into a video interface. Researchers collected data from law enforcement officers and naive controls. Each viewed videos and made judgements whether someone was concealing a weapon. Results of this study support previous findings, with both groups performing poorly and lacking confidence in their decisions.  Using the list from the previous study had little effect, possibly due to lack of user training.  Data on the interface’s usability was collected, and showed favorable responses from users.  Findings contribute to concerns about the accuracy of surveillance monitoring and need for improved training for surveillance monitors.

With recent events like the Boston Marathon bombing and the Charleston, South Carolina shooting, public safety is a heightened concern to many.  One way human computer interaction has worked to detect and prevent events like this from happening is the use of video surveillance monitoring.  Technology has been quick to adapt, and systems are getting better at detecting faces or bodies in motion and have the potential to identify guns in surveillance videos (Darker, et al., 2009; Darker, Gale, & Blechko, 2008; Kmieć, & Glowacz, 2015), but there is still a need for someone to monitor the video feed for most surveillance systems.  Although surveillance systems are able to detect firearms in some instances, the rate of error is high, particularly with low-resolution images that are commonly used in closed circuit television (CCTV) (Darker, et al., 2009).  CCTV research in the United Kingdom has found that even when the surveillance system is monitored by a trained observer, there is no noticeable increase in the detection of gun crime (Darker, Gale, Ward, & Blechko, 2007). Due to the limitations in monitoring and automation, there is still a need for behavioral research to train law enforcement officers to monitor video feeds.

Behavioral researchers have long worked to understand both how people make decisions and how individuals act when trying to conceal actions that would make them look suspicious. While most research had focused on facial expressions of emotion, de Gelder (2009) illustrated the need to inspect the relationship between body language and emotions. Bodies can convey more because they reflect actions, as opposed to reactions. When someone moves, they have a goal in mind and that can be emotionally charged, making the whole body more worthwhile to examine than facial emotions. One of the implications of this understanding of bodies is that they are more easily identified in surveillance videos and at a distance. This makes de Gelder’s research the starting point for confronting the need for advances in technology and training for those working on identifying behaviors of concern, focusing on the body instead of the face.

Behavioral research has also examined one’s ability to make a judgement about someone’s emotions with a small sample of behaviors. Quick samples of behaviors, usually in just a matter of seconds, can lead to accurate judgments (referred to as “thin slicing”, see Ambady, Bernieri, & Richeson, 2000 for a more detailed explanation). Research by Ambady, Bernieri and Richeson (2000) found that viewers can make accurate judgements from clips that are less than one minute equally as well as those longer than five minutes. The authors also found that accuracy of judgements can improve when given feedback. This research promotes the notion that with proper training, individuals are capable of accurately identifying deceptive or suspicious behaviors, even in short video clips. However, before researchers can begin to investigate how thin slicing effects threat detection accuracy, research must first establish not only what behaviors should be focused on in the minimal time available, but also what the current baseline accuracy rate is when individuals have more time to make decision.

In an effort to better understand baseline accuracy rates at detecting suspicious behavior, Sweet and Meissner (2015) conducted a study in which law enforcement officers and naïve controls watched videos of individuals who may or may not be concealing an unstable device (e.g., an open water bucket in a backpack).  The authors found that both law enforcement officers and controls (without any training or experience) performed no better than chance odds and that all participants were likely to conclude that there was an object concealed even when there was not, i.e. showing a bias toward seeing threat.  This bias can create complications including the time spent by law enforcement officers focusing on the wrong individuals, frustrations from innocent people confronted as suspicious, and money spent on systems that fail to improve the safety of people (Davis, et al., 2013).

The goals of this present study are to test the efficacy of [name your software] and further explore what nonverbal behaviors may be associated with attempts to conceal a firearm

**Methods**

**Participants**

Participants were XX active law enforcement officers from two Midwestern police departments (M=X) and XX naïve controls from a large Midwestern university (M=X).  Law enforcement officers were compensated $100 for participation and university students were compensated $25 for participation.

**Design**

The design of the experiment is a 2 Experience (Law Enforcement Officers vs. Controls) x 2 Ground Truth (Weapon Present vs. Not Present) mixed design.  The experience manipulation was between subjects and the ground truth manipulation was within subjects.  The dependent variables of interest were accuracy of judgement, confidence, number of behaviors identified, and perceived usability.

**Materials**

**Videos/Stimulus Material.** Participants viewed 8 video clips of two different Caucasian male targets walking approximately 120 yards toward the entrance of a secured courthouse. Each target had four opportunities to enter the courthouse. Targets were instructed that they must conceal a police issue duty weapon (e.g., Glock 21) on their person two times. Targets were further instructed to choose which part of their waistband they wanted to conceal the weapon and that their goal was to enter the courthouse without being identified as the “threat” (Sweet & Meissner, 2015). A video camera tracked each target as he walked across the street and into the courthouse. The average video length was 42 seconds.

**Video Player.**The interface for this project was created using the QT Creator software. QT Creator includes packages that assist in the creation of an interactive video player window (Figure X). The window itself features the video player as well as forms that hold all the qualitative behavioral data. Behind the scenes, the data that is collected from user input will be sent to an Excel file to be stored.

**Procedure**

Study participants viewed each video on the [name the software] and were asked to perform three primary tasks. First, participants were asked to identify characteristics about the target’s movement patterns that informed their decision. Second, participants were asked tomake a “yes” or “no” judgement about whether or not the individual was concealing a weapon and state how confident they were using a 50% - 100% rating scale (Appendix X).

Finally, once participants finished Tasks 1 and 2, they completed a usability survey for [name the software] adapted from Calisir and Calisir (2004). This measure was used to assess participants’ views on the interface (e.g., “I found the system easy to use.”) and all questions were answered on a 7 point Likert scale with 1 representing strongly disagree and 7 representing strongly agree (Appendix X, adapted from Calisir & Calisir, 2004).  An additional section was included to get more qualitative feedback from those using the interface.

**Results**

 **For this summer project, only data from controls was collected. These are preliminary results.**

**Overall Accuracy and Confidence of Decisions**

So, I think here we can talk about the overall accuracy of the decisions. We can calculate the 4 types of identifications made (hit, miss, false alarm, correct rejection) and the corresponding confidence for those decisions.

**Body Parts/Areas Selected**

Here I think that we should discuss the frequencies that certain body parts/areas were selected. We can break this down by accuracy or individual in the video.

**Usability Survey**

Before this study was conducted, data had been collected on what behaviors one notes when seeing concerning behavior or trying to determine whether or not someone is concealing.  In this study, those indicators were further analyzed by the interface.  Data from this study now shows the frequency of selection and order of selection of those behaviors.  An example of the data output can be seen in Figure X.  The Yes/No responses of the users were compared in groups

Between-subjects analyses were performed to analyze differences between the groups on accuracy and confidence.  Law enforcement performed (better/at the same level/worse) than laypersons with significance (). These data can be viewed in Table X.

 For the usability portion of the study, the goal was largely to just receive feedback.  Results showed positive responses to how useful the interface would be to their job (M =, SD =).  This portion of the survey (questions X,Y, and Z) was only analyzed for law enforcement due to the lack of job applicability for lay persons.  Responses by question can be found in Table X.  An important piece of data was that when users were asked “INSERT RELEVANT QUESTION” they reported on average XXXX.

In regards to our hypothesis about accuracy, the officers who completed this study performed at a base level of (M = , SD = ).  In addition, naive controls showed no improvement when using the interface (M =, SD = ) compared to Sweet & Meissner’s previous findings.  The overall confidence rating when making a decision was as follows: officers and controls showed low confidence in their judgments. These data allow us to further examine the effects of the interface on detection of concealed weapons.

**Discussion**

In this study we have applied past research on suspicious behavior with a user interface to examine what impact technology has on user responses as well as collect more behavioral data.  These findings expand the research done by Sweet and Meissner (2015).  Data was collected using their list of predefined behaviors to see if it improved accuracy in determining whether or not someone was concealing a weapon.

Our hypothesis that accuracy would not improve for both groups performance was supported.  Results showed that law enforcement performed no better than naive controls (regardless of training) and that performance was very poor, only getting the judgement right X% of the time.

For this project, there were several limitations that need to be taken into consideration. Understanding of behavior was variable amongst the users. Experience in behavior research ranged from none to graduate students in Psychology and Law. This posed a challenge to the “naïve” nature of our controls. In addition, we had a fairly small sample size for this preliminary analysis. Future research will use more to validate findings. The location of the study was a shared workspace, so several participants experienced distractions, which may have influenced their focus on the study.

In the broader sense of behavioral research, this indicates a need for better training when law enforcement is monitoring CCTV.  This supports past research that surveillance monitoring may not be effective at preventing crime (Darker, Gale, Ward, & Blechko, 2007).  In the future, this interface can be edited to reflect user responses on the usability and needs of law enforcement.  Several features are programmed in, like the ability to store user clicks on the video, which can be used to later include features like body part selection on the video (often used in CCTV automation) and highlighting parts to reflect areas of concern.

The long term goal of this project is to create an algorithm to calculate risk based upon behaviors identified.  There is more data to be collected on how people identify suspicion, which is one of the next steps of this project.  By better understanding what behaviors one exhibits that are suspicious, training can then work to more proactively teach people to identify those behaviors.  A next step for this project and data collection on LEO decision making would be to see if applying the behavioral cues to a training would make a difference in accuracy of judgements as well as allowing for more practice identifying those in practice videos.

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