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Master Thesis

Exploring the validity of behavioral cues perceived to indicate violence in the context of police-citizen interactions

| Navn: | Spencer King, Aleksandra Moksnes |

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Aleksandra Moksnes

Spencer King

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Thorvald Hærem

Content

Summary

The aim of this thesis is to explore whether behavioral cues, which are thought to be predictive of violence, correspond with violent behavior in police-citizen interactions. The method applied consisted of qualitatively reviewing fifty-six existing video recordings of actual police encounters and subsequent coding in NVivo software. Further, the data was transformed and analyzed in a quantitative manner. Results indicated that a number of behavioral cues correlated with violent behavior, while no relationship was found between a subset of these behaviors and violence. Notably, not all suspects who exhibited valid behavioral cues during an encounter become violent, indicating that a nuanced approach is needed when evaluating the relevance of such behavior during a given interaction. The results of this study contribute to a relatively unexplored field of research on behavioral cues in the context of police-citizen interactions. The findings presented here suggest that future research on behavioral cues in the context of police-citizen interactions is warranted.

1. Introduction

Police officers are often faced with the risk of injury or death during police-citizen interactions, which can rapidly transition from being a trivial encounter to life threatening situation (Dunham & Alpert, 2009). Consequently, police officers rely on a variety of techniques to mitigate these risks. For instance, police officers commonly make inferences about individuals they are interacting with based on behaviors and mannerisms in an attempt to detect any threat that may exist. This tactic is based on the assumption that an officer can recognize a sign of an impending attack by interpreting a suspect's behavior.

There is much debate and conjecture about which, if any, behaviors actually predict violence. Most sources base their assumptions on anecdote or personal experience rather than empirical methods. Ad-hoc instructional guides about these behaviors are widely disseminated in both official and unofficial police training material, and the range and substance of behaviors covered varies widely. Even so, many non-empirical assertions about these behaviors have been promulgated by official and non-official training material for police. A variety of terms are used to describe this concept across law enforcement educational sources, such as "assault cues" (Fight Science, 2017), "pre-fight indicators" (Young, 2018), or "pre-attack indicators", as mentioned by Johnson (2018) and Kahn, McMahon and Stewart (2017). Johnson (2017, 2018) also uses the terms "interpersonal social cues" and "behavioral cues" throughout his research. Arguably, *behavioral cues* is a term that captures the most essential aspects of this concept, and is used in this thesis to refer to *observable mannerisms, body language, and/or vocalizations that are thought to be exhibited by an individual prior to becoming violent within the time-frame of a given interaction.*

There is scholarly research that explores the connection between body language and deception (e.g. DePaulo et al., 2003; Vrij, Semin & Bull, 1996), and violent intent (e.g. Johnson, 2015; Johnson, 2017; Johnson & Aaron, 2013), but there is limited research on behavioral cues that has been conducted outside of controlled settings and the ecological validity of these findings remains largely unknown. Until very recently, no studies had been conducted using observational methods in a naturalistic setting to investigate the validity of these behavioral cues in the

context of police-citizen interactions. Consequently, there is a large gap of knowledge regarding what, if any, relationship exists between these behaviors and subsequent violence.

It can be argued that some officers' split-second decisions to use deadly force are derived from interpreting a suspect's behavioral cues. In this way, there has been increasing attention in the media regarding tragic episodes when deadly force is used on unarmed civilians by officers who misperceived their behavior as a threat (e.g. Derench, 2017; Bever, 2016; Blankstein & Associated Press, 2017). Although factors such as training, experience, and environmental conditions undoubtedly contribute to such outcomes, these cases highlight the inherent risk involved when officers rely on interpretations of behavioral cues to trigger use of deadly force.

While it is beyond the scope of the present study to conclusively determine whether or not behavioral cues are capable of reliably predicting violence, it is possible to investigate if these behavioral cues are related to violence in the first place. If evidence of this relationship were established, there would be a stronger foundation for subsequent research to further explore this phenomenon, and perhaps enrich police training curriculum; alternatively, a lack of evidence would also implicate a need for future research to be conducted for the sake of deconstructing widespread assumptions. Therefore, our research question is;

Do any relationships exist between behavioral cues and violence in the context of police-suspect interactions?

Our aim is to investigate the basis for these claims that behavioral cues are correlated with violence, using naturalistic observations of these encounters as seen in footage taken from body-cameras worn by officers, dashboard-cameras from their patrol cars, and closed-circuit television (CCTV) cameras that had adequate vantage points of these events. Furthermore, we aim to compare our findings to the recent study conducted by Johnson (2018), who used similar techniques in his investigation of behavioral cues. Coincidentally, several of the same behaviors were researched in both studies, which introduce a singular opportunity to compare our findings with the latest (and only other) study that has

investigated behavioral cues in a similar manner. Due to the potentially influential role that these behavioral cues can have on an officer's perceptions and decision making, we also aim to incorporate theory related to decision making to better understand the ramifications of relying on these cues in practice. In these ways, we intend to meaningfully contribute to the small, yet growing body of research on behavioral cues in the context of police-citizen interactions.

2. Literature Review

2.1 Relevant research on nonverbal behavior

A body of evidence exists that certain non-verbal behaviors are identifiable and interpretable by observers, and that they may signal internal emotional state. Although researchers have for some time investigated whether non-verbal signals are inborn or learned, their origins and mechanisms are still debated. For example, Ekman, Sorenson and Friesen (1969) found consistencies in facial expressions across various cultures, suggesting that these are inborn. Johnson (2018) found variations among racial groups regarding which behavioral cues they exhibited in police-citizen interactions, but these differences can be argued along the lines of either genetic or socio-cultural explanations. Regardless of their origin, the mechanism underlying nonverbal behavior is assumed to be an unconscious reflection of our emotional state, and each non-verbal behavior and movement is thought to reveal what emotions a person may be experiencing at a particular point in time (Pease & Pease, 2004). Based on this assumption, research has been increasingly oriented toward developing better understanding of how emotional states correspond with nonverbal behaviors. A notable avenue of this research is focused on distinguishing nonverbal behaviors that could indicate violent and/or deceptive intentions.

2.2 Behavioral cues and deception

According to Ekman and Friesen (1969b), a person will learn movements early in life which will help satisfy emotional needs by manifesting in bodily actions, but these are gradually repressed until only fragments of the original action are visible. During an interaction where deception occurs, it is suggested that these

body movements and facial expressions can function as "leakage" cues that signal that the individual is withholding or misrepresenting information. Leakage cues can found in facial movements, but it is possible for the deceiver to self-monitor and inhibit these cues. On the other hand, leakage cues originating from movements of hands and feet may be harder to suppress. For instance, deception cues can be found in restless and repetitive acts or shift in posture (Ekman & Friesen, 1969a; 1969b). Contrary to Ekman and Friesen's (1969b) findings, Vrij, Semin and Bull (1996) found that the subjects in their study who were deceptive made fewer subtle movements of the hands and feet. This indicated that deceivers were more rigid in their mannerisms, due to the cognitive load involved in self-monitoring and attempting to control their demeanor. Vrij (2008) argues this may be due to the fact that in laboratory studies, suspects are instructed to lie, whereas the suspect will attempt deception on their own accord in a naturalistic setting. Consequently, while these findings provide insight into the dynamics of body language and deception, the generalizability of these observations beyond laboratory conditions is uncertain.

2.3 Studies on behavioral cues and violence

While there is a growing body of research related to nonverbal behaviors and body language in general, there is a scarcity of scholarly research on behavioral cues associated with violence (Johnson & Aaron, 2013). What research does exist pertains to specific contexts such as educational or healthcare settings. For example, Arsenio, Cooperman and Lover (2000) conducted a study on fifty-one preschoolers to assess their aggression and peer acceptance using observational data. It was found that when controlled for children's baseline aggressiveness, an increase in angry affect predicted both physical and verbal acts of aggression. Additionally, children high in aggression and who were less accepted by their peers tended to display higher levels of cheerful affect during aggressive behavior. Interestingly, Arsenio, Cooperman and Lover (2000) discuss the possibility of provoked aggression as linked to anger and other negative emotions, while instrumental aggression, meaning those behaviors which can result in psychological or material gains, as more associated with positive emotions.

Another study on children's aggression and emotion expressions in the context of peer interaction and competitive game play was explored by Hubbard (2001). She found that children who are rejected by their peers generally expressed more facial and verbal anger compared to others. They also tended to express more nonverbal happiness when something happening in the game was favorable to them. Extending this study, Hubbard et al. (2002) explored the reactive versus proactive aggression to children's anger, finding that reactive aggression was positively related to angry nonverbal behavior. Alternatively, children rated as displaying high levels of proactive aggression were not likely to convert this anger into visible angry nonverbal behaviors when experiencing heightened levels of anger during a game. Hubbard et al. (2002) proposed that children high in proactive aggression may be able to control their expression of anger in spite of feeling angry.

Hospital settings have provided a rich environment for studying behaviors that can predict violence, since unruly patients create widespread problems that affect nurses and other hospital staff (see for example Balamurugan, Jose & Nandakumar, 2012; Gates, Gillespie & Succop, 2011, as referenced in Jackson, Wilkes & Luck, 2014). Through an observational study, Jackson, Wilkes and Luck (2014) reported five behavioral cues as significantly predictive of physical violence towards nurses; these behaviors were resisting health care, aggressive statements, yelling, abusive language, and prolonged or intense glaring. In another study, Jackson, Wilkes, Waine and Luck (2014) reported that pacing around the bed was the only behavioral cue commonly displayed by patients who later became violent. While these studies are among the few that have collected data on behavioral cues in a naturalistic setting, the definition of violence operationalized in these studies generally pertains to "physical assault, threatening behavior, bullying, verbal abuse and various forms of harassment" (Jackson, Wilkes & Luck, 2014, p. 66). In this way, a behavior that may be predictive of "violence" in a hospital setting may not have the same implication in a police-citizen interaction, where the benchmark is an attempt to physically cause harm, rather than verbal abuse or harassment.

2.4 Behavioral cues in the context of police-citizen interactions

There is a plethora of training material intended for law enforcement that suggest which behaviors are warning signs of an imminent attack (for example, Young, 2018; Demand & Cliffe, 2011; Glennon, 2008; Glenn, 2015; to name very few). Although some sources purport themselves as "evidence-based", the evidence they are referring to is rarely derived from empirical research. To date, only one study has attempted to test the predictive validity of such behaviors in the context of police-citizen encounters; using his previous work as a basis (Johnson & Aaron, 2013; Johnson, 2015, 2017), Johnson (2018) tested nine cues which were thought to predict violent resistance among suspects within a sample of real-world footage of police-citizen interactions taken from a television show.[1] He found that only four out of nine cues tested were indicated to be predictive of violent resistance among suspects. The four behaviors found to be valid were the following: taking a fighting stance, invading personal space, clenched hands, and placing hands in pockets. Alternatively, Johnson (2018) did not find evidence for other behaviors that had been suggested as predictors of violence, such as looking around the area, pacing around, hostile verbalizations, glaring, or stretching of the neck and shoulders. Due to these mixed results, Johnson (2018) recommended that criminal justice professionals should be careful about relying on these cues to predict violence.

The set behavioral cues that were tested by Johnson (2018) were derived from the previous work of Johnson and Aaron (2013), who collated fourteen behaviors that were most consistently mentioned in various training materials as being indicators of violence. This list was further supplemented with nine more behaviors derived from formal studies conducted by Arsenio et al. (2000), Hubbard (2001) and Hubbard et al. (2002). Ultimately, a list of twenty-three behaviors associated with violence was compiled (see Appendix A). Johnson (2015) then compared perceptions of these behavioral cues among a sample of police officers that had been assaulted in the past year, as well as officers who have not been assaulted

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[1] By the time that Johnson (2018) published his paper, the data collection and analysis for this thesis had been completed. This gave us an opportunity to compare and contrast our data with Johnson's (2018) findings.

recently. The findings revealed that recent exposure to violence had little effect on perceptions of the cues, but behaviors such as taking a boxer's stance, invasion of personal space, placing hands in pockets, clenched fists, threats and glancing around were overall perceived to be concerning by the study's respondents. This study also found that officers were generally not concerned by suspects' who place their hands on their hips, presumably because they could see that they were not holding a weapon (Johnson, 2015). Subsequently, Johnson (2017) compared the perceptions of police officers and university students toward these of behavioral cues. This study found that police officers tended to be more sensitive to certain behavioral cues; specifically, taking a boxers stance, invading personal space, and placing one's hands in one's pockets were the top three cues they perceived as most threatening (Johnson, 2017). Interestingly, the behavior with the greatest difference in average score between the two groups proved to be placing one's hands in pockets, which underlines the contrast in the way this behavior is perceived among police and civilians (Johnson, 2017).

2.5 Police officer's perceptions of cues and their role in cognitive processes

In the context of law-enforcement culture in the US, the concept of officer safety is a predominant fixture which impacts training, standard operating procedures, and legal precedents that define what constitutes a justified use of force. From this perspective, the idea that "safety must take priority" (Cambridge Review Committee, 2010) is necessary to counteract the inherent risks faced by police officers. For example, in 2017, ninety-three officers were killed in the line-of-duty, with forty-six of these being feloniously killed (rather than accidentally); in total, 60,211 officers were assaulted that year (FBI, 2018). Although only 1.5% of all police-interactions involve any kind of force and deadly encounters are even more rare (Miller, 2015), it is in officer's best interest to approach every encounter as having the potential to become deadly (Crank, 1998). In light of these facts, it is unsurprising that Johnson (2017) found officers to have different perceptions of body language than did average citizens, explaining that "a person displaying the interpersonal social behaviors [mentioned before] may be expected to provoke an officer to draw a weapon, aggressively challenge the citizen, or preemptively use physical force, regardless of the person's actual intent" (p. 92).

Liv Finstad (2013) argues that the police officers perceive certain situations as suspicious due to their previous experience. This "police sight" is therefore a result of both reason and instinct. The basis of this intuition can be traced to the human ability to implicitly learn and detect cognitive patterns all the while unconsciously combining information in complex ways to make correct judgments based on fragmentary cues (Dreyfus & Dreyfus, 1980). This process of assimilating cues into a whole is therefore believed to be the basis of such intuitive abilities (Sobkow, Traczyk, Kaufman & Nosal, 2018). Using this kind of intuition, it is possible to make inferences based on limited information (Westcott, 1968).

It is thought that experienced individuals can have a "built in prioritization" method of determining which cues are sought in the environment (Seamster, Redding, Cannon, Ryder & Purcell, 1993). When an individual becomes aware of environmental conditions with certain properties, these features are given further attention on the basis of pre-established characteristics (Neisser, 1967). According to Endsley (1995), recognizing key features (or "critical cues") in an environment provides a foundation for understanding a situation, and even projecting its future status.

The concept of situational awareness (Endsley, 1995) provides a useful construct that encapsulates how behavioral cues can prompt police officers to understand an encounter from a certain frame of reference, thereby informing them of which set of actions is most appropriate in a given setting. More specifically, situation awareness (SA) is a state of knowledge that is the product of various cognitive processes involved with perceiving key elements in the environment, the comprehension of a current situation, and projection of its future status (Endsley, 1995). Once identified, these cues determine which mental model is most appropriate to adopt and in turn, shape how a situation is conceptualized (Manktelow & Jones, 1987). In this context, mental models are "mechanisms whereby individuals are able to generate descriptions of system purpose and form, explanations of a system functioning and observed system states" (Rouse & Morris, 1985, p. 7). As an example of how cues prompt the selection of a mental model, Boulton and Cole's (2016) case study of British officers who were involved in violent encounters found that officers used audio, visual, and

intelligence feeds to inform their expectations of an encounter and which tactical procedures were appropriate.

In this way, mental models allow individuals to match their current circumstances to prototypical situations, each which correspond to a set of correct responses (Boulton & Cole, 2016). The advantage of using mental models in the context of police work is that a situation does not need to exactly resemble previous encounters, as long as it has similar features of a known prototype (Klein, 1989). Prototypical situations can also be associated with a script that guides an ensuing pattern of action that is appropriate for the task at hand (Schank & Abelson, 1977). These scripts are helpful for reducing cognitive load because an individual does not need to formulate unique patterns of action for every situation, but can instead rely on automatic processing to respond to a similar situation based on its appropriate script (Endsley, 1995). For example, for an officer who believes a suspect they are interacting with is drawing gun, their reaction may be guided by an adherence to a pre-practiced script of drawing and firing their sidearm as quickly as possible.

Mental models and their associated scripts can significantly increase an individual's processing speed and reaction time by allowing for single-step, "recognition-primed" decision making (RPD) that begins once critical cues are noticed and categorized according to past experiences (Klein, Calderwood & Clinton-Cirocco, 1986; Klein, 1993). Although some information is lost when coded in this way, environmental stimuli become more ordered and comprehensible. The circumvention of conscious consideration of alternatives aids in faster retrieval and processing times, thereby enhancing performance when appropriately aligned with the situation in real time (Mayer, 1983; Endsley, 1995). In support of this theory, Klein (1989) found that most expert first-responders usually did not rely on conscious deliberation to identify alternative solutions to a problem, but rather focused on classifying the situation to more readily acquire an appropriate response from memory.

The cognitive processes involved in the RPD strategy can be compared to other theories related to simplifying heuristics (Kahneman & Klein, 2009), regarding how the manner in which a situation is framed influences what actions are thought

to be called for based on how the problem is perceived. This process can be described as "System 2 thinking" (Kahneman, 2011), which aids faster processing, but introduces the risk of making mistakes due to the dependence on mental shortcuts that bypass conscious consideration (Kahneman, Slovic, & Tversky, 1982). Since automatic processes normally do not rely on feedback, another hazard that arises is the potential to become less responsive to new, contradictory stimuli (Logan, 1988, as cited in Endsley, 1995).

There is evidence that making intuitive assessments on the basis of individual behavioral cues may not be reliable; Vrij (2008) suggests that observers who prioritize paying attention to nonverbal cues when trying to attempt deception are more likely to accuse someone of lying, even when that person is actually innocent. Similarly, a sample of criminal justice agents showed poor performance when determining innocence or guilt during face-to-face encounters when studied by Strömwall and Granhag (2003). There are also indications that misinterpretation of an individual's behavior as a cue of deception or violent intent can lead to officers escalating an encounter unnecessarily (Kahn, McMahon & Stewart, 2017; Steele & Aronson, 1995). In these ways, a misinterpretation of a suspect's behavioral cues by police can lead to an unnecessary escalation of force. The results of this misunderstanding can be most poignant in instances of "split-second syndrome", a term that describes a situation when an officer is too quick in making a decision to use lethal force, characterized by an officer's misperception of danger and subsequent overreaction (Dunham & Alpert, 2010). Examples of split-second syndrome can demonstrate how an officer seems to follow a set program of actions while they are "going on automatic" (Miller, 2015, p. 103).

While behavioral cues can theoretically act as a crucial warning to officers, they must be properly interpreted. It is important to consider the cognitive mechanisms that involve the recognition of these cues because they highlight the need for a better understanding of which cues, if any, are valid predictors of violence that might be used by police to make life or death decisions.

3. Methodology

A primary inspiration for the present study was derived from Johnson and Aaron (2013), who proposed that "perhaps security camera footage of violent incidents in prisons or bars could be analyzed in a frame-by-frame nature to examine if the parties actually displayed any of these nonverbal cues before the violence erupted" (Johnson & Aaron, 2013, p. 893). Since it is impossible to recreate complex, dynamic police interactions in a laboratory (Kahneman & Klein, 2009), we therefore rely on secondary data in the form of existing video footage of actual police encounters in order to better understand behavioral cues in this context. Using the footage as an investigative tool enabled us to analyze interpersonal phenomena, particularly regarding the observable cues manifested in behavior. Due to the ability videos have of capturing a sequence of action, we were also able to observe the interaction between the police and the public, thus enriching our understanding of the topic at hand (Heath, Hindmarsh & Luff, 2010).

3.1 Research method

Other researchers who have investigated similar topics to our own, such as Pais and Felgueiras (2016), based their methodology on Naturalistic Decision-Making theory (NDM), which involves ethnographic techniques, structured and unstructured interviews, retrospective analysis of critical incidents, videos of task performance, and cognitive task analysis. In order to investigate our research question, a qualitative approach was necessary to process the data that could not initially be measured in a quantifiable, nominal way. Given that the method used in this research is unique in its execution; qualitative research methods were beneficial, as they allowed for flexibility in regard to adjusting the scope of the study (Bryman & Bell, 2011; Corbin & Strauss, 2015). When choosing which cues were most relevant and conducive to being measured, the analytic induction allowed us to define how certain behaviors would be operationalized so that cues could be consistently coded. In the same way as proposed by Miles and Huberman (1994), the initial list of codes was partly derived from the literature, especially

from the research paper by Johnson and Aaron (2013).[2] Building upon this list (Appendix A) and on training material available to us, we assembled our own list of behaviors to use when coding the data.

Additionally, the analysis contained some grounded theory practices, such as open coding. The process of open coding involved breaking down, investigating, contrasting, conceptualizing, and categorizing data; eventually, this resulted in categories (Strauss & Corbin, 1990). Once the data was in a measurable format, our analysis relied more on quantitative methods using statistical software.

3.2 Operationalization of behavioral cues and key action cues

This research sets out to explore the validity of certain behaviors as cues of impending violence. Many of the cues studied are derived from the research of Johnson and Aaron (2013). Out of these twenty-three original cues, *removes excess clothing, exaggerated hand gestures, looks around the area, pacing,* and *places hands in pockets* retain their original names and definitions are in this study. Meanwhile, other cues were adapted from Johnson and Aaron (2013) and modified slightly for the purposes of our study; for instance, *standing with bladed feet, hands near waist line, stare, agitated,* and *concealing hands behind back.* As for the remaining thirteen cues from the original study that are not included, these were either merged with modified cues or were excluded because they were not readily identifiable or occurred too infrequently in our sample. For example, "suspect forward" was the code used in place of "invades personal space" because "personal space" is a subjective measure. It was observed that in many instances, the police officer took action when the suspect was moving toward him or her, so this code can be thought of as an apparent attempt to invade the officer's personal space. Due to this discrepancy, this action will not be examined as a nonverbal behavioral cue, as it was perceived as a suspect action.[3] Additionally,

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[2] At the time of finalizing this thesis, in June 2018, Johnson published a research paper which also incorporated observational study of video footage from the TV-series "Cops". In contrast to our research aim, Johnson (2018) explored the validity of behavioral cues as predictive of physically resisting arrest rather than attempting an attack.

[3] Furthermore, "blinks eyes rapidly", "face becomes flushed red", and "avoids eye contact" were omitted due to our inability to consistently observe suspect's face closely enough to identify this in

observational studies can be threatened by potential misinterpretations of nonverbal behavior. To minimize this risk in our research, great efforts were taken to limit the coding and our analysis to what is observable while avoiding making assumptions about police officer's or suspect's intentions, thoughts, or feelings.

The cues that we studied were recorded by the number of times they occurred and were operationalized as follows:

Standing with bladed feet; standing with feet spread apart, angling away from one another. Standing in this way allows potentially for quick throw of a punch without shifting leg position. It is commonly referred to as a fighter's or boxer's stance. This cue corresponds to Johnson and Aaron's (2013) "boxer's stance", which was defined as "the person puts his/her hands up in front of the face, slightly bends the knees, and takes a slight step backward with the right foot" (Johnson & Aaron, 2013, p. 893). In our sample, we observed a few instances of a suspect putting their hands up in front of their face before striking, yet positioning of feet in this fashion was prevalent before striking.

Removes excess clothing; taking off items of clothing, such as a jacket or a sweatshirt, presumably to attain increased freedom of movement during a fight. This cue was directly derived from Johnson and Aaron's (2013) article. In a study of police perceptions, which included police officers who have been assaulted during the last twelve months, removing excess clothing produced mid-range mean scores between 4.0 and 5.0, on a 7-point scale across the entire sample. At least a quarter of respondents marked them as a six or seven, and there was a statistically significant difference between non-assault officers and recently assaulted officers, with higher mean score for this behavior for the latter group (Johnson, 2015).

Exaggerated hand gestures; making hand and/or arm gestures while taking. This cue was also derived from the Johnson and Aaron's (2013) article. When Johnson

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a video. Likewise, "clenched hands", "jaw muscle tenses", "stretches arms or shoulders", "head-rolls or neck stretches", "cries", "breaths more rapidly", "makes threats", and "sweats profusely" were also excluded because they were either too difficult to positively identify or did not occur in our sample.

(2017) tested police perceptions compared to public perceptions, police officers ranked this behavior as number thirteen, while non-police subjects ranked it as number nine. Increased body movements are said to be associated with deceptive or suspicious behavior (Vrij, Semin & Bull, 1996).

Hands near waistline; the suspect moves his or her hands towards their waistline or places them on their hips. This cue was originally listed in the Johnson and Aaron (2013) article, but was shown not to raise any concerns among neither police nor citizens when later tested (Johnson, 2017). *Hands near waistline* was included in our study because it was identified during our open coding process that this was a frequently the location where suspects stored concealed weapons.

Places hands in pockets; the suspect places one or both hands inside pockets of his or her jacket or pants. This behavior was ranked third most concerning by police officers, yet it only ranked as number eighth most concerning for the non-police sub-sample (Johnson, 2017).

Concealing hands behind back; the suspect positions or moves his or her hands behind their back. This is distinct from *hands-waist area* because the suspect's hands are not visible to an officer when standing head-on. The Johnson and Aaron (2013) article and the Johnson (2014, 2017) articles do not include this behavior. Despite this, several of the deadly encounters in our sample featured suspects reaching behind their backs to access a concealed weapon, so it was included.

Looks around the area; the suspect turns their head to either side, or an apparent attempt to visually scan the surrounding area. This behavior was found to be threatening by both police officers and public, as top six and top five most concerning cues respectively (Johnson, 2017). In theory, a suspect who does this during an encounter might be looking for escape routes or determining if there are any witnesses to interfere with a planned attack on the police officer.

Pacing; the suspect walks back and forth in front of the police officer. In the 2017 Johnson study it was considered to be somewhat threatening by both police and non-police respondents. The number of steps taken or distance covered was not considered as criteria for recording this action as long as the suspect walked back and forth in an aimless manner.

Stare; a suspect having a gaze fixated on a random point in space, as if they were lost in contemplation. Initially, the code was derived from Johnson and Aaron's (2013) work, where it involved prolonged stare into the police officer's eyes, although the criteria was eventually expanded.

Agitated; the suspect exhibiting agitation in the way they speak to the officer, characterized by talking in an excited, argumentative, exasperated and/or irritated manner. While the cue is not directly derived from Johnson and Aaron (2013), it is reminiscent of the original cue, "angry expression". Due to the video quality, we were not able to consistently code "angry expressions", and therefore opted to use a less specific but more consistently identifiable set of behaviors that are characteristic of a suspect being *agitated.*

Resists handcuffing/tensing up; suspect resists handcuffs or any other police action intended to restrain the suspect, such as police officer grabbing the suspect. Resisting handcuffing can naturally be perceived to involve tensing up muscles and/or pulling away; however, it is not violent in and of itself. Tensing up was not coded separately, as it is not readily visible. In some instances the officer telling the suspect not to tense up, was the basis for coding it as *resists handcuffing/tensing up*. This behavior was not evaluated as a behavioral cue, but as a suspect action.

Suspect hitting/initiating struggle; hitting or initiating physical contact with the officer, such as pushing, grabbing and/or tackling. Although hitting and initiating a struggle are distinct from one another, hitting an officer in this context will almost never be independent of an ensuing struggle with an officer, either because the suspect is pressing the attack or the officer is fighting back, or both.

Suspect incapacitates officer; the suspect overcomes the police officer by some means, and the police officer is no longer in a position to take any offensive action. This action was recorded in a dichotomous fashion.

3.3 Procedure

The program that was used for coding the data was NVivo, specifically designed for qualitative research. In accordance to guidelines provided by Bryman and Bell

(2015), the coding categories and subcategories were mutually exclusive and exhaustive, so they did not overlap. Each code was also quite specific; for example, we distinguished between *drawing gun, aiming gun,* and *shooting*. Similarly, codes were made for short-range implements such as knives or other tools that can be used as a weapon. To insure that the codes were used correctly and were sufficiently discrete, a coding manual was developed (Appendix B). The early versions of the coding manual were piloted by the authors and developed further. The coding manual enabled coding to be done in a consistent manner, and was especially helpful when both of the authors were coding separate videos (Bryman & Bell, 2015). Initially, videos were coded by both of the authors and the interrater reliability was measured using Cohen's kappa coefficient. Additionally, an independent, cooperating student was recruited to learn and apply the coding manual to the data, in order to establish inter-reliability with a third party. The student was educated about the research, the different codes were explained, and the coding manual was provided. Finally, the student was taught how to use and navigate in the NVivo software. We ran a coding query to compare the interrater reliability between the two authors and the student. The Cohen's kappa coefficient was almost perfect (0.81 up to 1) for 279 items out of 335, substantial (0.61 to 0.8) for ten items, moderate (0.41-0.6) for thirteen items, fair (0.21 to 0.4) for five items, and insufficient for twenty-eight items (McHugh, 2012). The percentage agreement was 90% and above for 321 of the items, between 80 and 90% for ten items and below 80% for only five of the items (53.39%-76.8%). Consequently, these results indicate that the coding manual appears to be well-suited for the purpose of this research, and that the coding process could be replicated by third parties.

We also extended our data collection and created categories to distinguish if the suspect was armed or not. A suspect in the "armed" category meant they wielded either a firearm or a short ranged weapon, such as a knife or club. Although it is worth noting that either of these essentially poses differing capabilities regarding wounding mechanisms and effective range, a police officer confronted with a suspect who has any type of weapon will regard them as potentially deadly threat (Miller, 2015). It is worth mentioning the distinct difference between suspects that were armed with a short range weapon rather than a firearm is that police

sometimes attempted de-escalation techniques with the former, but rarely with the latter. Ultimately, the distinction between the two is captured in our library of codes.

Further, videos were also classified categorically based on the outcome. We categorized a video to have a peaceful outcome when the situation did not involve any violence or use of force, beyond taking hold of someone in a standing position or applying handcuffs. The less-lethal outcome involved violence that was not immediately life threatening, being either enacted by the police officer(s) or suspect. In our sample, this outcome usually involved officers attempting to gain control of antagonistic suspects. The violence that took place in a less-lethal outcome included actions such as physical struggle, tackling, hitting, using baton, pepper spray or Taser. This outcome did not preclude the suspect possessing a lethal weapon; however, it was not brought to bear during the encounter. In contrast, lethal outcomes were distinguished by either the suspect or the officer using lethal means in an attempt to cause fatal injury. This outcome was further characterized by officers firing upon a suspect, while suspects could utilize either a firearm or short ranged weapon. Although encounters with a lethal outcome were more often fatal for the suspect involved, the primary requirement for an encounter to be included in this group was for deadly force to have been used to any effect.

Many of the videos that were included in the sample extended past the period that was coded. According to Heath, Hindmarsh and Luff (2013) when conducting qualitative analysis of video material, based on a range of interest and concerns, fragments of videos should be selected. Repeated viewing of the fragments of videos in NVivo allowed us to develop our observational skills and grasp the fine details of the actions and activities (Heath, Hindmarsh & Luff, 2013). While most videos were approximately two minutes in duration, others videos varied in length and could be as short as thirty seconds or as long as five minutes.

In order to analyze the data in a quantitative manner in IBM SPSS Statistical Software, we created counting spreadsheets which incorporated frequencies of each code as they occurred throughout the videos. We organized this in two parallel datasets that were denoted as *Partial timeline* dataset and *Total timeline*

dataset. In the *Partial timeline* dataset, we only included cues that preceded the violence, and omitted all the codes that happened after violence had precipitated. In cases where violence did not occur (i.e. de-escalation and peaceful encounters), all of the cues that occurred throughout the video were included in this dataset. This was done because the suspect's behaviors are potential cues from an officer's perspective, even during encounters that turned out to be peaceful. Cues that occur during this timeframe are operationalized as *ambiguous cues,* because an officer who observes them cannot know for sure if they represent an imminent threat or not. Excluding actions that occurred after the violence was necessary so the analysis would not be based on cues which happened after the ambiguous phase, i.e. cues which are not indicative of future violence. In this way, the *Partial timeline* dataset captures the ambiguous phase of an interaction. By including instances of cues drawn from both peaceful and violent interactions, analysis based on the *Partial timeline* dataset allows for conclusions to be drawn about how cues relate to outcomes on average, independently of violent actions. Alternatively, the *Total timeline* dataset incorporates cues across the whole police-citizen interaction, including timeframes that were characteristically violent, or non-ambiguous. The purpose of the *Total timeline* dataset was to identify relationships between certain cues and specific violent behaviors through correlational analysis.

3.4 Sample

Due to the nature of our study, our sample was purposive, as is generally the case in qualitative research (Bryman & Bell, 2015). Initially, the criteria for the sample were strict and limited to videos where a suspect attacked a police officer. Due to the interest in the verbal and nonverbal communication, as well as the ambiguous phase of a police-citizen interaction, high-stake situations, such as suspect keeping a hostage, a robbery or a car chase were omitted.

Generally, our sample is composed of various types of encounters, such as domestic calls, normal and violent traffic stops, street encounters, and de-escalation situations with unpredictable suspects. The final sample size consisted of fifty-six videos obtained from sources such as YouTube and other video hosting platforms on the World Wide Web, where these videos were available.

Three videos originated from Great Britain and one from Australia; however, the vast majority was from the United States.[4] Many of the police departments in the United States release body-camera and dash-camera footage on a regular basis. Although graphic aspects of these videos are occasionally blurred, they usually capture the majority of the incident and pertinent events that led up to a use of deadly force. Bodycam footage is frequently released by police departments across the world for various reasons. A video of a lethal police shooting may be released to counter accusations of misconduct, as this footage often gives context to an officer's decision to use lethal force. Alternatively, a particular department may want to enhance public relations by releasing footage of an officer successfully de-escalating a situation. A minority of the videos in the sample originated from CCTV or other third parties.

According to the British Psychological Society (1993, as referenced in Sociology Lens, 2013), it is acceptable not to supply informed consent when the behavior in question was conducted in the public domain. Although it would be ideal to protect the anonymity of the individuals involved in this study, references to the online location of these videos are provided for the purposes of transparency and replication (Appendix C).

4. Analysis and results

4.1 Descriptive statistics

Initially data were explored in terms of descriptive statistics, as well as frequencies. Our sample had parity in regards to gender, three female police officers and two female suspects and fifty-four male police officers and suspects. While the age of the police officers was close to normally distributed (see Appendix D1), the age of the suspect was skewed towards young adults (see Appendix D2). The sample consisted of seventeen peaceful interactions, twelve less-lethal and twenty-seven lethal interactions. In total, 48.2% of the suspects were white, 37.5% of the suspects were black, while 14.3% were distributed

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[4] Since the videos from elsewhere are of similar nature, we chose not to omit them.

across other races. Within the lethal outcome, 48.1% were white suspects while 37% were black, which is relatively comparable to racial demographics of lethal force encounters reported in the US between 2009 and 2012 (DeGue, Fowler & Calkins, 2016) that reported that of lethal encounters, 52.2% of suspects were white and 32.4% were black. Our sample also revealed that in 62.5 % of the police-citizen interactions, the suspect was armed, 37.5% of the suspects were unarmed. The only two suspects who were killed while being unarmed were white (see Graph 1).
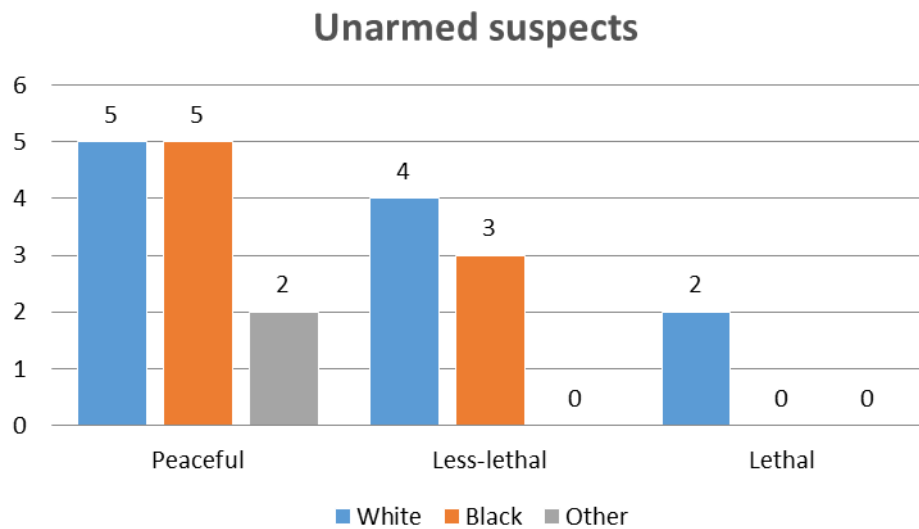
Unarmed suspects

Graph 1. Unarmed suspect's race according to outcome.

Comparing the frequencies between outcomes revealed that some suspects expressed some cues more often in certain outcomes than others (see Table 1). Among interactions that had peaceful outcomes, 27.8% of the suspects were *agitated,* 16.7% of the suspects exhibited *pacing,* while 5.6% *removed excess clothing*. *Yells* and *"shoot me"* were mostly exhibited by suspects involved in encounters with less-lethal outcomes. *Exaggerated hand gestures* were exhibited half the time by suspects involved in less-lethal outcomes, but this cue was even more expressed in lethal outcome, where 51.9% of the suspects made hand gestures. In over a third of lethal interactions, the suspect moved their *hands near waistline, 37%* of the suspects *looked around the area,* while 29.6% of the suspects *placed hands in pockets* and 18.5% *stood with bladed feet.* Additionally, *stare* and *concealing hands behind back* was mostly exhibited by suspects involved in the lethal outcomes.

Table 1. Frequencies of behavioral cues overall and according to outcome.

			Overall		Peaceful	Less-lethal	Lethal
	Min.	Max.	Mean	1 or more	1 or more	1 or more	1 or more
Places hands in pockets	0	3	0,411	23.2%	22.2%	8.3%	29.6%
Concealing hands behind back	0	3	0,143	8.9%	5.6%	0 %	14.8%
Hands near waistline	0	5	0,41	25 %	11.1%	16.7%	37 %
Standing with bladed feet	0	3	0,16	12.5%	0 %	16.6%	18.5%
Exaggerated hand gestures	0	19	1,57	46.4%	33.3%	50 %	51.9%
Removes excess clothing	0	1	0,04	3.6%	5.6%	0 %	3.7%
Looks around the area	0	5	0,64	28.6%	16.7%	25 %	37 %
Stare	0	7	0,25	12.5%	0 %	16.6%	18.5%
Pacing	0	3	0,13	8.9%	16.7%	8.3%	3.7%
Agitated	0	3	0,27	16.1%	27.8%	16.6%	11.1%
Yells	0	7	0,57	16.1%	22.2%	25 %	11.1%
"Shoot me"	0	10	0,3	7.1%	0 %	16.6%	7.4%
Unarmed	0	1	0,38	37.5%	72.2%	58.3%	7.4%
Armed	0	1	0,63	62.5%	27.8%	41.7%	92.6%

Although the number of suspects who exhibited *exaggerated hand gestures* and *stare* are accurately represented in Table 1, the means reported for these behaviors are skewed due to these being recorded an unusually high number of times each within a single encounter. Therefore, both of these behavioral cues were omitted in the subsequent analysis.

4.2 Correlation matrix

Using the *Total timeline* dataset, we investigated which behavioral cues were correlated with violent acts perpetrated by a suspect. The complete correlation matrix is illustrated in Table 2. Correlations with p≤.05 level are marked with one star (*), while the correlations at p≤.01 level are marked with two stars (**). Based on our correlational analysis, it can be determined that statistically significant relationships were found between some of the expected cues and violent behavior. Suspect actions that involved hand movements around their waist, pockets, or concealed behind their back were positively correlated with certain violent behaviors. *Places hands in pockets* and *hands near waistline* were found to be correlated with *suspect hitting/suspect initiated struggle* (r=.298 and r=.384 respectively). *Places hands in pockets, concealing hands behind back* and *hands near waistline* were also positively correlated with *suspect shooting*, with

r.=.383, r.=.452 and r.=.273 respectively. As expected, the correlation matrix revealed positive correlation between *standing with bladed feet* and *suspect hitting/initiating struggle* (r.=.339).. *Looks around the area* correlated with *suspect hitting/initiated struggle* (r=.306), as well as *suspect incapacitates officer* (r=.406). *Hands near waistline* was the only individual suspect behavior that was directly associated with a *lethal outcome* (r=.313). Other expected predictors of violence were not correlated as expected. For instance, *pacing* was not found in our sample to correlate with behaviors that were characteristically violent, but instead was found to correlate with behaviors such as being *agitated* (r=.394). Similarly, the suspect being *agitated* was not correlated with violent behavior, but rather with *yelling* (r=.370) and, previously mentioned, *pacing* (r=.394). Furthermore, there was a negative correlation between *agitation* and the suspect being *armed* (r=-.339). Additionally, a moderate positive correlation (r.=426) was found between *removes excess clothing* and *resists handcuffing/tenses up* but not with any specifically harmful behavior.

Table 2. Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1. Places hands in pockets																									
2. Concealing hands behind back	,471**																								
3. Hands near waistline	,587**	,604**																							
4. Standing with bladed feet	-0,03	0,12	0,05																						
5. Exaggerated hand gestures	,446**	0,16	0,13	0,07																					
6. Removes excess clothing	-0,11	-0,07	-0,02	-0,08	-0,02																				
7. Looks around the area	0,26	0,24	,277*	0,06	0,05	0,19																			
8. Stare	0,07	-0,07	-0,06	-0,08	0,05	-0,06	,389**																		
9. Pacing	,317*	-0,07	-0,08	-0,09	,646**	0,11	-0,13	-0,07																	
10. Agitated	0,14	-0,11	-0,12	-0,13	,360**	0,25	-0,01	,319*	,394**																
11. Yells	-0,10	-0,02	0,03	-0,07	0,06	0,06	-0,11	-0,07	0,02	,370**															
12. "Shoot me"	-0,12	-0,07	-0,05	-0,01	-0,07	-0,06	-0,12	-0,06	-0,07	-0,08	,264*														
13. Resists handcuffing/tensing up	-0,01	0,13	0,03	-0,10	-0,03	,426**	-0,03	0,00	0,08	0,21	0,03	-0,08													
14. Suspect moving toward officer	-0,14	0,03	0,06	0,23	-0,01	-0,12	-0,13	-0,13	-0,06	-0,15	0,15	,278*	-0,08												
15. Suspect hitting/initiating struggle	,298*	0,25	,384**	,339*	-0,02	0,11	,306*	0,23	-0,10	-0,01	-0,02	0,00	0,17	0,08											
16. Drawing short range weapon	-0,17	0,02	-0,09	0,24	0,13	-0,08	-0,13	0,03	-0,09	-0,05	-0,09	0,21	-0,10	,505**	-0,12										
17. Using short range weapon	-0,11	-0,07	-0,11	0,08	0,11	-0,06	-0,12	0,10	-0,06	0,14	-0,04	0,09	-0,07	0,03	-0,09	,430**									
18. Suspect drawing	0,13	0,00	0,07	-0,12	-0,11	-0,09	0,19	0,07	-0,10	-0,15	0,03	0,25	-0,11	-0,14	0,00	-0,13	-0,09								
19. Suspect aiming	0,24	-0,10	0,10	-0,11	0,01	-0,08	0,23	0,09	-0,09	-0,13	-0,13	-0,09	-0,10	-0,12	0,02	-0,12	-0,08	,567**							
20. Suspect shooting	,383**	,452**	,273*	-0,14	-0,08	0,09	0,24	0,02	-0,11	-0,16	-0,15	-0,11	0,05	-0,17	-0,05	-0,14	-0,10	,474**	,666**						
21. Suspect incapacitates officer	0,04	-0,10	-0,03	0,24	0,13	0,17	,406**	,380**	-0,09	0,03	-0,13	0,10	-0,10	0,22	0,17	0,07	-0,08	0,22	0,25	0,26					
22. Unarmed	0,06	0,00	-0,07	0,12	-0,02	-0,02	0,16	0,10	0,19	,339*	0,01	-0,17	0,23	-0,25	0,19	-,268*	-0,18	-,293*	-,268*	-,324*	-0,03				
23. Armed	-0,06	0,00	0,07	-0,12	0,02	0,02	-0,16	-0,10	-0,19	-,339*	-0,01	0,17	-0,23	0,25	-0,19	,268*	0,18	,293*	,268*	,324*	0,03	-1,000**			
24. Peaceful outcome	-0,04	-0,11	-0,21	-0,22	0,09	0,02	-0,09	-0,17	0,24	0,25	0,02	-0,17	-0,03	-,298*	-0,24	-0,10	-0,16	-0,25	-0,23	-,276*	-0,23	,451**	-,451**		
25. Less-lethal outcome	-0,20	-0,14	-0,14	0,18	-0,10	0,07	-0,02	0,22	-0,05	-0,01	,268*	0,18	,298*	-0,01	0,25	-0,18	-0,12	-0,07	-0,18	-0,22	0,10	0,22	-0,22	,345**	
26. Lethal outcome	0,20	0,22	,313*	0,05	-0,01	-0,07	0,10	-0,03	-0,18	-0,22	0,01	0,01	-0,21	,282*	0,01	0,24	0,25	,284*	,359**	,433**	0,13	-,600**	,600**	,637**	,504**

Note: Cronbach alpha shown in diagnoal. N=56. **. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

4.3 MANOVA and discriminant analysis

Next in our analysis we were interested in whether the outcomes differ along a combination of variables, thus multivariate analysis of variance (MANOVA) was performed using the *Partial timeline* dataset. MANOVA is designed to simultaneously look at several dependent variables. The Barlett's test of sphericity was shown to be significant. The Bartlett's test of sphericity, which tells us whether our correlation matrix is significantly different from an identity matrix, was significant at $p < ,001$. As Field (2015) points out, this test is useful only in univariate repeated-measures designs because this assumption is not required in MANOVA. Simultaneously, all tests of multivariate significance, Pillai's Trace, Wilks' Lambda, Hotelling's Trace and Roy's Largest Root were $p < ,005$. From this result we could conclude that the cues have a significant effect on outcome. Nevertheless, the nature of the effect is not clear from just a MANOVA, as it does not tell us which outcomes differ from which. Consequently, we ran a discriminant analysis to establish how the dependent variables interact.

The discriminant analysis of the *Partial timeline* dataset revealed two discriminant functions. While the first function explained 61.7% of the variance, canonical R^2 =.564, the second function explained 38.3% of the variance, canonical R^2=.445 (see Appendix F1). In combination and on their own, both discriminant functions significantly differentiated the outcomes, with values of p= .015 for function 1 through 2, and p= .140 for function 2; this means that the two functions significantly discriminate the groups in combination, but the second variate alone is non-significant (see Appendix F2). The discriminant function plot displayed that the first function differentiated between a lethal outcomes from peaceful and less-lethal outcomes, while the second function discriminated most strongly between peaceful and less-lethal outcomes.

The structure matrix (see Table 3) revealed that police officer *hands near waistline, aiming gun, warning, show hands, concealing hands behind back, places hands in pockets* and *looks around the area* loaded negatively on the first function and were therefore were most related lethal outcomes. *Handcuffing, yells, agitated, pacing* and *person search* loaded positively on and were mostly related

to the first function, increasing the likelihood of a less-lethal or peaceful outcome, rather than a lethal outcome, when occurring together.

For the second function, *casual conversation*, *calming down* and *removes excess clothing* were negatively loaded, indicating that these were more related to peaceful outcomes rather than less-lethal ones. *Grabbing, resist handcuffing/tensing up, standing with bladed feet, "shoot me"* and *attempts handcuffing* loaded positively and were mostly related to the second function, indicating a higher likelihood of a less-lethal outcome rather than peaceful outcomes.

Table 3. Structure matrix of the discriminant analysis

	Function	
	1	2
Handcuffing	,355*	-0,137
Hands near waist-line	-,291*	-0,001
Aiming gun	-,283*	0,117
Yells	,225*	0,218
Warning	-,219*	0,001
Agitated	,206*	-0,149
Show hands	-,194*	-0,001
Concealing hands behind back	-,194*	-0,062
Places hands in pockets	-,177*	-0,142
Pacing	,174*	-0,171
Looks around the area	-,090*	0,027
Person search	,088*	0,07
Grabbing	-0,092	,322*
Resists handcuffing/tensing up	0,183	,275*
Standing with bladed feet	-0,057	,272*
Casual conversation	0,226	-,267*
"Shoot me"	0,037	,265*
Attempts handcuffing	0,122	,238*
Calming down	0,046	-,149*
Removes excess clothing	0	-,126*

Note. Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions. Variables ordered by absolute size of correlation within function. * symbolises the largest absolute correlation between each variable and any discriminant function

The centroids for function 1 were -1.145 for the lethal outcome, .950 for the less-lethal and 1.148 for the peaceful outcome. The centroids for function 2 were -.057 for the lethal outcome, 1.492 for the less-lethal outcome and -.963 for the peaceful outcome (see Appendix F3). Below the centroids are illustrated in the combined-outcome plot (see Graph 2).
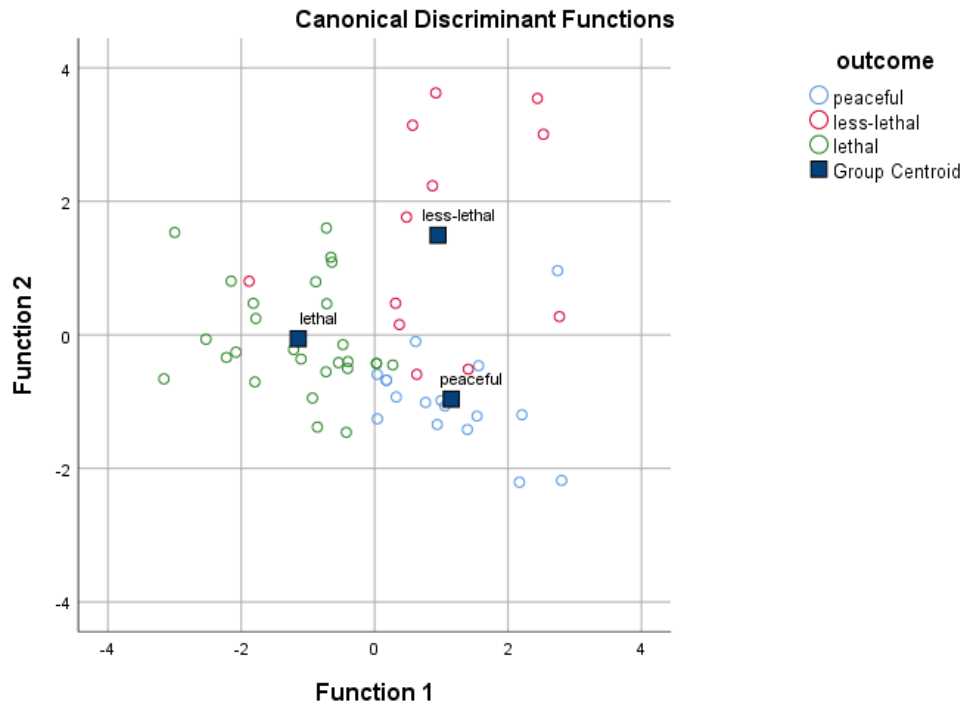
Graph 2. Combined-outcome plot.

The classification results revealed that 85.7% of the original grouped cases were correctly classified (see Table 4). The largest proportion of errors were in the classification of the less-lethal outcome (three cases were classified as peaceful and one as less-lethal) and lethal outcome (two cases were classified as less-lethal and one as peaceful). The classification of the peaceful outcome wrongly predicted one case as less-lethal and one case as lethal.

Table 4. Predicted group membership of each outcome based on discriminant analysis

| | | outcome | Predicted Group Membership | | | Total |
			peaceful	less-lethal	lethal	
Original	Count	peaceful	16	1	0	17
		less-lethal	4	7	1	12
		lethal	1	1	25	27
	%	peaceful	94,1	5,9	0,0	100,0
		less-lethal	33,3	58,3	8,3	100,0
		lethal	3,7	3,7	92,6	100,0

Note. 85.7% of original grouped cases were correctly classified.

26

The results from the discriminant analysis align with what the correlation matrix revealed regarding which behaviors are related to violent behaviors and outcome. Based on this analysis, the behavioral cues that are most related to lethal outcomes are *hands near waistline*, *concealing hands behind back*, *places hands in pockets*, and *looks around the area*. The behavioral cues that are associated with less-lethal outcomes are *standing with bladed feet* and *yells*. Alternatively, the behaviors that were related to peaceful outcomes were *agitated*, *pacing* and *removes excess clothing*.

5. Discussion

Based on the results of our statistical analysis, we found that some of the behavioral cues explored do correlate with violence, while a subset of the cues examined did not prove to be related to imminent violence. Furthermore, the discriminant analysis revealed that the likelihood of various outcomes was influenced by the presence of cues. Notably, our observations of the video recordings of these encounters revealed considerable variation. Attacks were not always preceded by a behavioral cue, and cues that were shown to have valid relationships with violence were in some cases exhibited by suspects who never became violent. This inconsistency highlights that these findings should not be simplistically interpreted.

Each individual behavior described below is evaluated based on the results our study and compared to relevant research such as Johnson's (2018) study. Meanwhile, appropriate weight is given to extenuating circumstances that exemplify how individual behavioral cues can be incidental rather than meaningful.

5.1 Places hands in pockets/hands concealed behind back/Hands near waistline

Our finding that suspects' putting hands in pockets was related to violence seems to corroborate with Johnson's (2018) finding that suspects who placed their hands in pockets were likely to be violent resisters more often than not. Additionally, we found that *hands near waistline* was also correlated with violent actions and was

also notable because it was the only individual suspect behavior that was found to be directly correlated with a lethal outcome. While the causal relationship between these behaviors and *suspect hitting/initiated struggle* remains unclear, it is more feasible to make inferences about *hands concealed behind back*, *hands near waistline*, and *places hands in pockets* being positively correlated with *suspect shooting*; a suspect who shoots during an encounter usually had to access a firearm from concealment around their waistline, an area that corresponds with the actions of *hands pockets, hands near waist-area,* and *hands back* (in our sample, only one suspect drew a firearm from a different place on their body, in this case from a vest pocket).

Based on these findings and those of Johnson (2018), there appears to be some basis for the common perception among police officers that actions such as placing hands in pockets are indicative of a threat. Even so, none of these three suspect actions proved to be significantly correlated with the suspect being armed or drawing a weapon. This fact highlights the problem that valid behavioral cues are not always a precursor to violence, since they overlap with normal behaviors. For example, 23.5% of the suspects involved in peaceful interactions were observed to exhibit these actions within our sample. In this way, an individual who articulates their hands near or around their pockets, waistline, or back cannot be definitively said to be trying to access a weapon, nor does it necessarily prove that they are armed. A suspect putting their hands in their pockets or fidgeting with their waistline may be the byproducts of anxiety, which can occur when individuals are interviewed by the police (Cambridge Review Committee, 2010).

5.2 Stands with bladed feet

S*tanding with bladed feet* was positively correlated with *suspect hitting/initiating struggle*. Additionally, discriminant analysis indicates that *standing with bladed feet* contributes to an increased likelihood of a less-lethal outcome, rather than one that is peaceful. Although this finding is unsurprising, it is useful because it helps to authenticate previous findings regarding this relationship and further validates the integrity of the coding procedure and analysis. Notably, *standing with bladed feet* was not observed among suspects in peaceful encounters. This is in congruence with Johnson's (2018) finding that violent resisters were more likely

to take up a "fighter's stance" than nonviolent suspects. Furthermore, Johnson (2018) only observed one nonviolent suspect who took a fighter's stance in his sample. While this behavior can act as a cue to officers that an attack may be imminent, it is worth noting that it is possible to strike and/or launch an attack without standing in this way or taking other obvious preparatory actions. Furthermore, although this behavioral cue is positively correlated with *suspect hitting/initiating struggle,* the casual relationship between those behaviors has not been examined, and one behavior does not necessarily lead to the other.

5.3 Looks around the area

Previously, "looking around the area" was a behavior that was identified among officers as an indicator of potential violence (Johnson, 2015, 2017), but was subsequently not found to be associated with suspects who violently resisted arrest (Johnson, 2018). On the contrary, we did find evidence that this behavior was associated with violence; specifically, it positively correlated with *suspect hitting/initiated struggle* and *overcomes.* Furthermore, discriminant analysis indicated that *looks around the area* was more associated with lethal outcomes rather than peaceful or less-lethal outcomes. There are several possible explanations for the discrepancy between our findings and those of Johnson's (2018). Firstly, this behavior was operationalized differently in the former study, which required that the suspect's head turned away from an officer at least 90 degrees to be counted, whereas the present study recorded this behavior when it could be sensibly recognized during an encounter. Secondly and perhaps more importantly, the composition of Johnson's (2018) sample of videos in comparison to our sample may be chiefly responsible for the divergence in findings; if it can be assumed that the action of looking around the area is something suspects do to check for witnesses before initiating an attack, then it would be logical that they would not do this because they already knew they were in the presence of witnesses in the form of a film crew, as was the case in Johnson's (2018) sample of footage taken from the reality TV show, "Cops". In contrast, the footage used in the present study was taken from passive sources such as body cameras and

dashboard cameras.[5] Although using one of these passive sources to film a suspect might deter them from doing something incriminating, it is arguable that suspects who are intent on resorting to violence do not consider these types of cameras with the same caution as they would active witnesses who are capable of intervening. In this way, it was possible to uncover a relationship between *looks around the area* and violent behavior in our sample. Nonetheless, this behavior was not exclusively related to violent behaviors, as *looks around the area* was exhibited by 16.7% of nonviolent suspects who were involved in peaceful encounters in our sample. There are many reasons why a suspect without violent intent might look around the area during an encounter; for instance, the presence of other passersby, traffic, or other features of the environment might draw the suspect's attention and cause them to do this. Even so, an officer might be more inclined to see this behavior as a possible sign of a threat if he or she considers this observation in combination with pertinent information, such as other suspicious behaviors the suspect exhibits.

5.4 Removes excess clothing

Clothing removal during an encounter was not found to be associated with violence in our sample, despite the finding that it was a behavior that officers considered to be potentially indicative of violence (Johnson 2015, 2017). Although this cue correlated with *resists handcuffing/tenses up*, this action is not in and of itself inherently violent. Furthermore, discriminant analysis indicates that this behavior was related to peaceful outcomes.

 Taken at face value, it would seem that this behavior could predict violence in some situations, since it not unheard of for individuals to do this prior to engaging in a fight to avoid restriction of movement. Alternatively, the reasons why an individual might remove items of clothing during an encounter are numerous; for example, a person might remove an outer layer if it is warm outside, or because they simply wish to do so. It is safe to say that an officer cannot be expected to

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[5] One peaceful encounter in our sample was taken from a video segment titled "Who's Calm", from A&E's TV show, Live PD.

account for every factor that influences a person to remove clothing during an encounter. An exception to this may arise in the form of a suspect removing their clothing in the midst of a heated interaction with police, which could indicate they are removing it to avoid being restricted. It is worth noting that this behavior was uncommon in our sample, and the recording of this behavior in any sample may be influenced by a variety of factors such as the weather, time of the year, geographical location of the interaction, and/or the researchers' sampling method. The findings regarding this behavior cannot yet be compared and contrasted with other studies since the present study is the only instance of this behavior being examined using observations of police-citizen interactions. In light of this, any conclusions that are drawn should be done so cautiously.

5.5 Agitated

Our analysis indicates that the cue *agitated* is unrelated to violence. Not only did it fail to positively correlate with any violent behavior, but it was found to be negatively correlated with the suspect being armed. Furthermore, the discriminant analysis revealed that *agitation* contributed to an increased likelihood of an outcome being less-lethal or peaceful, rather than lethal. This finding appears to be in contrast with studies by Arsenio et al. (2000) and other researchers (Hubbard, 2001; Hubbard et al., 2002; Jackson, Wilkies & Luck, 2014) who found that hostile verbalizations were often accompanied by aggressive acts in a study involving children. Similarly, police officers were reported to rank "angry expressions" as a potentially concerning behavior (Johnson, 2014). The results of the present study seem to go against these findings, but they is an agreement with evidence gathered by Johnson (2018) who similarly did not detect a relationship between a suspect making hostile verbalizations and violently resisting arrest. The two behaviors examined across studies are not identical, but they overlap in the sense that they may be displays of a suspect's frustration.

While one might take a suspect's agitation at face value and assume that this is a sign that they have malicious intentions, this is not necessarily the case. For example, Margarita (1980) proposed that while some suspects attack officers impulsively, others use violence in an "instrumental" way to achieve a set goal. A suspect who has a concealed weapon or is planning to attack at an opportune

moment would have an incentive to maintain the element of surprise by staying calm and collected, thereby not drawing attention to themselves. This theory is in line with Hubbard et al.'s (2002) finding that children who displayed aggressive acts seemed capable of controlling their emotions up to that point by refraining from expressing anger beforehand. Alternatively, an unarmed suspect who has nothing to hide from an officer would not necessarily have the same incentive to control the display of their emotions to the same degree. Furthermore, suspects who were *agitated* were often found to *pace* back and forth, which was also not found to be related to violence. Of course, a suspect who exhibits agitation might impulsively attack an officer in the heat of the moment, but a suspect's agitation does not provide a set guarantee that the suspect is planning on launching an attack.

5.6 Pacing

In light of Ekman and Friesen's (1969a; 1969b) suggestion that restless movements of the hands and feet can represent an externalization of an individual's anxiety, pacing back and forth could be considered as a sign that a suspect is unnerved and possibly a threat to an officer. Accordingly, pacing has previously been suggested as a behavioral cue that might predict violence in various settings (Johnson & Aaron 2013; Jackson, Wilkies & Luck, 2014) but our analysis did not find this behavior to be related to violence. Instead, we observed that the highest proportion of *pacing* suspects was found among peaceful encounters, and discriminant analysis also indicates that this behavior was more likely to be involved in peaceful outcomes in our sample. These results corroborate with Johnson's (2018) research, which similarly found that pacing was more common among nonviolent suspects than those who were violent. In light of this consistency, there appears to be a growing indication that this behavioral cue is unrelated to violence in the context of police citizen encounters.

This is not to say that *pacing* is non-existent among deceptive or potentially violent suspects; for example, pacing has been found to be associated with violent behavior in hospital settings (Jackson, Wilkes, Waine & Luck, 2014). Consequently, the relevance of this behavioral cue may be dependent on the context in which it occurs.

5.7 Yelling

No evidence was found that this behavior was related to violence; y*elling* was only positively correlated with *pacing* and *agitated.* Furthermore, discriminant analysis revealed that *yelling* is more associated with less-lethal outcomes, and occurred twice as many times in the peaceful and less-lethal outcomes than in the lethal outcomes. In this way, yelling may be more associated with displays of frustration, rather than as a cue of imminent violence. These results diverge from Jackson, Wilkes, and Luck's (2014) finding that yelling was one of five behaviors that was significantly predictive of patients becoming violent with staff in a hospital setting. The disparity of these findings may be explained to the differing nature of police interactions versus those found in hospital settings. If so, this would again highlight the importance that the context in which a cue occurs may affect whether or not a behavioral cue is meaningful in that setting.

Similarly to *agitation,* a suspect who is yelling during an interaction may lead an officer to proceed with more caution in the event that an impulsive attack is anticipated. It should be recognized that there are a multitude of factors that can explain this behavior in individual circumstances, and drawing a conclusion that a suspect means harm because they are yelling is not necessarily consistent. In consideration of these factors and the lack of evidence for the notion that yelling is directly related to violent behavior, we can conclude that this behavior was characteristic of irate but not necessarily violent suspects in our sample.

Overall, the results from this study found that *places hands in pockets, hands concealed behind back, hands near waistline, stands with bladed feet*, and *looks around the area* were behavioral cues that were related to violent behavior. Meanwhile, *removes excess clothing, agitation, pacing, yelling* were behaviors that were not found to be related to violence; of these, *removes excess clothing* and *yells* were behaviors that were related to resisting arrest and less-lethal outcomes respectively, but were not shown to be directly related to violent behaviors in isolation; in light of this, the status of these behaviors as cues that can predict violence remains uncertain. A recurrent theme uncovered by our findings is that valid behavioral cues can overlap with harmless mannerisms that commonly occur during peaceful police-citizen interactions.

5.8 Implications

The primary implications of these findings point to the limitations of effectively utilizing these behavioral cues in practice. While the evidence presented in this study indicates that certain behavioral cues are related to violence, it is clear that the meaningfulness of an individual behavioral cue can vary from one encounter to another. For example, even nonviolent suspects occasionally exhibit behavioral cues which have been demonstrated here to be related with violence.

In theory, correctly identified cues can be useful for framing an encounter in a way that informs the officer regarding which actions are appropriate. While the capability of rapidly recognizing and comprehending the nature of an encounter can be useful, officers may follow an inappropriate course of action if the cues that trigger this process are not valid. For example, *hands near waistline* was a cue that was found to be related to violent behavior; despite this, it is often not followed by a suspect becoming violent. If taken at face value, this behavior can be interpreted by an officer as a sign that the suspect is reaching for a weapon, thereby acting as a salient cue that forms the basis for a split-second decision to use deadly force. This was apparently the process of events that occurred when an officer in our sample fired on a suspect when he was reaching for his waistline (see video "Police fatally shoot Daniel Shaver" from Appendix C). Ultimately, the suspect was found to be unarmed, and his hand movements can most likely be explained as an attempt to pull his pants up. Pertinent factors were overlooked by the officer beforehand, such as the suspect's compliance and submissiveness, which could have acted as useful clues that the suspect did not share the characteristics of a person who might suddenly act in a violent manner. All things considered, the officer's actions and method of handling the encounter prior to the shooting were questionable, and cannot be ignored along with other factors that contributed to his decision making (such as training, experience, cognitive overload, and personality). Nevertheless, this example highlights how making inferences about behavioral cues can be potentially problematic, especially when they form a basis for automatic decision making processes.

Taking note of a suspect's behavioral cues can be potentially beneficial to officers, but these observations should be used in a way that supplements an

officer's understanding of a situation holistically, rather than defining it entirely. By considering how the presence of a cue can be explained in relation to previous observations, an officer might be able to better determine whether a behavioral cue is a valid warning of violence or not. This appreciation for circumstantial factors when evaluating behavioral cues should be emphasized in training curriculum for police officers.

There is a practical implication of these findings that applies to the general public; if citizens were better informed which behaviors officers perceive as threatening, it may help prevent misunderstandings that inadvertently lead to the use of less-lethal or deadly force. In particular, behavioral cues involving hand movements such as placing hands in pockets should be emphasized because civilians do not associate this behavior with potential violence as much as police officers (Johnson, 2017). Considering the findings of the present study, there appears to be a basis for this perception.

5.9 Limitations

Much of the criticism toward the qualitative research method has been aimed at its dependency (which corresponds to reliability in quantitative research). To address the issue of future researchers replicating the first part of our study, we have been rigorous and honest in documenting our progress; the attached coding manual (see Appendix B) should aid in the transparency and replicability of our method. The codes, subcategories, and categories that were developed can be perceived as somewhat proprietary to this sample, but they have not been attempted or applied to samples outside this research. On the other hand, we believe that the strength in this method lies in the fact that none of these codes assume the police-officer's or suspect's motivations, thoughts, experiences nor feelings, but instead rely on observable phenomenon. Additionally, they were inspired by extensive research by Johnson and Aaron (2013) and Johnson (2014).

Another matter that applies to the limitations of our findings is its generalizability in regard to the sample that was used for this study. While these findings may not relate to absolutely all police encounters that occur, we believe that they are potentially generalizable to similar cases. In particular, cases where police-officers

were attacked by suspects are likely to be generalizable, as a large proportion of the sample size consisted of this type of videos. The saturation in our sample of interactions characterized by police-officer being attacked meant that fewer of the regular, uneventful interactions were included. As previously mentioned, our sample was directly affected by the types of videos that have been recorded and released online, thus we were unable to practically sample all the recordings that exist. An important point is that not every incident is in fact recorded, and not every recorded incident is made available.

The quality of the footage was not uniform across the videos in the sample, and the camera's vantage point and field of view varied as well. All the recordings were reasonably unobstructed, but the placement of body-cameras on officers' uniforms occasionally led to parts of the picture being covered or temporarily out of view. In contrast to this, in several cases we had access to multiple angles and video-footage of the same situation, gaining a better view of what actually happened. The audio in the video footage was generally good, but in some instances there was a fifteen second delay in the start of audio-recording compared to video-recording on the body-cameras (caused by the programming when activated), which usually occurred during the period of time when the police officer was moving towards the suspect. In a few instances, the sound was disrupted by traffic noise or the chaos of the situation.

A major limitation of our study is that there are numerous factors that can influence an interaction that cannot be controlled for. In our research it was not possible to hold all factors constant, as the data collected stemmed from real-life interactions. For example, the reason for the initiation of contact between the police officer and the suspect was not always clear in our sample. Additionally, information about whether the officer had prior knowledge of the suspect, and whether this suspect had any previous convictions or history of mental illness was unknown. It is also impossible to know whether the nature of the encounter (e.g. traffic stop, domestic call, robbery or burglary, personal dispute, a street encounter) influenced the interaction between the police officer and the suspect, thereby affecting their observable behavior. The interactions could also have been influenced by the time of day, setting, and location.

Police officer's previous training, experience, personality, and state of mind on the day of the encounter could also play an unknown role in how these interactions unfolded. While previous experience may have affected a police officer's perception and reactions, we could not control for past experience with violent encounters. In addition, we did not control for race in our analysis, although it was recorded. Finally, it cannot be ignored that the interaction was a product of all parties involved, thus the actions of the suspect were not entirely detached from the actions taken by the police officer.

5.10 Future research

Since the amount of body camera footage is constantly growing, future research in this area could apply methods similar to those used in this study to continue investigating these behavioral cues. In larger studies with this foundation and those of Johnson (2018), stronger conclusions could be drawn about the validity of behavioral cues and their potential viability as tools to be used in the field by police officers. Considering the widespread use among police officers in the US, additional research on behavioral cues is called for to clarify which of these should be integrated into training curriculum for police officers.

A large body of the literature we encountered concentrated solely on either the role of the police officer or the suspect in the police-suspect encounters. An interesting contribution in the future could address the interaction effects between police and citizens, and how the outcomes of these encounters are influenced by these. Our study revealed that the presence of certain combinations of suspect and police actions simultaneously increased likelihood of specific outcomes; exploration of whether there exist dynamics that contribute to escalations or de-escalations could prove helpful in future training programs. Since cues and actions are not isolated from the context in which they appear, future research should investigate if cues occur in certain combinations or "clusters" that make them more or less relevant to predicting violence.

Another avenue of investigation that could shed further light on de-escalating potentially lethal situations would be to explore the notion of action space in the context of police work. Syndow, Schreyögg and Koch (2009) argued that path

dependence may cause simplification of patterns of actions, which contributes to a "locked-in" routine.

In this study, extensive data on police actions was collected (see Appendix B) and several analyses revealed strong correlations between certain suspect behaviors with police actions. We therefore propose that future research should investigate the effects of the police officers' actions in response to behavioral cues, especially which cues might offer a better chance of an officer reacting appropriately to the circumstances, and identifying which cues are most often misinterpreted.

5.11 Conclusion

To date, this research and Johnson's (2018) study are the only attempts that have been made to study behavioral cues that are thought to be predictive of violence based on observations of real police-citizen interactions. Our methodology was uniquely suited to investigate this question through naturalistic observations and quantitative analysis. With such a modicum of empirical research on the topic, it remains difficult to ascertain which of these behaviors are valid *predictors* of violence; however, our findings offer some indications of which of these behaviors are *related* to violence. Furthermore, this study provides a template for future research in this area. While it would be ideal for officers to have a discrete list of behaviors they could use as early warning signs of impending violence, there is not yet enough evidence to supplement or modify existing training standards based on existing research. Our results suggest that behavioral cues can add to the spectrum of available information that can supplement an officer's understanding during an encounter, but should not act as definitive, stand-alone indicators of violence.

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7. Appendices

Appendix A. List of nonverbal cues predictive of violence developed by Johnson and Aaron (2013)

Muscle cues
Tenses up whole body/becomes rigid
Clenched hands
Jaw muscle tenses
Stretches arms or shoulders
Head-rolls or neck stretches
Facial characteristics
Blinks eyes rapidly
Face becomes flushed red
Stares into your eyes
Avoids eye contact
Angry expression
Body movements
Removes excess clothing
Places hands on hips
Places hands in pockets
Makes exaggerated hand gestures
Paces back and forth
Looks around the area
Invades personal space
Assumes a boxer's stance
Vocal sounds
Cries
Yells
Makes threats
Physiological changes
Breathes more rapidly
Sweats profusely

Note. Reprinted from Johnson and Aaron (2013).

Appendix B. Coding manual

Name	Description
Action	Different types of actions that can happen during a police encounter
Actions taken by police	Actions only done by the police officers
Procedures	Physical actions made by the police officers
Aiming gun	Aiming a gun at a suspect
Area search	Searching an area
Asking questions	Asking questions regarding who the suspect is, where the person is going/coming from, about their relations, previous convictions etc.
Attempt handcuffs	Attempting to put handcuffs
Away	Moving, taking steps backward, getting away
Background check	Looking up background/checking criminal history on the radio or computer
Backup	Specifically calling in for backup
Calming down	Attempting to calm the suspect down either by hand gestures or speech, or both
Car search	Physically searching a car
Cover	Seeking cover behind a car, a house, or objects which can provide cover
Deflecting	Deflecting blows with hands
Falling	Falling on the ground
Firing gun	Pulling the trigger and firing a gun at a suspect
Grabbing	Attempting to or grabbing a person
Moving toward	Moving, taking steps toward suspect

Officer initiated struggle	Taking down suspect via bodyslam/grapple/takedown/hitting, wrestling manuever that might include headlock	
Person search	Physically searching a person	
Pursuit	Pursuing suspect on foot by running or by car	
Put handcuffs	Successufully putting on handcuffs	
Reaching gun	Placing hand on holstered weapon or making a hand movement to reach for it, but then not pulling it out	
Releasing dog	Releasing the K9-unit to pursue, stop or subdue the suspect	
Subdues	Physically subdues the suspect	
Swinging baton	Swinging or striking with baton	
Using taser	Applying taser. After it has been shot off, it's possible to tase someone by pressing the tip of the taser against their body.	
Speech	Different ways of verbal communication	
Commands	Commands given from the police officer to the suspect	
Show hands	Let me see/show me your hands	
Warning	I'm going to tase you/ You're going to get tased/ Will shoot/ You're going to get shot	
Communication to other police officers	Communicating to other police officers by speech or hand movements	
Radio communication	Communication to other police officers by radio	
Casual conversation	Conversing with the suspects	
Actions taken by suspect		
Actions	Done by the suspect	

Drawing knife or blunt object	Drawing a knife or another blunt object, which is of close range
Losing weapon	Losing the knife, whether it is dropped by accident or taken away
Moving away	suspect walking or running
Resists handcuffing/tensing up	Attempting to resist handcuffs or any other action from police officer such as when the police officer grabs the suspect
Suspect aiming	Aiming a gun at a police officer or other people
Suspect drawing	Drawing a gun
Suspect moving toward officer	Moving, taking steps toward the police officer
Suspect hands up	Suspect lifts his or hers hands up
Suspect hitting/initiating struggle	Suspect using fists or arms to strike, attempting to grab, push or tackle the officer
Suspect incapacitates officer	The suspect has overcome the police officer by some means, and the police officer is no longer in a position to take any offensive action.
Suspect pretends having weapon	Suspect pretends to have any kind of weapon, for example a knife or gun, by making movements that are associated with possession of these weapons. Situational example: rising two fists close to each other and directing them towards the officer, as if possessing a gun.
Suspect questions	Asking the officer questions
Suspect shooting	Suspect has fired his or her gun

	Using short range weapon	Stabbing someone with a knife or using any other blunt object/short range weapon to hit
	Waving weapon	Waving with the improvised weapon, excluding knife and gun
Body movements		
	Standing with bladed feet	Assumes a boxer's stance
	Removes excess clothing	Removes excess clothing
	Exaggerated hand gestures	Makes exaggerated hand gestures
	Places hands in pockets	Places hands in pockets
	Concealing hands behind back	Places hands behind the back
	Hands near waistline	Unexplained movements of hands towards waistline
	Looks around the area	Looks around the area
	Pacing	Paces back and forth
Facial characteristics		
	Stare	Prolonged eye contact
Speech		
	Agitated	The person is talking in an aggravated, fast way
	shoot me	Suspect telling cop to shoot him either trying to commit suicide by cop or antagonizing them
Vocal sounds		
	Yelling	Yelling

Appendix C. List of videos with links

| Video ID-nr	New name	Link	Timeframe
1	Attempted knife attack in an intersection	https://www.youtube.com/watch?v=IC3rmKtgLks	
2	Female UK officer assaulted	https://www.youtube.com/watch?v=6hhv_sEh3-E	
3	Man in camouflage jacket shoots officer before fleeing	https://www.youtube.com/watch?v=1mHsWtNC07s	
4	Dashcam of a Texas Trooper being beat up by suspect	https://www.youtube.com/watch?v=VpHyon_FPqQ	
5	Police officer attacked during routine traffic stop	https://youtu.be/zmJ8vdqLNlc	
6	Fatal shooting of a man with his own gun	https://www.youtube.com/watch?v=L161LW6-R_A	
7	Dashcam Footage Of Police Shootout in South Carolina	https://www.youtube.com/watch?v=AgDoDKqgr0M	
8	Man attacks police officer with a shovel before being shot	https://www.youtube.com/watch?v=9wZPcrjTdEI	
9	Two officers shot by a suspect who fled the scene	https://www.youtube.com/watch?v=JitD-ZAdt1E	
10	Officer down, as seen from bodycam	https://www.youtube.com/watch?v=BjHJQveR1Ms	
11	Man attacks police officer with a flagpole	https://www.youtube.com/watch?v=P4yZBap8C9k	
12	Traffic stop where police officer warns suspect not to reach	https://www.youtube.com/watch?v=G5pgZ0yq1-E	
13	Police officers confront suspect in restaurant before shootout	https://www.youtube.com/watch?v=kSiqfM2GR4E	
14	Police fatally shoot homeless man with knife	https://www.youtube.com/watch?v=nr5tqMxR-Ms	
15	Routine stop of a female driver	https://www.youtube.com/watch?v=qSQFkxNhrf8	
16	Traffic-stop of a biker due to reckless driving	https://www.youtube.com/watch?v=p8kJOzDwGpk	02:07-3:47
17	Police stop a suspect riding a borrowed motorbike	https://www.youtube.com/watch?v=p8kJOzDwGpk	4:22-6:15
18	Routine traffic stop of a motorbike at nigh-time	https://www.youtube.com/watch?v=CtsTDmnd3RI	6:04-7:40
19	Police stops a citizen on a go-kart	https://www.youtube.com/watch?v=CtsTDmnd3RI	1:30-3:01
20	Man denied entry to a night club-talks to police officer	https://www.youtube.com/watch?v=czhzxAizojo	

21	A less-lethal take-down of a suspect destroying a police car	https://www.youtube.com/watch?v=8-bi3aREzJ4
22	Peaceful de-escalation of a man attempting suicide-by-cop	https://www.youtube.com/watch?v=4X3VuHgWYic
23	Man draws an axe at a police station	https://www.youtube.com/watch?v=m8guLbozuMs
24	Suspect pretends having a gun, K-9 takedown	https://www.youtube.com/watch?v=MeCNtYAuqaw
25	Live PD-video segment of de-escalation	https://www.youtube.com/watch?v=cGSKtLJY88Y
26	Attempt at suicide-by-cop is averted	https://www.liveleak.com/view?t=k50DF_1521524591
27	Man retrieves gun from his breast-pocket, shootout ensues	https://www.youtube.com/watch?v=AqKRNp2vF4c
28	Suspect refuses to leave his car before firing at officers	https://www.youtube.com/watch?v=HMlzW6iVrRA
29	Fatal shooting of homeless man trying to steal a police car	https://www.youtube.com/watch?v=KcvgrF5BTcw
30	Fatal shooting of a man who stabbed a police officer	https://www.youtube.com/watch?v=vOMNaJXparE
31	Knife-wielding man fatally shot	https://www.youtube.com/watch?v=fBJyYGo7uTU
32	Police shoot man armed with knife	https://www.youtube.com/watch?v=13U6-inlWEI
33	Bodycam shows Bellingham officer shoot man armed with knife	https://www.youtube.com/watch?v=Gz88Q8pTMGQ
34	Suspect shoots officer during questioning, flees	https://www.youtube.com/watch?v=7Q6kb3ZjhNI
35	Bodycam shows police shoot man armed with knife in Maryland	https://www.youtube.com/watch?v=9lJcr_yRJqc
36	Man attacks police officer during arrest in Brisbane	https://www.youtube.com/watch?v=Qo6KFG_7mp4
37	Colorado police officers fatally shoot suspect armed with knife	https://www.youtube.com/watch?v=3bHO0sf4ACM
38	Suspect reaches for a gun, fired on by police	https://www.youtube.com/watch?v=FGsbTPJ_6-Y
39	Standoff with suspect armed with knife	https://www.youtube.com/watch?v=wTtGmodTCSc
40	Suspect armed with knife is fatally shot in a doorway	https://youtu.be/LfVYK1mnyqQ
41	Fatal shooting of a suspect armed with a screwdriver	https://www.youtube.com/watch?v=wq2BoeTtAIE
42	Suspect who reaches for gun is shot before running away	https://www.youtube.com/watch?v=IGqz5_AtInQ

43	Police fatally shoot Daniel Shaver	https://www.youtube.com/watch?v=VBUUx0jUKxc	
44	Citizen with concealed carry-licence is fatally shot	https://youtu.be/PMKcWz5nNoM	
45	A man wielding a machete is disarmed	https://www.youtube.com/watch?v=9mzPj_IaMzY	
46	Officers de-escalate man with knife	https://www.youtube.com/watch?v=M4hrsYLuzhU	
47	Drug dealer attempts to escape British police	https://www.youtube.com/watch?v=S5DvXSEjgQ4	
48	Albuquerque police talk-down armed man	https://www.youtube.com/watch?v=SDtBaZ2UlRw	
49	Successful de-escalation of a conflict with armed suspect	https://www.youtube.com/watch?v=xwwVjzigP5Y	
50	Routine traffic stop of the NAACP president	https://www.youtube.com/watch?v=PmnfnUnW63E	
51	A commissioner is stopped for a traffic control	https://www.youtube.com/watch?v=eY6X_XPlN5w	
52	Non-compliant suspect hits female officer and gets tasered	https://youtu.be/De3TYPnQWMY	1:58-3:50
53	Take-down of a suicidal man armed with rifle	https://www.youtube.com/watch?v=k0R_ysj8-dU	
54	Lieutenant arrested for drunk driving	https://www.youtube.com/watch?v=v6HvvPC2hL0	
55	Angry driver pulled over	https://www.youtube.com/watch?v=JRRTlrfTw0s	
56	Police encounter with citizen open-carrying a firearm	https://www.youtube.com/watch?v=ZFzH5Oe-YL4	

Note. Timeframe is only applicable to videos which are part of a compilation.

Appendix D. Distribution of the age of the sample

Appendix D1. Distribution of the age of police officers

Mean = 30,18
Std. Dev. = 8,632
N = 56
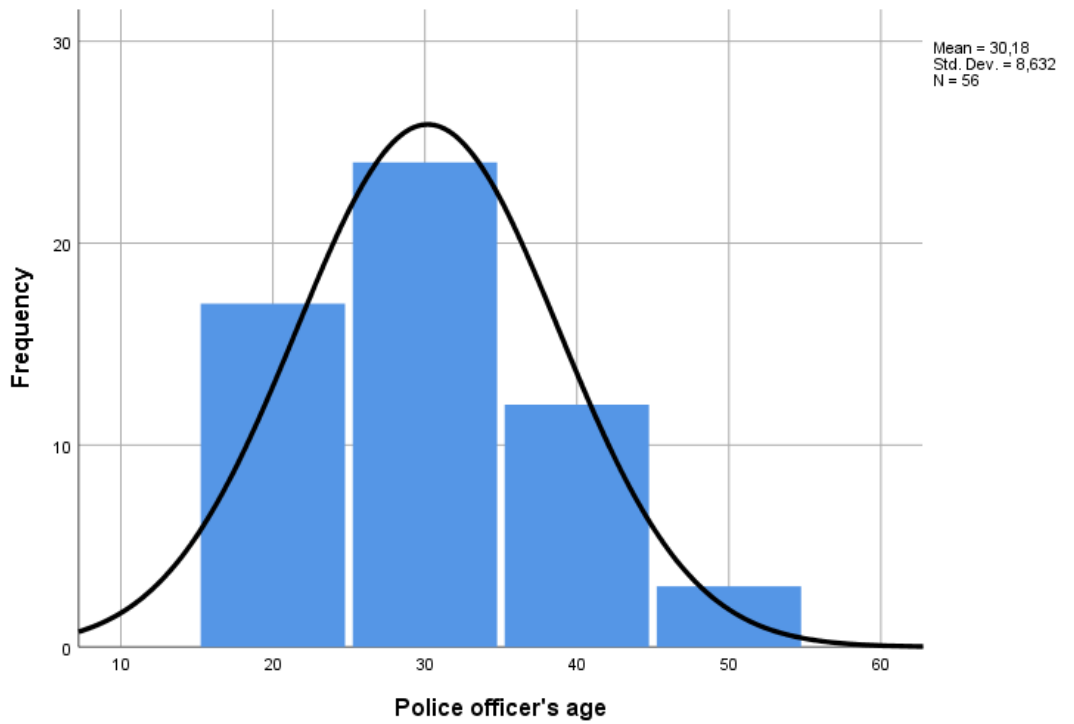
Appendix D2. Distribution of the age of the suspects

Mean = 29,11
Std. Dev. = 10,14
N = 56
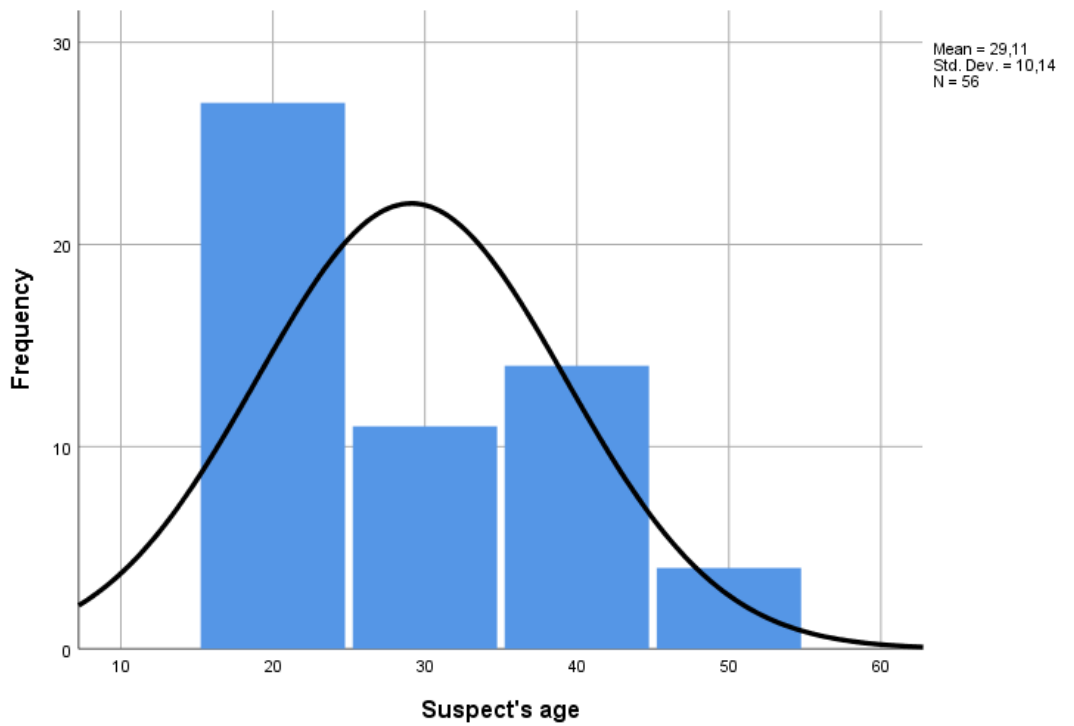
Appendix E. The MANOVA analysis

Appendix E1. The MANOVA statistic-table

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0,737	4,774b	20,000	34,000	0,000
	Wilks' Lambda	0,263	4,774b	20,000	34,000	0,000
	Hotelling's Trace	2,808	4,774b	20,000	34,000	0,000
	Roy's Largest Root	2,808	4,774b	20,000	34,000	0,000
outcome	Pillai's Trace	1,010	1,785	40,000	70,000	0,017
	Wilks' Lambda	0,242	1,759b	40,000	68,000	0,020
	Hotelling's Trace	2,099	1,732	40,000	66,000	0,024
	Roy's Largest Root	1,296	2,268c	20,000	35,000	0,016

Notes. b. Exact statistic. c. The statistic is an upper bound on F that yields a lower bound on the significance level.

Appendix E2. MANOVA: Tests of Between-Subjects Effects

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Handcuffing	,929a	2	0,464	4,738	0,013
	Aiming gun	2,407b	2	1,204	3,045	0,056
	Hands near waistline	4,493c	2	2,246	2,899	0,064
	Warning	,981d	2	0,491	1,640	0,204
	Agitated	1,830e	2	0,915	1,928	0,155
	Show hands	3,066f	2	1,533	1,292	0,283
	Concealing hands behind back	,731g	2	0,365	1,371	0,263
	Pacing	,716h	2	0,358	1,663	0,199
	Places hands in pockets	2,236i	2	1,118	1,507	0,231

	Looks around the area	1,039j	2	0,519	0,293	0,747
	Person search	,074k	2	0,037	0,371	0,692
	Grabbing	1,327l	2	0,663	2,493	0,092
	Resists handcuffing/tensing up	1,213m	2	0,606	2,760	0,072
	Standing with bladed feet	,813n	2	0,406	1,691	0,194
	"Shoot me"	6,256o	2	3,128	1,541	0,224
	Casual conversation	15,792p	2	7,896	3,279	0,045
	Attempts handcuffing	,399q	2	0,200	1,720	0,189
	Yells	13,508r	2	6,754	2,749	0,073
	Calming down	1,022s	2	0,511	0,547	0,582
	Removes excess clothing	,024t	2	0,012	0,340	0,713
Intercept	Handcuffing	1,185	1	1,185	12,086	0,001
	Aiming gun	6,077	1	6,077	15,375	0,000
	Hands near waistline	5,448	1	5,448	7,032	0,011
	Warning	1,262	1	1,262	4,217	0,045
	Agitated	4,426	1	4,426	9,325	0,004
	Show hands	11,020	1	11,020	9,291	0,004
	Concealing hands behind back	0,565	1	0,565	2,118	0,151
	Pacing	0,959	1	0,959	4,454	0,040
	Places hands in pockets	5,907	1	5,907	7,963	0,007
	Looks around the area	18,723	1	18,723	10,577	0,002
	Person search	0,717	1	0,717	7,191	0,010
	Grabbing	2,550	1	2,550	9,582	0,003

	Resists handcuffing/tensing up	1,822	1	1,822	8,292	0,006
	Standing with bladed feet	1,500	1	1,500	6,241	0,016
	"Shoot me"	7,238	1	7,238	3,566	0,064
	Casual conversation	34,757	1	34,757	14,433	0,000
	Attempts handcuffing	0,668	1	0,668	5,749	0,020
	Yells	27,302	1	27,302	11,113	0,002
	Calming down	5,496	1	5,496	5,881	0,019
	Removes excess clothing	0,051	1	0,051	1,427	0,238
outcome	Handcuffing	0,929	2	0,464	4,738	0,013
	Aiming gun	2,407	2	1,204	3,045	0,056
	Hands near waistline	4,493	2	2,246	2,899	0,064
	Warning	0,981	2	0,491	1,640	0,204
	Agitated	1,830	2	0,915	1,928	0,155
	Show hands	3,066	2	1,533	1,292	0,283
	Concealing hands behind back	0,731	2	0,365	1,371	0,263
	Pacing	0,716	2	0,358	1,663	0,199
	Places hands in pockets	2,236	2	1,118	1,507	0,231
	Looks around the area	1,039	2	0,519	0,293	0,747
	Person search	0,074	2	0,037	0,371	0,692
	Grabbing	1,327	2	0,663	2,493	0,092
	Resists handcuffing/tensing up	1,213	2	0,606	2,760	0,072
	Standing with bladed feet	0,813	2	0,406	1,691	0,194
	"Shoot me"	6,256	2	3,128	1,541	0,224

	Casual conversation	15,792	2	7,896	3,279	0,045
	Attempts handcuffing	0,399	2	0,200	1,720	0,189
	Yells	13,508	2	6,754	2,749	0,073
	Calming down	1,022	2	0,511	0,547	0,582
	Removes excess clothing	0,024	2	0,012	0,340	0,713
Error	Handcuffing	5,196	53	0,098		
	Aiming gun	20,950	53	0,395		
	Hands near waistline	41,061	53	0,775		
	Warning	15,858	53	0,299		
	Agitated	25,152	53	0,475		
	Show hands	62,863	53	1,186		
	Concealing hands behind back	14,126	53	0,267		
	Pacing	11,409	53	0,215		
	Places hands in pockets	39,318	53	0,742		
	Looks around the area	93,819	53	1,770		
	Person search	5,283	53	0,100		
	Grabbing	14,102	53	0,266		
	Resists handcuffing/tensing up	11,644	53	0,220		
	Standing with bladed feet	12,741	53	0,240		
	"Shoot me"	107,583	53	2,030		
	Casual conversation	127,636	53	2,408		
	Attempts handcuffing	6,154	53	0,116		
	Yells	130,206	53	2,457		

	Calming down	49,532	53	0,935		
	Removes excess clothing	1,904	53	0,036		
Total	Handcuffing	7,000	56			
	Aiming gun	32,000	56			
	Hands near waistline	55,000	56			
	Warning	19,000	56			
	Agitated	31,000	56			
	Show hands	82,000	56			
	Concealing hands behind back	16,000	56			
	Pacing	13,000	56			
	Places hands in pockets	51,000	56			
	Looks around the area	118,000	56			
	Person search	6,000	56			
	Grabbing	18,000	56			
	Resists handcuffing/tensing up	14,000	56			
	Standing with bladed feet	15,000	56			
	"Shoot me"	119,000	56			
	Casual conversation	178,000	56			
	Attempts handcuffing	7,000	56			
	Yells	162,000	56			
	Calming down	57,000	56			
	Removes excess clothing	2,000	56			
Corrected Total	Handcuffing	6,125	55			
	Aiming gun	23,357	55			

	Hands near waistline	45,554	55			
	Warning	16,839	55			
	Agitated	26,982	55			
	Show hands	65,929	55			
	Concealing hands behind back	14,857	55			
	Pacing	12,125	55			
	Places hands in pockets	41,554	55			
	Looks around the area	94,857	55			
	Person search	5,357	55			
	Grabbing	15,429	55			
	Resists handcuffing/tensing up	12,857	55			
	Standing with bladed feet	13,554	55			
	"Shoot me"	113,839	55			
	Casual conversation	143,429	55			
	Attempts handcuffing	6,554	55			
	Yells	143,714	55			
	Calming down	50,554	55			
	Removes excess clothing	1,929	55			

Notes. a. R Squared = ,152 (Adjusted R Squared = ,120), b. R Squared = ,103 (Adjusted R Squared = ,069), c. R Squared = ,099 (Adjusted R Squared = ,065), d. R Squared = ,058 (Adjusted R Squared = ,023), e. R Squared = ,068 (Adjusted R Squared = ,033), f. R Squared = ,047 (Adjusted R Squared = ,011), g. R Squared = ,049 (Adjusted R Squared = ,013), h. R Squared = ,059 (Adjusted R Squared = ,024), i. R Squared = ,054 (Adjusted R Squared = ,018), j. R Squared = ,011 (Adjusted R Squared = -,026), k. R Squared = ,014 (Adjusted R Squared = -,023), l. R Squared = ,086 (Adjusted R Squared = ,052), m. R Squared = ,094 (Adjusted R Squared = ,060), n. R Squared = ,060 (Adjusted R Squared = ,024), o. R Squared = ,055 (Adjusted R Squared = ,019), p. R Squared = ,110 (Adjusted R Squared = ,077), q. R Squared = ,061 (Adjusted R Squared = ,026), r. R Squared = ,094 (Adjusted R Squared = ,060), s. R Squared = ,020 (Adjusted R Squared = -,017), t. R Squared = ,013 (Adjusted R Squared = -,025)

Appendix F. Discriminant analysis

Appendix F1. Table of the summary of canonical discriminant functions

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	1,296a	61,7	61,7	0,751
2	,803a	38,3	100,0	0,667

Appendix F2. Wilks' Lambda of the discriminant analysis

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 2	0,242	61,800	40	0,015
2	0,555	25,643	19	0,140

Appendix F3. Functions at Group Centroids

outcome	Function 1	2
peaceful	1,148	-,963
less-lethal	,950	1,492
lethal	-1,145	-,057

Note. Unstandardized canonical discriminant functions evaluated at group means