

AOS-17-1302

Resilient Communications Project:

Body Worn Camera Perception Study Phase 1

Memorandum Report

17 November 2017



Asymmetric Operations

Prepared for:
Department of Homeland Security Science and Technology Directorate
Washington, D.C.

This document was prepared under funding provided by the U.S. Department of Homeland Security Science and Technology Directorate (Contract Number N00024-13-D-6400; Task Order 0372, Task Number S8906, Resilient Systems for Public Safety Communication). Points of view or opinions expressed in this document are those of the authors and do not necessarily represent the official position or policies of the U.S. Department of Homeland Security.

The Johns Hopkins University Applied Physics Laboratory (JHU/APL) assumes no liability for this document's content or use thereof. This document does not constitute a standard, specification, or regulation. Additionally, JHU/APL does not endorse particular products or manufacturers. Trade and manufacturer's names may appear in this report only because they are considered essential to the object of this document.

Principal Authors: Steven Babin (JHU/APL), Wendy Koslicki (Washington State University)
Contributing Authors: Ruth Vogel, John Contestabile, Karen Kohri (JHU/APL); David Makin (Washington State University)

The authors would like to express their appreciation to the Department of Homeland Security Science & Technology Directorate First Responders Group and our sponsors Mr. John Merrill and Mr. Cuong Luu.

Please send comments to:

Mr. John Contestabile
Program Manager
JHU/APL
11100 Johns Hopkins Road
Laurel, MD 20723-6099
Phone: 443-220-8090
E-mail: John.Contestabile@jhuapl.edu

Executive Summary

Body worn cameras (BWC) have become more widely used by law enforcement over the last few years, with over sixty different BWCs marketed for law enforcement use (as of May 2016). This usage has resulted in increased scrutiny by governments and news agencies, with many suggesting that BWCs may increase legitimacy and accountability of both law enforcement and civilians. However, it is known that there are differences between human and video observations of the same scene. A person's perception of the observed event is influenced by factors such as their emotional state, personal biases and experiences, etc. The video may not have captured enough of the scene to put the event in context (e.g., shadows, sudden movements out of the field of view). In addition, a person's perception of an event may be influenced by a number of factors such as whether they have observed the video and also have personal recall of the event, whether they only have personal recall, or whether they only have seen the video.

The Johns Hopkins University Applied Physics Laboratory (JHU/APL), under the direction of the Department of Homeland Security (DHS) Science and Technology Directorate (S&T), was assigned a two part task which included a) performing a synthesis study to identify and summarize existing BWC-related research, specifically that which involves law enforcement personnel perceptions of an incident/event to compare with data/video acquired from BWC devices, and b) Develop a research synthesis report that summarizes all applicable research identified and associated findings to DHS S&T for review and approval. Following the completion of these efforts, DHS S&T asked JHU/APL to provide a recommendation regarding the need for a follow-on pilot study.

Because of their ongoing complementary efforts and their large existing library of BWC data, researchers at the Washington State University (WSU) Complex Social Interactions Lab participated in this effort. In the performance of this task, the team of JHU/APL and WSU 1) identified and collated relevant research already undertaken, 2) identified gaps in existing BWC-related research, and 3) provided findings and recommendations to help inform and help shape any follow-on pilot study.

A comprehensive literature search was conducted to identify empirical research, reports and literature reviews, and commentaries and legal reviews considered to be relevant to the task mentioned above. This search resulted in 102 articles, of which 75 were selected for the coding and collation process because they specifically focused on BWCs. A gap analysis of all 75 published and identifiable forthcoming literature as of July 2017 revealed thirteen studies that devoted some focus to police or public perceptions of events captured by BWC. These thirteen studies were grouped into the following categories:

1. Citizen recall of events captured by BWC (two studies);

2. Police/public interpretation of events captured by BWC footage (four studies);
3. Court interpretation of BWC footage (three studies); and
4. Officer recall of events captured by BWC (four studies).

Among our findings was that the reliance on BWC footage as a full or accurate presentation of an event may lead to negative or unintended outcomes. Visual distortions, limited field of view (FOV), as well as mental and physiological stressors, are key factors that can affect a person's perception, understanding, and decision-making. Unfortunately, the most relevant discussions were not empirical studies but rather three author commentaries concerning police perceptions and recall, particularly as they apply to report writing and statements in court.

In summary, no empirical studies were found to have explored law enforcement personnel perceptions of an incident/event as compared to the data/video captured by BWC devices. Therefore, the JHU/APL and WSU team believe that a follow-on study would be of great value to the law enforcement community as it could provide insight to BWC-related policies and procedures. The team found six key knowledge gaps that a study could help address and therefore provide the following potential study topics for consideration:

- a) ***Studies to help determine the best approach for mounting cameras on police officers.*** In alignment with DHS S&T objectives, research should explore *human factor integration associated with the various BWC mounting options* and how differences in mounting may influence the video footage as well as perceptions of events.
- b) ***Studies of the how video footage characteristics influence the perception of the person viewing the BWC video.*** Recognizing the considerable volume of video footage that is captured and widely distributed, it is important to *understand how video data characteristics (e.g., FOV, lighting, frame rate, compression) affect the perception of the person viewing the video compared with what a person saw while observing the event in real-time (e.g., the officer)*. Research could include both experimental research in controlled laboratory and field settings examining differences in the ability or inability to detect objects, and how different objects (e.g., possibly resembling or being a weapon) lead to perceptions of danger and influence the observer's assessment of the interaction.
- c) ***Studies of how observer characteristics influence perceptions of an incident and BWC footage of an incident.*** Perceptions of an incident may vary based on the individual characteristics of those involved, including participants and observers. Research in this area should *examine to what extent race, gender, education, personal experiences and other factors influence perceptions*. Additionally, research in this area could focus on how characteristics of those captured in the footage influence perceptions of threat.

- d) ***Studies on information recall of an event based both on time delay and whether the event was considered traumatic for the observer.*** Information recall associated with negative emotional events has been an active area of research. Subsequent research with eyewitness memory has focused on improving recall and on understanding specifically how trauma influences perceptions of events. Access to BWC footage of critical events would allow for expanded empirical research demonstrating specifically how trauma influences perceptions of time, distance, and the Field of View (FOV). *Research should focus on how different aspects such as time frames, previous experiences, and other physical and mental stressors can influence the recall of an event.*
- e) ***Studies to develop and assess the effectiveness of BWC video training sets.*** In addition to capturing accurate portrayals of proper procedures in field interactions, it will be important to *develop training sets associated with interactions most often associated with critical incidents.* These training sets should then be evaluated to determine the extent to which agency specific training sets improve acquisition and retention of skills and applications of that training in the field.
- f) ***Studies involving automated classification and analysis of BWC video.*** As the volume of BWC footage increases, there is a growing need to *develop automated forms of classification and analysis to improve the efficiency and effectiveness of using this footage.* Interdisciplinary research should be encouraged with social science/criminal justice interpreting and developing useful coding protocols, and in the areas of computer science, social sciences, and engineering developing computer vision and machine learning algorithms.

The complexities of human visual perception and factors that affect the quality or interpretation of BWC video have remained relatively unexplored. This report is one of the few state of the field reports on BWC devices and the first to assess BWC research that examines law enforcement officers' perceptions of events as compared to BWC footage. Findings from this report validate the need for additional study with a focus on one or several of the six knowledge gaps that have been identified. Because neither the human nor the video camera is foolproof, gaining additional knowledge and an improved understanding of where their fallibilities lie will help to inform BWC-related policies and procedures.

This page intentionally left blank.

Table of Contents

Executive Summary	3
1. Introduction.....	8
1.1 Goal of this report.....	8
1.2 BWC Systems Overview	9
1.3 Event Observation (Real-time or Recorded) and Human Perception	14
1.4 Law Enforcement Use of BWC	18
2. Methods and Analysis	19
3. Findings.....	20
4. Conclusions.....	31
5. Recommendations	31
References	35
Appendix A: Article Summaries	39
Appendix B: Article Descriptive Statistics.....	85

1. Introduction

The U.S. Department of Homeland Security (DHS) is committed to using cutting-edge technologies and scientific talent in its efforts to make America safer. The DHS Science and Technology Directorate (S&T) is tasked with researching and organizing the scientific, engineering, and technological resources of the United States and leveraging these existing resources into technological tools to help protect the nation.

Body worn cameras (BWC) have become more widely used in law enforcement over the last few years. As of May 2016, over 60 different BWCs were marketed for law enforcement use and that number is likely increasing. Video recording of interactions between civilians and law enforcement has received increased scrutiny by the news media, as well as local, state, and federal government agencies. There have been suggestions that BWCs have the potential to increase legitimacy and accountability for both citizens and the law enforcement community [e.g., Lum, et al., 2015; President's Task Force on 21st Century Policing, 2015; White, 2014]. However, there are differences between what a human observes and perceives and what a camera captures of the same scene. Video may not reveal the full context of an event due to limited field of view, shadows, etc. (e.g., Boivin et al. 2017). A person's perception of an event can be readily influenced by factors such as emotions, environmental elements, personal bias, situational awareness, and more (e.g., Ito & Urland, 2005; Trawalter, Todd, Baird, & Richeson, 2008). These factors may affect not only a person's recall of the event, but may also influence their decisions and responses.

Therefore, DHS S&T has directed JHU/APL to implement a synthesis study to identify and summarize existing BWC-related research, specifically that which involves law enforcement personnel perceptions of an incident/event to compare with data/video acquired from BWC devices. Because of their existing library of BWC data and ongoing BWC research, researchers at the Washington State University (WSU) Complex Social Interactions Lab participated in this effort. For example, WSU research has identified the influence that camera point of view has on perceptions relating to policy adherence in police use of force. This preliminary research is part of a series of studies exploring how characteristics of a video (camera angle, presence of audio, quality of video, etc.) influence myriad outcomes. These outcomes include, but are not limited to, assessment of policy adherence, support for use of force, evaluation of threat or risk posed, and others.

1.1 Goal of this report

The goal of this initial research effort is to provide DHS S&T with a literature review summary of the current state of research and associated findings related to law enforcement personnel perceptions of an incident/event compared with data/video acquired from BWC devices. Gaps in

this current state of research are identified. Recommendations are made for a possible follow-on study to address one or more gaps found in this review of previous research.

The goals of this initial synthesis study are to:

- a. Identify and collate relevant research already undertaken,
- b. Identify gaps in BWC-related research, and
- c. Summarize the findings to help inform proposed follow-on efforts that align with DHS S&T interests

The following sections provide contextual information that assists in understanding the results and conclusions of the studies reviewed for this task (See Appendix A: Article Summaries).

1.2 BWC Systems Overview

BWC systems typically consist of a camera, microphone, battery, and onboard data storage. They may also include other features, such as infrared illumination or the capability to tag video data with a case number for reference. The resulting video and audio data are stored and later analyzed with compatible software (see Figure 1). The camera records video images within its FOV. While the scene is three-dimensional, these images are two-dimensional. These images are stills taken at a certain frame rate, so that movement is perceived by displaying the recorded still images at a rate that is rapid enough for the human watching the video to perceive motion. This video is limited by the camera FOV, the direction it is pointing, lighting, shadows, frame rate, movement, resolution, and other factors. Also, there could be some limitations due to the way the video is processed for storage, such as compression algorithms to reduce the size of the data. Wallentine et al. (2017) found that, while fooling the human eye to not notice any missing pixels or scenes, BWC video may seem to have recorded continuous action when some of what appears to be new images are actually repeated frames taken from the previous recording to compress the data. The dropped images are not immediately obvious and the resulting video may give the illusion of action not necessarily representative of what actually occurred. Despite their increasingly widespread use, a single set of universally adopted BWC technical requirements does not exist. Therefore, the technical specifications vary among BWC systems. In the following paragraphs, BWC features will be discussed in greater detail.

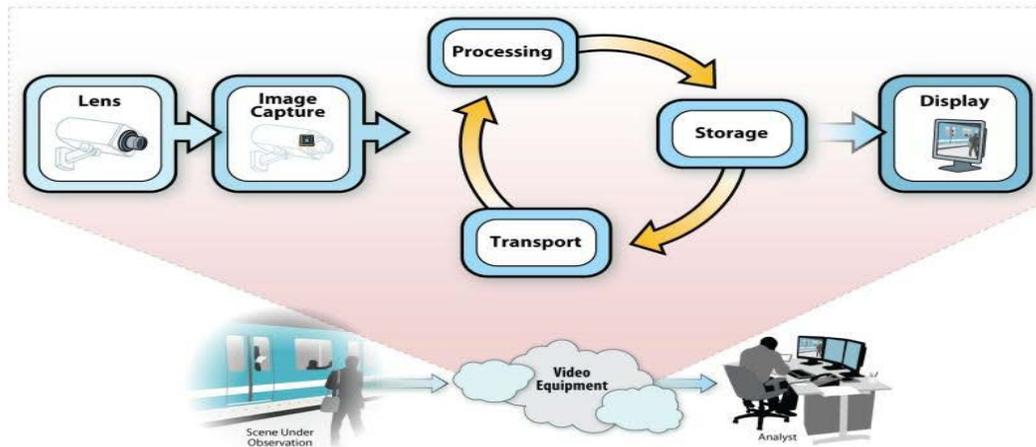


Figure 1: BWC video data acquisition, processing, storage, and analysis.

Camera Mount

The BWC must be mounted to the officer in some fashion, with options including mounting around the ear or head, on a helmet or hat, on the chest, and other less common options. See Figure 2 below. Mounting has a substantial impact on the resulting video. For example, mounting a BWC on the head (e.g., helmet) provides a view of the direction that the officer's head is facing (although the eyes could be looking to one side or above or below). The FOV and subject's distance from the camera are confounding factors that prevent the recorded video from coinciding with the officer's actual visual perceptions at the time of the incident (Williams, 2016).

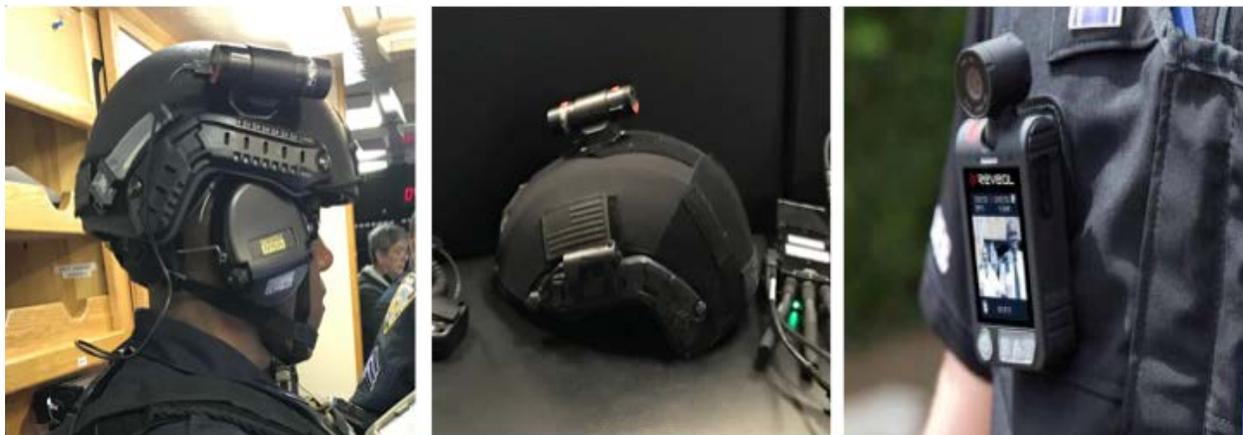


Figure 2: Examples of BWC Placement

Camera mounting is usually determined by policy and requirements set forth by each police department based on what they need the camera to do in their concept of operations. Human integration factors include comfort, ease of use, and possible interference with the officer's field of vision or use of their radio, weapon, etc. Law enforcement executives have provided the following feedback regarding different camera placements (Miller, 2014):

- Chest placement was the most popular placement location among agencies, based on the survey reported by Miller (2014).
- Placement on a pair of sunglasses or a headband is a very popular location because the camera looks in the direction the officer faces (although their eyes could be looking off to the side). However, an officer cannot always wear sunglasses. Some officers have also reported that the headband cameras are uncomfortably tight. Some expressed concern about the potential for injury when wearing a camera so close to the eyes.
- Shoulder/collar placement may provide a good perspective, but the camera view could easily be blocked when officers raise their arms. One agency, for example, lost valuable footage of an active shooter incident because the officer's firearm knocked the camera from his shoulder.
- Some agencies specify that officers should wear cameras on the gun-shooting side of the body, which they believe affords a clearer view of events during shooting incidents.

Camera Resolution

Camera resolution is measured in pixels. The more pixels a camera has, the more detail it can capture and the larger pictures can be without becoming blurry or "grainy" (Nice, 2016). The higher the resolution, the more storage space is needed, thereby incurring more costs. At video graphics array (VGA) resolution (640x480) and a frame rate of 30 frames per second, an hour of video recording would take approximately 550-1,100 MB of storage. High-definition (HD) resolution, also called 720P, is 1280x720 pixels; an hour of recording would take approximately 1,650-3,325 MB of storage (NIJ, 2016).

The DHS S&T System Assessment and Validation for Emergency Responders (SAVER) Program's Wearable Camera Systems Focus Group recommends a minimum VGA resolution (640x480 pixels) (ManTech, 2012). The type of post-recording analysis performed on the video must also be considered before selecting a resolution. For example, a resolution higher than VGA would provide for better quality video to be used as evidence in court. Some cameras have the ability to record in multiple resolutions that can be set by the user. Camera resolution, along with frame rate, contributes to the camera's ability to provide a sharp, clear image with minimal distortion.

Frame Rate / Recording Speed

The frame rate (or recording speed) is defined by the number of frames (or images) the camera takes per second. The DHS S&T SAVER Wearable Camera Systems Focus Group recommends a minimum frame rate of 25 frames per second (fps) (ManTech, 2012). Thirty fps is a standard video frame rate that provides clear and smooth video for later viewing. Too low a frame rate may miss important action, such as the direction a suspect flees or the use of a weapon. The higher the frame rate, the smoother (less jumpy) the video will be. Frame rates lower than 25 fps suffer from increased motion blur (NIJ, 2016). Frame rate, along with video resolution, contributes to the camera's ability to provide a sharp, clear image with minimal distortion so the user can identify people and objects.

Frame rate also has an impact on the size of the video files. Higher frame rates capture more motion detail but require increased storage. This larger video file requires additional data storage, which in turn impacts the resources (financial and human) needed to store, back up, and manage large amounts of data (Sallee, 2014).

Field of View

The field of view (FOV) is the surrounding area that the camera can capture in an image while stationary (e.g., not panning). According to the Video Quality in Public Safety (VQiPS) Digital Video Quality Handbook (VQiPS, 2012), the FOV may be measured in two different ways:

- 1) Horizontal (i.e., from left to right edges of the frame) and vertical (i.e., from the top to the bottom of the frame), or
- 2) Diagonal (i.e., measured from one corner to the opposite corner of the frame)

The FOV is specified in degrees, which may be listed either as diagonal or as horizontal X vertical. Most vendors provide only the diagonal FOV, which is a single number. Some vendors provide the horizontal and vertical numbers for FOV. It is important to note that having only a diagonal FOV number does not provide as much information because a diagonal FOV specification essentially assumes that the camera FOV is square. For example, a 160 degree diagonal FOV would be equivalent to a 113 degree horizontal X 113 degree vertical FOC (assuming a square image), but would also be equivalent to a 125 degree horizontal X 100 degree vertical FOV, which has a significantly better horizontal viewing angle. Also, for a given fixed image resolution, a larger FOV will encompass more objects but in less detail, while a smaller FOV will include less objects, but in greater detail. Furthermore, certain types of lenses (e.g., fisheye) used to increase FOV may result in some distortion, especially near the edges of the video. Lens distortions may complicate efforts to determine distances and may pose a challenge for analytics software.

Lux Rating

Lux is the unit of measure for the amount of light falling on an area and is weighted for human eye sensitivity. The lux rating of the camera refers to minimum amount of light that produces an acceptable image during normal camera operation, not taking into account any night mode feature. A camera with a high lux rating may have difficulty visualizing information in shadow or low light conditions. The DHS S&T SAVER Wearable Camera Systems Focus Group recommends that the camera should have a lux rating less than or equal to 1 lux, with the preferred rate being closer to 0.1 lux (ManTech, 2012).

Low-light Recording

Low-light recording capability refers to the camera's ability to provide a sharp, clear image with minimal distortion so the user can identify people and/or objects in low-light conditions. The SAVER focus group noted that options such as a low lux, infrared light, and black-and-white modes might improve the ability of the camera to record in low-light conditions. Visible flash and infrared illumination may create tactical concerns if they may reveal an officer's location during law enforcement activity. Low-light filtering, infrared, near infrared, and other lowlight compensation technologies or mechanical filters can increase the quality of video taken in low light and severe weather conditions, but may also affect scene and motion detail (NIJ, 2016).

Pre-event Recording

Pre-event recording is a feature that allows the BWC to capture footage for a pre-determined amount of time before an event. A BWC that has this capability will continuously record video images into a temporary storage device (such as a cache memory). In response to a triggering event (e.g., when the police officer presses a button to record), this feature will record the temporarily stored video images into a long-term storage for later retrieval. Thus, when a police officer presses the button to record, the recorded video will include footage for a pre-determined amount of time prior to pressing the record button. Depending on the BWC product, the amount of buffered time usually varies from 15 seconds to 2 minutes. Some BWC systems may have the ability to enable or disable audio capture during pre-event recording to protect private conversations.

BWC Audio

Most BWC systems also capture audio. The audio recording is useful, especially in cases involving investigation of use of force incidents where the video FOV may be limited or partially obscured, for example, due to the officer and suspect being in physical contact during an altercation. Note that the placement of the microphones on the BWC may impact the quality of the recording,

especially for head or shoulder-mounted systems. Some BWC systems include noise suppression technology and more than one microphone.

1.3 Event Observation (Real-time or Recorded) and Human Perception

There are similarities and differences between what a human observes and what a camera viewing the same scene records. Human eyes are constantly moving and adjusting to the scene characteristics in terms of lighting, movement, and focusing on specific objects or persons. There are many models of human information processing but Figure 3 (from a training module used by the US Federal Aviation Administration — FAA) is an example of one very simple model that illustrates some of the intricacies compared with the video processing in Figure 1. Perception is a complex interaction between what the eyes detect and how the brain interprets the images along with the audio, tactile, and other information the brain possesses. In contrast to a video recording, binocular human vision, along with binaural hearing, provide depth perception that creates a three dimensional interpretation of the scene in the brain. In the field, an officer will likely be more attentive to things that are perceived as threatening, such as any rapid movement or anything that resembles a weapon. The human brain has at least two ways of processing this information: a rapid reflexive approach and a slower approach using higher cortical functioning. The rapid reflexive approach is quicker in providing protection from a threat but it may be more prone to making a mistake in interpretation. The slower processing makes fewer mistakes but the results of that interpretation may not be timely enough to offer protection.

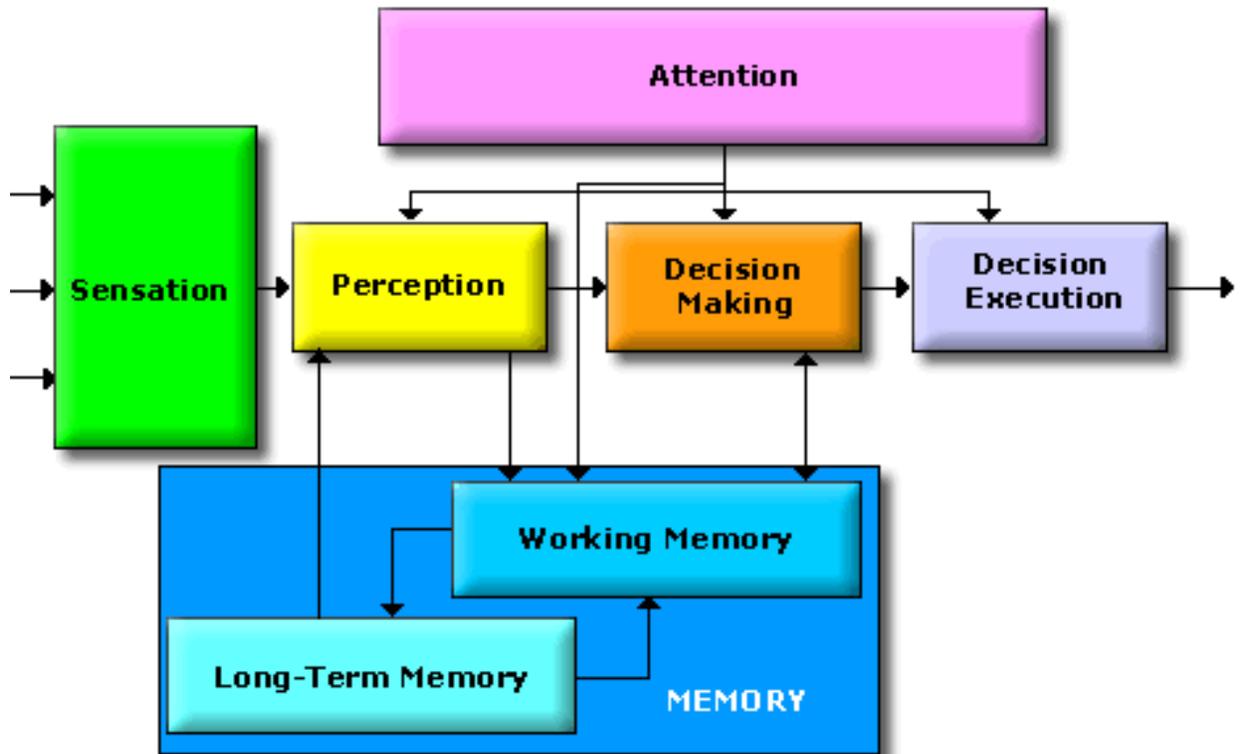


Figure 3: Example of a Simplified Human Information Processing Model used by the FAA
http://www.hf.faa.gov/webtraining/Cognition/Information/info_process1.htm

As noted earlier, a digital video camera captures light within a particular FOV that depends on the direction the lens is facing (see left image in Figure 4). The camera is monocular so the captured images are two-dimensional. In contrast, human eyes provide a three-dimensional moving image. The human eye allows perception of light, color, and depth. The human eye can detect a luminance range of 10^{-6} to 10^8 candela per square meter, compared to 0.1 lux (i.e., 0.1 candela per square meter) recommended by SAVER for a video camera, as mentioned earlier.

The video consists of frames, which are still images recorded by the camera at a certain number of frames per second. Although each image is static, a human perception of motion is created when these images are presented to the viewer's eye in rapid succession. Each frame within the video is typically identified by a unique frame index such that the frame indices are increments of unity (e.g., frame 1, 2, 3, 4, and so forth). Although the video may be played back at any speed, the limiting factor is the rate at which the images were recorded.

Unlike a camera, the human eye is capable of rapid movement to acquire a new image (saccades). Also, it is not possible to cite a frame rate for the human eye. This issue is different from and should not be confused with the determination of the minimum camera frame rate above which

the eye perceives uniform motion (i.e., the fusion rate or the lowest rate of intensity variation for which no flicker is reported). Saying that the human eye typically perceives uniform motion at camera frame rates above, say, 60 fps, is not the same as saying this number represents the frame rate for the human eye. Unlike a camera, the human brain and eye are always adapting to the light received on the retina. This includes involuntary as well as voluntary eye movement, lens focusing, pupil dilation, and the neural processing that occurs almost immediately within the brain. In terms of neural processing, myelinated nerves can fire between 300 and 1000 times per second, which might be considered a frame rate. However, neuron firing is highly variable so one cannot state a single frame rate for processing a set of images.

The FOV of a single human eye is typically 30 degrees upward, 70 degrees downward, 45 degrees toward the nose, and 100 degrees toward the temple. For both eyes combined, the field is 100 degrees vertical and 200 degrees horizontal (see right image in Figure 4). The presence of the optic nerve entering the retina creates a blind spot at about 15 degrees temporal and 1.5 degrees below the horizontal. This blind spot is roughly 7.5 degrees high and 5.5 degrees wide.

Figure 4 below illustrates how a camera may completely miss objects or movements outside of its FOV and therefore might provide an incomplete picture of what really happened. In contrast, the officer's FOV extends beyond what the camera is capable of documenting. Also, in contrast to the camera, the officer's binocular vision provides depth perception within a 60 degree FOV. Beyond 60 degrees, there is less overlap of each eye's FOV so depth perception becomes more limited. However, the officer can still see shape and color. Beyond 120 degrees, where the areas are blind to the opposite eye, the officer can detect movement but not much else.

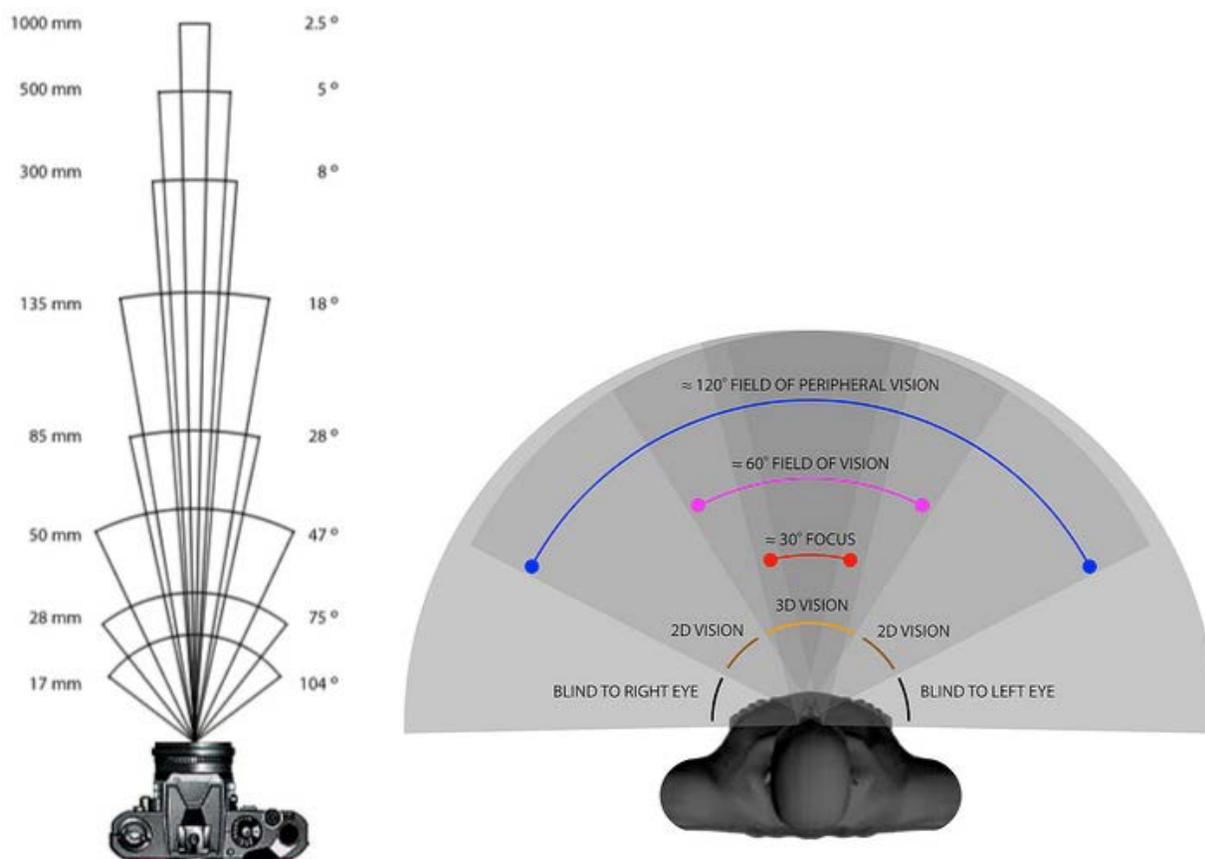


Figure 4: Comparison of different camera FOVs with the FOV of a human with normal vision.
 (Creative Commons Attribution-Noncommercial-Share Alike 3.0 US license,
[http://newmediaabington.pbworks.com/w/page/31338181/ART_314 - Photography as Metaphor](http://newmediaabington.pbworks.com/w/page/31338181/ART_314_-_Photography_as_Metaphor))

Appendix A includes several articles on human visual processing and perception. Some older research studies (especially those highly cited by more recent studies) may supply useful information that either remains current or forms the background for more recent studies on human visual perception. As these articles suggest, there is a great deal of image processing that occurs within each second. The results of this image processing are immediately available to the viewer and can be combined with audible and tactile information. The unique background experiences and biases of each officer influence interpretation of the visual scene. Visual scenes may contain people and objects that compete for the attention of the human observer. This attention is also biased by the experience, knowledge, and emotional state of the observer. In a law enforcement situation, any object that may resemble a weapon, any rapid sudden movement, and a person's physical appearance (e.g., do they look like the person reported to police or do they look like they could physically threaten the officer) could be considered a threat and command attention. The expectation that a threat is present influences the context of the

scene leading to the possibility that something benign might be misinterpreted as that threat. Rapid interpretation of the visual scene is essential when a threat is present to avoid or mitigate the threat. However, such rapid processing is more error prone than slower, more thoughtful cognition (e.g., Muller and Rabbitt, 1989).

Digital video does not inherently have such human biases so it may be considered objective. However, the person viewing the digital video again brings their own past experiences and biases into their interpretation of these images (e.g., Kahan et al., 2009). Especially when used in court as evidence, the assumption of video objectivity collides with the malleability of interpretation (Morrison, 2016). Also, lighting, motion, and frame rate of the video may result in the digital video missing or altering critical information that was available to the person on the scene. These video characteristics and the fact that these images are two-dimensional may also misrepresent or lead to misinterpretation of what the image is showing. A rather dramatic example of this is when a 25 fps frame rate of a video camera matches the rotor speed of a helicopter such that the video appears to show the helicopter flying without any turning of its blades. Such video characteristics are well known and often utilized for their effects on the audience by those who make film and television productions.

In summary, it is important to recognize that neither the human nor the video camera is foolproof. While both are fallible, knowledge of where those fallibilities lie is important in trying to determine what really happened from both the video evidence and the officer's report.

1.4 Law Enforcement Use of BWC

Body-worn cameras have been rapidly emerging as a popular law enforcement tool over the past decade, in both national and international law enforcement contexts (Lum, Koper, Merola, Scherer, & Reieux, 2015). Primary among the reasons for their widespread adoption is the belief that they will increase police accountability and legitimacy (Lum, et al., 2015; President's Task Force on 21st Century Policing, 2015; White, 2014). Other predominant themes that emerge from the current body of BWC literature are the use of BWCs to reduce complaints against officers, to reduce use of force, and to obtain an objective record of events for evidentiary and courtroom use (Capps, 2015; Lum, et al, 2015; White, 2014).

There has been little research to date to question the assumption of BWC footage objectivity. Recent articles have begun to explore biases in BWC footage interpretation (Brucato, 2015; Culhane & Schweitzer, forthcoming; Culhane, Boman, & Schweitzer, 2016; Morrison, 2016) and issues of officers' visual perceptions not always coinciding with the information captured by BWC devices (Phillips, forthcoming). However, the complexities of human visual perception and the aforementioned factors that affect the quality or interpretation of BWC video have remained relatively unexplored. The following gap analysis will assess the state of the field of BWC research,

particularly as it pertains to the question of how officer perceptions of events compare to the information recorded by BWC devices.

2. Methods and Analysis

To identify relevant literature on BWC research, the research team conducted searches primarily through Google Scholar and both the Johns Hopkins University and the Washington State University Library's online academic journal catalogues, which have access to relevant databases such as Sage Complete, LexisNexis, Taylor & Francis Online Complete, the Elsevier SD Freedom Collection, and Academic Search Premier (EBSCO Host). The references of identified articles and reports were also examined to identify additional relevant research. The search was not limited by publication dates, but was designed to include all published and identifiable forthcoming literature to obtain a state of the field of BWC research. This comprehensive search was first conducted in January 2017 and was repeated in May of the same year. A final search was conducted in July 2017 to obtain the most current literature, as well as forthcoming literature that has been accepted to academic journals but has not yet been published.

Literature was limited to empirical research, reports and literature reviews, and commentaries and legal reviews that were considered to be relevant to the goal of this report. Articles that were summaries of a previously published research project with no substantive change in design or findings were excluded to avoid inflation. *A total of 102 relevant articles were found and are listed, along with qualitative summaries, in Appendix A.* These included studies of human visual processing and perception as well as different types of video (not just BWC).

Of these 102 articles, there were 75 that specifically mentioned BWC. These 75 articles were coded according to a comprehensive coding scheme that collected the publication information of each article, as well as information on the research team, article type, primary focus (or foci) of each article, length of study (when applicable), and location of the study (when applicable). Articles with multiple analytical approaches were coded for the highest-level analysis type. For example, a randomized controlled trial that involved an interview component was categorized as a randomized controlled trial. If multiple foci or research questions were included in a single article, each focus or research question was recorded. Given the goal of DHS S&T to identify BWC research that explores law enforcement officers' perspectives of incidents captured by BWC devices, the coding and collation process assessed only studies that specifically focused on BWC devices. Upon the collection and coding of relevant articles, univariate analyses were conducted to assess frequencies and means of the collected variables. Descriptive statistics of the entire sample of BWC articles (N = 75) can be found in Appendix B in Table B-1.

3. Findings

Analyzing the descriptive statistics allowed for the identification of several details about the extant BWC literature, including several gaps in the research relevant to law enforcement officers' perspectives of events captured on BWC devices. Collation of the literature revealed that *there are currently twelve completed randomized and non-randomized trials involving BWCs, with six taking place in the United States and six taking place internationally.* Tables 1 and 2 illustrate the academic citation information of these studies and their locations.

Table 1. Six Known Randomized and Non-Randomized Controlled Trials Involving BWC in the United States

	Academic Citation	Research Site
1	Ariel, B. (2016). Increasing cooperation with the police using body worn cameras. <i>Police Quarterly</i> , 19(3), 326-362.	Denver, CO
2	Ariel, B., Farrar, W.A., & Sutherland, A. (2015). The Effect of Police Body-Worn Cameras on Use of Force and Citizens' Complaints Against the Police: A Randomized Controlled Trial. <i>Journal of Quantitative Criminology</i> , 31(3), 509-535.	Rialto, CA
3	Jennings, W. G., Lynch, M. D., & Fridell, L. A. (2015). Evaluating the impact of police officer body-worn cameras (BWCs) on response-to-resistance and serious external complaints: Evidence from the Orlando police department (OPD) experience utilizing a randomized controlled experiment. <i>Journal of Criminal Justice</i> , 43(6), 480-486.	Orlando, FL
4	*Katz, C.M., Choate, D.E., Ready, J.R., & Nuño, L. (2014). <i>Evaluating the Impact of Officer Worn Body Cameras in the Phoenix Police Department.</i> Phoenix, AZ: Center for Violence Prevention & Community Safety, Arizona State University.	Phoenix, AZ
5	*Mesa Police Department. (2013). <i>On-officer body camera system: Program evaluation and recommendations.</i> Mesa, AZ: Mesa Police Department.	Mesa, AZ
6	White, M. D., Gaub, J. E., & Todak, N. (Forthcoming). Exploring the Potential for Body-Worn Cameras to Reduce Violence in Police-Citizen Encounters. <i>Policing: A Journal of Policy and Practice</i> , DOI: 10.1093/police/paw057	Spokane, WA

* Indicates research sites with multiple publications attached. The academic citation listed is the first known publication about the associated research site.

Table 2. Six Known International Randomized and Non-Randomized Controlled Trials Involving BWC

	Citation	Research Site
1	*Ariel, B., Sutherland, A., Henstock, D., Young, J., Drover, P., Sykes, J., Megicks, S., & Henderson, R. (2017). "Contagious Accountability": A Global Multisite Randomized Controlled Trial on the Effect of Police Body-Worn Cameras on Citizens' Complaints Against the Police. <i>Criminal Justice and Behavior</i> , 44(2), 293-316.	Multisite
2	Grossmith, L., Owens, C., Finn, W., Mann, D., Davies, T., & Baika, L. (2015). <i>Police, camera, evidence: London's cluster randomised controlled trial of body worn video</i> . London, UK: College of Policing Limited and the Mayor's Office for Policing and Crime.	London, UK
3	Hardy, S., Bennett, L., Rosen, P, Carroll, S., White, P., & Palmer-Hill, S. (2017). The Feasibility of Using Body Worn Cameras in an Inpatient Mental Health Setting. <i>Mental Health in Family Medicine</i> , 13, 393-400.	Northampton, UK
4	Henstock, D. & Ariel, B. (Forthcoming). Testing the effects of police body-worn cameras on use of force during arrests: A randomised controlled trial in a large British police force. <i>European Journal of Criminology</i> , DOI: 10.1177/1477370816686120.	West Midlands, UK
5	ODS Consulting. (2011). <i>Body Worn Video Projects in Paisley and Aberdeen, Self Evaluation</i> . Glasgow: ODS Consulting.	Renfrewshire/Aberdeen, Scotland
6	Owens, C., Mann, D., & Mckenna, R. (2014). <i>The Essex Body Worn Video Trial: The impact of BWC on criminal justice outcomes of domestic abuse incidents</i> . London, U.K.: College of Policing.	Essex, UK

* Indicates research sites with multiple publications attached. The academic citation listed is the first known publication about the associated research site.

Randomized and non-randomized controlled trials are often considered the "gold standard" of experimental research. In these 12 known randomized and non-randomized controlled trials, the primary hypothesis explored is the effect of BWC devices on reducing police use of force (six studies), and citizen complaints (eight studies). A complete list of research hypotheses explored by these randomized and non-randomized controlled trials is provided in Table B-2 of Appendix B. That table also provides descriptive statistics for this set of twelve articles. Some studies did explore officers' and citizens' perceptions regarding BWC devices themselves (three studies and

one, respectively); however, none of these experiments explored law enforcement officers' or citizens' perspectives of police-community interaction events captured by BWC devices.

Because these twelve studies did not include perceptions of police-community interactions, the analysis was expanded to include all articles types, both empirical and non-empirical in design. This revealed 13 published and forthcoming studies that contained research questions that were coded as being concerned with law enforcement officers' and citizens' perceptions regarding police-community interaction events recorded by BWC devices. It must be noted that three other articles contain quotes from police practitioners regarding fears that the BWC device may not capture the nuances and complexities of the event as the officer perceived it (Capps, 2015; Makin, 2016) and that inconsistencies between officers' reports – written based on the officer's recall of what he or she perceived during the event – and BWC camera footage may damage officer credibility in court (Miller & Tolliver, 2014). However, these quotes and statements are brief and do not comprise the main research questions of the articles; therefore, they were not classified as having an officer perception focus during article categorization and have been excluded from the thirteen.

Figure 5 demonstrates the breakdown of the 75 coded articles by primary research focus, with detail provided for the 13 identified studies that were concerned with law enforcement officers' and citizen's perceptions regarding incidents recorded by BWC. Full summaries of these 75 coded articles can be found in Appendix A, where they are identified by bold font in their citation.

Table 3 provides the academic citations, article types, and brief summaries of the thirteen studies categorized as being primarily concerned with law enforcement officers' and citizens' perceptions of events recorded by BWC. Full summaries of these thirteen articles are listed in alphabetical order by first author last name in Appendix A, as are summaries for all 102 articles.

Figure 5: 75 Articles Categorized by Primary Foci, with BWC Perception Studies Identified

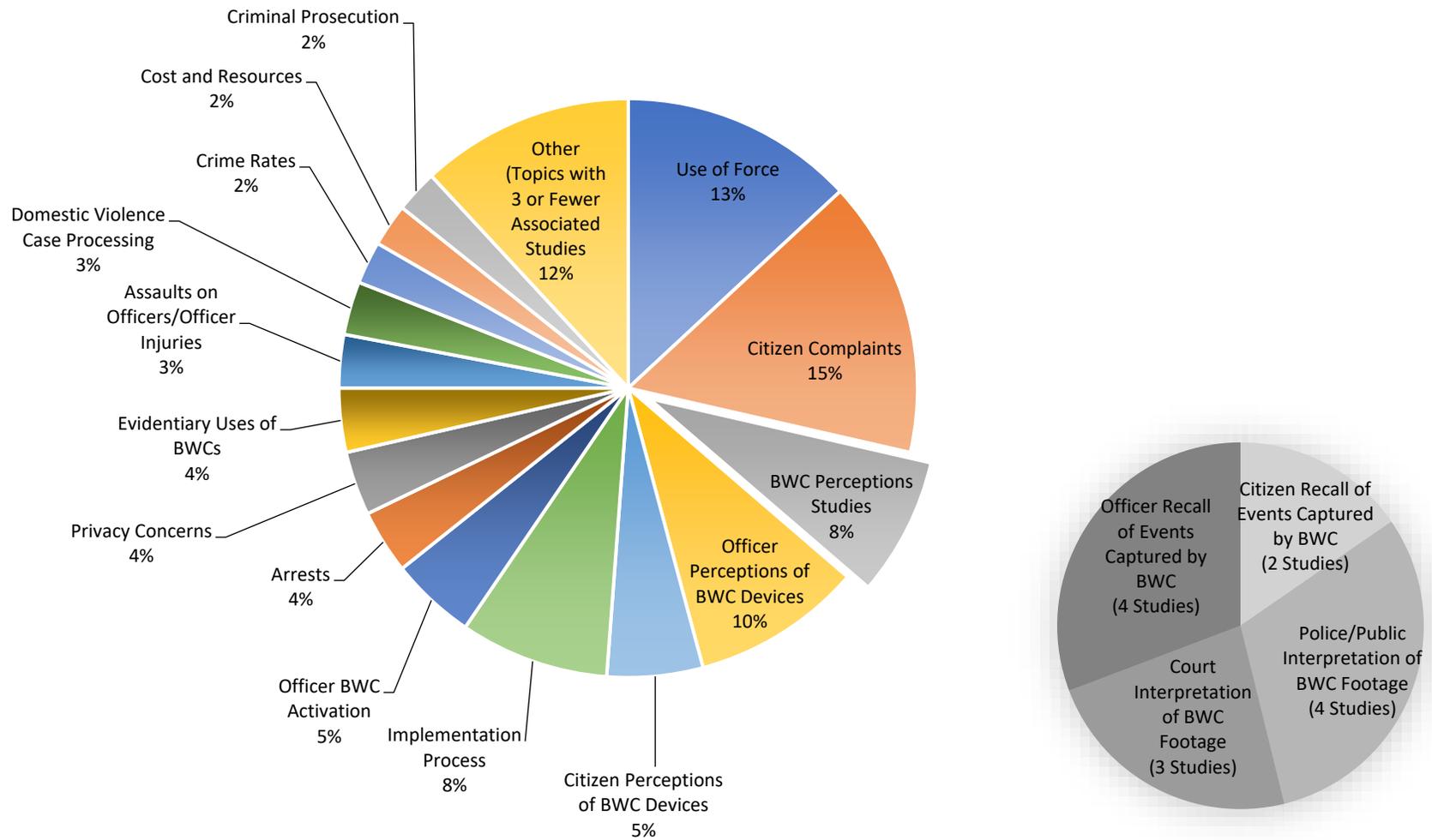


Table 3. 13 Citations and Summaries of Relevant Officer and Citizen Perception Research on BWCs

	Citation	Study Type	Focus	Summary
1	Baker, M. A. & Bacharach, V. R. (Forthcoming). Police Officer-Civilian Confrontations Caught on Camera: The Influence of Contextual Frames on Judgements of Excessive Force. <i>American Journal of Criminal Justice</i> , DOI: 10.1107/s12103-017-9387-5.	Empirical	Public/Police Interpretation of BWC Footage	The authors explore the effects of informational frames (what viewers know when watching video footage) and demographic frames on survey subjects' perceptions of excessive police force when watching video footage of a police use of force event. Found that both informational frames tested (whether respondents were warned that the footage does not contain contextual information preceding and following the filmed event, or whether respondents were informed of police procedural guidelines) did not affect respondents' perceptions of excessive force. Race/ethnicity of the survey respondent was found to be positively related to ratings of excessive force, with people of color more likely to rate the event as excessive, as compared to white respondents. The authors suggest that the video footage and informational frames may have been too brief to elicit a measurable emotional response from the viewers.
2	Boivin, R., Gendron, A., Faubert, C., & Poulin, B. (2017). The body-worn camera perspective bias. <i>Journal of Experimental Criminology</i> , 13(1), 125-142.	Empirical	Public/Police Interpretation of BWC Footage	The article discusses how "camera perspective bias" (the effects that different viewing angles have on viewer perception of events) may affect viewers' thoughts on the appropriateness of police use of force. It was found that police cadets did not vary on their views of the appropriateness of the officer's actions in the footage, but varied significantly in their rating of possible disciplinary actions towards the officer in the footage, depending on which footage type they viewed. It was also found that police cadets who viewed BWC footage were more likely to rate the officer as firing too soon. The authors suggest that BWCs may affect viewers' perceptions of distance, leading them to believe that suspects are further away than they actually are.
3	Brucato, B. (2015). Policing made visible: mobile technologies and the importance of point of view. <i>Surveillance & Society</i> , 13(3/4), 455-473.	Thought Piece/ Commentary	Court Interpretation of BWC Footage	The author explores the design and use of police BWC devices, arguing that they are counter-surveillance technologies, as they assist police agencies in presenting a more official form of footage, thus invalidating civilian footage types, such as cell phone footage. Though footage is often seen as an "objective" recording of events, footage is still subject to bias in interpretation.

	Citation	Study Type	Focus	Summary
4	Culhane, S. E. & Schweitzer, K. (Forthcoming). Police shootings and body cameras one year post-Ferguson. <i>Policing and Society</i> , DOI: 10.1080/10439463.2016.1275624.	Empirical	Public/Police Interpretation of BWC Footage	Provides a partial replication of Culhane, Boman, and Schweitzer (2016) below, one year post-Ferguson. Found that subjects in the video and audio only conditions were more likely to see the police shooting as justified, as compared to transcript only condition. Found a significant interaction between officer's orders and the presentation type (video, audio, or transcript) with video and officer's orders to wait for backup being viewed as the least justified condition. The authors suggest that the timing of charged media coverage of officer-involved shootings may influence public perceptions of police shooting justifiability. They also suggest that future research examine situational and behavioral factors contained in police footage and the influence on public views of the justifiability of a police shooting captured on BWC.
5	Culhane, S. E., Boman, J. H., & Schweitzer, K. (2016). Public Perceptions of the Justifiability of Police Shootings: The Role of Body Cameras in a Pre-and Post-Ferguson Experiment. <i>Police Quarterly</i> , 19(3), 251-274.	Empirical	Public/Police Interpretation of BWC Footage	An online sample of U.S. citizens was randomly allocated into several conditions based on presentation type (video, audio only, transcript only) of the same police-shooting incident. Subjects were also given different background information depending on the condition group. The study was replicated before publication following the events of Ferguson, Missouri. Study 1 showed subjects in the video and audio- only conditions to rate the shooting as more justifiable than the transcript condition. However, Study 2 (post-Ferguson) revealed that subjects in the video condition were more likely to rate the shooting as less justifiable than the other conditions. The authors discuss how controversial shootings and case facts may influence citizen perceptions of events captured by BWC.
6	Grady, R. H., Butler, B. J., & Loftus, E. F. (2016). What Should Happen After an Officer-Involved Shooting? Memory Concerns in Police Reporting Procedures. <i>Journal of Applied Research in Memory and Cognition</i> , 5, 246-251.	Thought Piece/ Commentary	Officer Recall	The authors discuss the psychology of memory retrieval and the effects of BWCs and waiting periods on officers' recall when writing reports. They also discuss how BWC footage may assist in officers' recall of events clearly captured on BWC, but may impede recall of other details not captured on the footage. They conclude that post-event information (such as BWC footage) can negatively affect officer accuracy in recalling what the officer actually noticed or thought during the event.

	Citation	Study Type	Focus	Summary
7	Harris, D. (2010). <i>Picture this: body worn video devices as tools for ensuring Fourth Amendment compliance by police</i> (Legal Studies Research Paper Series, Working Paper No. 2010-13). Pittsburgh, PA: University of Pittsburgh School of Law.	Law Review	Court Interpretation of BWC Footage	The author discusses BWC in light of using the technology to ensure Fourth Amendment compliance. Many officers and departments see BWC technology as a device to assist in corroborating their reports, as they believe that BWCs capture what the officer is seeing during the event in question. The author discusses the possibility of policies that mandate routine activation of head-mounted BWCs during any search interaction to provide an indisputable record of events to the court.
8	Ho, J. D., Dawes, D. M., McKay, E. M., Taliencio, J. J., White, S. D., Woodbury, B. J., Sandefur, M. A., Miner, J. R. (2017). Effect of Body-Worn Cameras on EMS Documentation Accuracy: A Pilot Study. <i>Prehospital Emergency Care</i> , 21(2), 263-271.	Empirical	Officer Recall	This pilot study tested the effects of BWC footage review on report documentation accuracy by paramedics. A sample of ten paramedics wore BWC during a staged scenario, wrote their reports, then were allowed to review the video and edit their reports following the review. The study found widespread errors in the reports after the paramedics reviewed the footage and edited their reports. The authors suggest considering the use of BWCs in a paramedic setting, and the review of footage before report documentation.
9	McClure, D., La Vigne, N., Lynch, M., Golian, L, Lawrence, D., & Malm, A. (2017). <i>How Body Cameras Affect Community Members' Perceptions of Police: Results from a Randomized Controlled Trial of One Agency's Pilot</i> . Washington, DC: Urban Institute.	Empirical	Citizen Recall	Among other outcomes, this study examined whether community members accurately recalled whether there was a BWC present during a police-citizen interaction. Forty-three percent of the survey respondents claimed they did not remember, and half of those who claimed to remember were inaccurate in their recall. Officer statement of BWC recording did not seem to affect accuracy of community member recall.

	Citation	Study Type	Focus	Summary
10	Morrison, C. M. (2016). <i>Body Camera Obscura: the Semiotics of Police Video</i> (Legal Studies Research Paper No. 2016-17). Atlanta, GA: Georgia State University College of Law.	Law Review	Court Interpretation of BWC Footage	The author discusses the lack of interpretation guidelines in the legal system when using BWC evidence. The author points out that while BWC footage is thought to be objective, it can lead to a perspective bias, where the courts focus on whether an officer may have been in fear for his or her life and may be influenced by the intensity of the video. The author also discusses the different meanings that can be ascribed by a viewer of images and footage, and the perspective bias that may occur when viewers are placed into an officer's perspective through BWC, thus viewing the officer much like a protagonist in a first-person video game.
11	Phillips, S. W. (Forthcoming). Eyes are not Cameras: The Importance of Integrating Perceptual Distortions, Misinformation, and False Memories into the Police Body Camera Debate. <i>Policing: A Journal of Policy & Practice</i> , DOI:10.1093/POLICE/PAW008.	Thought Piece/ Commentary	Officer Recall	The author discusses that while BWCs provide an objective recording of events, officers can experience perceptual distortions in crisis events and therefore their observations may not match the video footage. Regardless of the training that officers receive, officers infrequently deal with crisis events, and are therefore just as prone to perception and identification error as the average civilian. Because officers must make split-second decisions in crisis events, the high scrutiny given to reviewing police video when determining whether an officer behaved correctly may not be the best way of reviewing officer behavior. It cannot be assumed that any officer testimony that disagrees with BWC footage is a lie.
12	Rowe, M., Pearson, G., & Turner, E. (Forthcoming). Body-Worn Cameras and the Law of Unintended Consequences: Some Questions Arising from Emergent Practices. <i>Policing</i> , DOI:10.1093/POLICE/PAX011.	Thought Piece/ Commentary	Officer Recall	The authors discuss "unintended consequences" of BWC implementation. Relevant to the issues raised by Grady, Butler, and Loftus (2016) and others, these unintended consequences include the problem of officers viewing BWC footage before giving a statement, as the officer may then observe things in the footage that they may not have actually noticed or perceived during the actual event (and what the officer initially wrote in their report). The resulting inconsistency could lead to harsher prosecution or the defense using BWC footage to attack the credibility of an officer.

	Citation	Study Type	Focus	Summary
13	White, M. D., Todak, N., & Gaub, J. E. (Forthcoming). Assessing Citizen Perceptions of Body-Worn Cameras after Encounters with Police. <i>Policing: An International Journal of Police Strategies & Management</i> .	Empirical	Citizen Recall	This study examines how often Spokane, WA community members are aware of being recorded by BWC, and whether these citizens believe that awareness of being recorded affected their behavior positively. Twenty-eight percent of respondents were aware of being recorded, and only 10% of the 28% that were aware agreed that the knowledge of being recorded made them act more cooperatively with the police. The authors therefore find low support for the civilizing effect of BWCs on community members (in this study).

As seen in the summaries in the above table, the foci of these studies can be grouped into the following four categories: citizen recall of events captured by BWC (two studies); police/public interpretation of events captured by BWC footage (four studies); court interpretation of BWC footage (three studies); and officer recall of events captured by BWC (four studies).

The studies that focus on citizen recall of events recorded by BWC are fairly consistent in their findings, with both White and colleagues (forthcoming) and McClure and colleagues (2017) finding that few citizens accurately recall whether they were being recorded by BWC when interacting with a police officer, and that an officer's statement of recording did not appear to affect accuracy in citizen recall.

The studies focusing on police and public interpretation of footage captured by BWC primarily examine police and public perceptions of the footage itself post-event, with the main hypotheses assessing the relationship between camera placement or perspective (such as BWC footage compared to CCTV footage, or BWC footage compared to audio only) and viewer interpretation (Biovin et al, 2017; Culhane et al, forthcoming; Culhane et al, 2016) and the relationship between demographics and informational frames and viewer interpretation (Baker & Bacharach, forthcoming; Culhane et al, forthcoming; Culhane et al, 2016). These studies do not examine police (or public) perceptions of police-community interactions as they occur at the incident level. That is, these studies only examine post-event outcomes, such as viewer (not participant) interpretation of incidents captured by BWC in the past. None of these studies examine the dynamic individual interactions or the individual participants' (both officer and citizen) perceptions as these incidents occur.

There are developing dialogues between the studies within the categories that focus on court interpretation of events captured by BWC footage and officer recall. While Harris (2010) assumes BWC footage to be an "indisputable record of interactions between officers and citizens" (p. 19), Grady and colleagues (2016) recognize that, while BWC footage itself is an objective record of events, it does not capture what the officer actually noticed during the unfolding of the event. Morrison (2016) takes a more critical approach to footage interpretation, also recognizing that BWC footage is not as transparent as many believe, and arguing that BWC footage can bias viewers and the courts to the officer's perspective, as the first-person view that the BWC provides places the viewer into the officer's viewpoint, much like a first-person shooting video game places a player directly into the protagonist's role. Brucato (2015) largely agrees with Morrison (2016), though Brucato does not focus on the first-person perspective of the BWC footage as much as the bias that the American legal system has towards police evidence, as opposed to citizen video evidence.

The studies focusing on officer recall are likewise mixed, with the focus placed largely on whether to allow officers to review their BWC footage of an event before writing their reports or giving

testimony in court. Ho and colleagues (2017) recommend allowing BWC footage review before report writing due to the effects of trauma in reducing accurate memory recall (it must be noted that their study examines a population of emergency medical workers and not police officers). Grady and colleagues (2016) and Rowe and colleagues (forthcoming), however, do not advocate for BWC footage review before officers write reports or give statements in court. Though both studies recognize the negative effect of traumatic events on memory retrieval, Grady and colleagues (2016) note that information captured by BWC footage may include information that the officer did not mentally register during the actual event. Viewing the footage may influence the officer to “recall” information that he or she did not notice before viewing the footage. If this footage review and false recall occurs after the officer has written his or her report, but before the officer gives a statement in court, this inconsistency can also cast doubt on the officer’s credibility and honesty (Rowe et al, forthcoming). Conversely, should an officer provide an account of what he or she actually perceived during the event, and the account is at odds with the footage captured on video, the officer’s credibility may still be attacked in court. As discussed by Grady and colleagues (2016, p. 247):

An officer might honestly believe that the victim was rushing at him from the side; even if the video later shows that the person was walking. A discrepancy like this may lead to a perception that the officer is lying to protect him or herself, undermining trust from civilians and decreasing the desire to use BWCs at all. ... But mistaken officers, like mistaken victims and eyewitnesses, deserve consideration of processes other than deliberate lying that may lead to a report that is contradicted by video.

Perhaps the most comprehensive discussion of police officer perceptions and perceptual distortions during events and the comparison to events captured by BWC footage is found in Phillips’ (forthcoming) commentary. Phillips (forthcoming) recognizes the widespread occurrence of perceptual distortions (such as auditory variations, tunnel vision, and time distortions) that often take place during crisis events, such as officer-involved shootings (see Klinger, 2001 and Klinger and Brunson, 2009 for further discussion of these perceptual distortions). Phillips additionally emphasizes that, while officers receive some training, their involvement in crisis events is rare, resulting in officers being no more accurate than the average citizen when recalling events or making accurate judgments during events (Phillips, forthcoming). As discussed by Phillips (forthcoming, p. 4):

Based upon the officer’s concern for danger, their training to watch a person’s hands, and their inability to be better witnesses than anyone else, it is understandable that if an officer thinks he or she sees a gun, then the officer will say ‘I saw a gun.’ It is not a conscious intent to lie or misrepresent an event; rather it is a reasonable subconscious belief that they really saw something that was not there.

As Grady and colleagues (forthcoming) recommend, Phillips (forthcoming) concludes that courts cannot assume that officer testimony that disagrees with BWC footage is a lie, and BWC footage – though objective in its recording – does not provide a full testimony of events. The reliance on BWC footage as a full and accurate presentation of an event may indeed lead to negative consequences when perceptual distortions and other physiological responses to crisis events are not included in BWC discussions.

4. Conclusions

This report is one of the few state of the field reports on BWC devices (see Cubitt, Lesic, Myers, & Corry, forthcoming; Lum et al., 2015; Miller & Tolliver, 2014; and White, 2014 for previous reports), and the first known effort to assess BWC research that examines law enforcement officers' perceptions of events as compared to BWC footage. An extensive literature review found 102 articles published or forthcoming, among which 75 specifically involved BWCs. A gap analysis of all published and identifiable forthcoming BWC literature as of July 2017 revealed 12 known randomized and non-randomized controlled trials; however, these 12 experiments were found to focus largely on the same research questions (namely, the effects of BWC on police use of force and citizen complaints). Therefore, the analysis was expanded to all research and article types. This new analysis revealed 13 studies that devoted some focus to police or public perceptions of events captured by BWC. Of these 13, the most relevant studies were three discussions of police perceptions and recall, particularly as they apply to report writing and statements in court (Grady et al, 2016; Phillips, forthcoming; Rowe et al, forthcoming). It must be noted, however, that these three studies are author commentaries, not empirical studies. Another three articles (Miller and Tolliver, 2014; Capps, 2015; Makin, 2016) contained police practitioner quotes about officer perceptions of events and court interpretation. Because these quotes and statements did not comprise the main research questions of the articles, these three articles were not classified as having an officer perception focus during article categorization. While it seems that this is an issue that practitioners have quickly identified, it remains a gap because most prior academic publications have not studied it. Finally, our review shows that no known empirical study to date has examined the intricacies of law enforcement officer perceptions and interpretations of events captured by BWC devices.

5. Recommendations

How police officers perceive interactions, and the influence on perceptions of camera angles, mounting position, video and sound quality, and environmental conditions of those interactions is unknown, as determined by this comprehensive review of empirical studies. A considerable

gap has been revealed in the body of literature being produced. Specifically, these findings validate the need for research examining officers' perceptions and recall of events, both critical and seemingly benign, to the BWC footage of that event. Therefore, the JHU/APL and WSU team believe that a follow-on study would be of great value to the law enforcement community to provide insight to BWC-related policies and procedures. The team found six key knowledge gaps that further study should address. The following potential study topics are recommended for consideration:

- a) ***Studies to help determine the best approach for mounting cameras on police officers.*** In alignment with DHS S&T objectives, research should *explore human factor integration associated with the various BWC mounting options and how differences in mounting may influence the video footage and the perceptions of events.* Research conducted in the late 1980s by Kraft (1987) suggested camera angle influences evaluation and recall of events. This original research introduced the influence camera angle has on perceptions of events. Most recently, research by Parry, Moule, and Dario (2017) explored effects of point-of view and other technology exposures on perceptions of police.
- b) ***Studies of the how video footage characteristics influence the perception of the person viewing the BWC video.*** Recognizing the considerable volume of video footage that is captured and widely distributed, it is important to *understand how video data characteristics (e.g., FOV, lighting, frame rate, compression) have on the perception of the person viewing the video compared with the perception of a person who was observing the event (e.g., the officer).* Research could include both experimental research in controlled laboratory settings and field settings examining differences in ability or inability to detect objects, and how different objects (e.g., those resembling a weapon) lead to perceptions of danger and otherwise affect the observer's assessment of the interaction. Studies could be modeled after the Fessler, Holbrook, and Snyder (2012) research funded by the U.S. Air Force Office of Scientific Research.
- c) ***Studies of how observer characteristics influence perceptions of an incident and BWC footage of an incident.*** Perceptions of an incident may vary based on the individual characteristics of those involved, including participants and observers. Research in this area should *examine to what extent race, gender, and other factors influence perceptions of threat.* For example, research on observer bias indicates that race and gender of the observer influence perceptions of threat and may cause selective attention within recorded footage and still images (Ito & Urland, 2005; Trawalter, Todd, Baird, & Richeson, 2008). Research in this area could focus on how characteristics of people captured in the footage influence perceptions of threat. For example, do incidents involving the presence

of more official personnel or bystanders change evaluations of the risk associated with the event or perceptions of the outcome?

- d) ***Studies on information recall of an event based both on time delay and whether the event was considered traumatic for the observer.*** Information recall associated with negative emotional events has been an active area of research (see the comprehensive review by Christianson 1992). Subsequent research with eyewitness memory has focused on improving recall and on understanding specifically how trauma influences perceptions of events. Access to BWC footage of critical events would allow for expanded empirical research demonstrating specifically how trauma influences perceptions of time, distance, and the FOV. *Research should focus on how recall of the event is influenced by the time elapsed since the event. Research should also focus on examining the influence of trauma and other forms of stress on perceptions of incidents/events according to those involved and bystanders to these incidents.*
- i. To facilitate this recommended area of research, initial research efforts may attempt to co-collect biometric information from first responders and the BWC footage associated with critical incidents allowing for the *development of behavioral biometric detection to indicate the presence of a high stress state.* In concert with the aforementioned recommended research areas, validation of a biometric authentication system for detecting stress states could better contextualize perceptions of an event. Research in this area could model after the research of Seoane et al. (2014) on wearable devices for mental stress and would connect to recommendations by Willits and Makin (2017) to align biometric data with BWC footage. Research in this area could help explain inconsistencies in what is recalled from an event compared to what is recorded by the BWC.
- e) ***Studies to develop and assess the effectiveness of BWC video training sets.*** In addition to capturing accurate portrayals of proper procedures in field interactions, it will be important to *develop training sets associated with interactions most often associated with critical incidents.* These incidents would include domestic disturbances, mental health calls, incidents with suicidal persons, active shooters, and incidents associated with protests and riots. These training sets should then be evaluated to determine the extent to which agency specific training sets improve acquisition and retention of training, and applications of that training within the field.
- f) ***Studies involving automated classification and analysis of BWC video.*** As the volume of BWC footage increases, it will become necessary to *develop automated forms of classification and analysis to improve the efficiency and effectiveness of using this footage.* Interdisciplinary research should be encouraged with social science and criminal justice

collaboration in interpreting and developing useful coding protocols, and also in collaboration with computer scientists, data scientists, and engineers in developing computer vision and machine learning algorithms.

BWC footage is commonly featured in the court of law and the court of public opinion. It is presented as an objective record of the interaction, and yet it has its limits. Research suggests there is much we do not know as it pertains to what factors influence information recall, perceptions of events, and actions taken within police-citizen interactions. Research in the six proposed areas would provide valuable data towards improving the use of BWC data, in how the technology is developed, its presentation in the courts of law and public opinion, integration into police practice, and the development of technologies enhancing the efficiency and effectiveness of analyzing the data. Importantly, the proposed areas of study are not mutually exclusive, as research in one area would inevitably offer data supporting the other listed research efforts. For example, a research study examining the relationship between physiological stress, decision-making, perceptions of events, and information recall would overlap research areas b), c), and d) above. Additionally, such a study could provide data to investigate effects of technical differences, such as how the mounting angle of the camera influences perceptions of the events, providing important data in support of research area a) above. Studies in these areas would undoubtedly offer important data to inform the DHS S&T commitment to using cutting-edge technologies and scientific talent in its efforts to make America safer.

References

1. Williams, Timothy, Thomas, James, and Jacoby, Samuel. (2016). Police body cameras: what do you see? The New York Times. Retrieved from: <https://www.nytimes.com/interactive/2016/04/01/us/police-bodycam-video.html>
2. Miller, Lindsay, Toliver, Jessica, and Police Executive Research Forum. (2014). Implementing a Body-Worn Camera Program: Recommendations and Lessons Learned. U.S. Department of Justice Office of Community Oriented Policing Services.
3. Nice, Karim. Wilson, Tracy, and Gurevich, Gerald. (2006). How Digital Cameras Work. Retrieved 21 June 2016 from: <http://electronics.howstuffworks.com/cameras-photography/digital/digital-camera.htm>
4. ManTech Advanced Systems International Inc. (2012). A primer on body-worn cameras for law enforcement. U.S. Department of Justice Office of Justice Programs National Institute of Justice.
5. National Institute of Justice (NIJ). (2016). Operating characteristics and functionality of body worn cameras. Available at: <https://www.nij.gov/topics/law-enforcement/exhibits/Pages/body-worn-camera-operating-characteristics.aspx>
6. VQIPS. (2013). Digital Video Quality Handbook. Security Industry Association - Digital Video Subcommittee and the Video Quality in Public Safety Working Group. Available at: <https://www.dhs.gov/sites/default/files/publications/Digital%20Video%20Quality%20Handbook.pdf>
7. Sallee, Vern. (2014). Outsourcing the Evidence Room: Moving Digital Evidence to the Cloud. *The Police Chief* 81 (April 2014): 42–46.
8. Lum, C., Koper, C. S., Merola, L. M., Scherer, A., and Reioux, A. (2015). Existing and Ongoing Body Worn Camera Research: Knowledge gaps and opportunities. Report for the Laura and John Arnold Foundation. Fairfax, VA: Center for Evidence-Based Crime Policy, George Mason University.
9. President's Task Force on 21st Century Policing (2015). *Final Report of the President's Task Force on 21st Century Policing*. Washington, DC: Office of Community Oriented Policing Services.
10. White, M. D. (2014). *Police Officer Body-Worn Cameras: Assessing the Evidence*. Washington, DC: Office of Community Oriented Policing Services.

11. Capps, L.E. (2015). Police Body-Worn Cameras: An Overview. *The Police Chief*, 32(2), 52-54.
12. Brucato, B. (2015). Policing made visible: mobile technologies and the importance of point of view. *Surveillance & Society* 13(3/4):455-473.
13. Culhane, S. E. & Schweitzer, K. (Forthcoming). Police shootings and body cameras one year post-Ferguson. *Policing and Society*, DOI: 10.1080/10439463.2016.1275624.
14. Culhane, S. E., Boman, J. H., & Schweitzer, K. (2016). Public Perceptions of the Justifiability of Police Shootings: The Role of Body Cameras in a Pre-and Post-Ferguson Experiment. *Police Quarterly*, 19(3), 251-274.
15. Morrison, C. (2016). Body camera obscura: the semiotics of police video. *Georgia State University College of Law Legal Studies Research Paper No. 2016-17*.
16. Phillips, S. W. (Forthcoming). Eyes are not Cameras: The Importance of Integrating Perceptual Distortions, Misinformation, and False Memories into the Police Body Camera Debate. *Policing: A Journal of Policy & Practice*, DOI:10.1093/POLICE/PAW008.
17. Makin, D. A. (2016), When the Watchers Are Watched: An Interpretive Phenomenological Analysis of Body-Worn Cameras. *Journal of Qualitative Criminal Justice & Criminology*, 4(1), 113-151.
18. Miller, L. & Tolliver, J. (2014). *Implementing a Body-Worn Camera Program: Recommendations and Lessons Learned*. Washington, DC: Office of Community Oriented Policing Services.
19. White, M. D., Todak, N., & Gaub, J. E. (Forthcoming). Assessing Citizen Perceptions of Body-Worn Cameras after Encounters with Police. *Policing: An International Journal of Police Strategies & Management*, DOI: 10.1108/PIJPSM-07-2016-0105.
20. McClure, D., La Vigne, N., Lynch, M., Golian, L, Lawrence, D., & Malm, A. (2017). How Body Cameras Affect Community Members' Perceptions of Police: Results from a Randomized Controlled Trial of One Agency's Pilot. Washington, DC: Urban Institute.
21. Boivin, R., Gendron, A., Faubert, C., & Poulin, B. (2017). The body-worn camera perspective bias. *Journal of Experimental Criminology*, 13(1), 125-142.
22. Baker, M. A. & Bacharach, V. R. (Forthcoming). Police Officer-Civilian Confrontations Caught on Camera: The Influence of Contextual Frames on Judgements of Excessive Force. *American Journal of Criminal Justice*, DOI: 10.1107/s12103-017-9387-5.

23. Harris, D, 2010. Picture this: body worn video devices as tools for ensuring Fourth Amendment compliance by police. Legal Studies Research Paper Studies, Working Paper No. 2010-13, April 2010, University of Pittsburgh School of Law.
24. Grady, R. H., Butler, B. J., & Loftus, E. F. (2016). What Should Happen After an Officer-Involved Shooting? Memory Concerns in Police Reporting Procedures. *Journal of Applied Research in Memory and Cognition*, 5, 246-251.
25. Ho, J. D., Dawes, D. M., McKay, E. M., Taliercio, J. J., White, S. D., Woodbury, B. J., Sandefur, M. A., Miner, J. R. (2017). Effect of Body-Worn Cameras on EMS Documentation Accuracy: A Pilot Study. *Prehospital Emergency Care*, 21(2), 263-271.
26. Rowe, M., Pearson, G., & Turner, E. (Forthcoming). Body-Worn Cameras and the Law of Unintended Consequences: Some Questions Arising from Emergent Practices. *Policing*, DOI:10.1093/POLICE/PAX011.
27. Klinger, D. A. (2001). *Police Responses to Officer-involved Shootings*. Final Report to the National Institute of Justice.
28. Klinger, D. A. and Brunson, R. K. (2009). Police Officers' Perceptual Distortions During Lethal Force Situations: Informing the Reasonableness Standard. *Criminology & Public Policy*, 8(1), 117-140.
29. Cubitt, T. I., Lesic, R., Myers, G. L., & Corry, R. (Forthcoming). Body-worn video: A systematic review of literature. *Australian & New Zealand Journal of Criminology*, DOI: 10.1177/0004865816638909.
30. Kraft, R. N. (1987). The influence of camera angle on comprehension and retention of pictorial events. *Memory & cognition*, 15(4), 291-307.
31. Parry, M. M., Moule Jr, R. K., & Dario, L. M. (2017). Technology-Mediated Exposure to Police–Citizen Encounters: A Quasi-Experimental Assessment of Consequences for Citizen Perceptions. *Justice Quarterly*, 1-25.
32. Christianson, S. Å. (1992). Emotional stress and eyewitness memory: a critical review. *Psychological bulletin*, 112(2), 284.
33. Seoane, Fernando, Inmaculada Mohino-Herranz, Javier Ferreira, Lorena Alvarez, Ruben Buendia, David Ayllón, Cosme Llerena, and Roberto Gil-Pita. "Wearable biomedical measurement systems for assessment of mental stress of combatants in real time." *Sensors* 14, no. 4 (2014): 7120-7141.
34. Roesner, F., Kohno, T., and Molnar D. (2014). Security and privacy for augmented reality systems. *Commun. ACM*, 57(4), 88-96. DOI: <https://doi.org/10.1145/2580723.2580730>

This page intentionally left blank.

Appendix A: Article Summaries

This appendix lists the academic citations and summaries of all the 102 articles included in the literature review. These articles include presentations and non-academic articles, as well as relevant literature on visual processing and perception. Note that some of the listed papers related to visual processing and perception are not very recent. Sometimes older articles represent seminal research studies that supply useful information that either remains current or forms the background for more recent studies. One indication of their relevance is how often these studies are cited by more recent papers. These papers are included because of their relevance to the accuracy of human visual perception.

The 75 articles that mentioned BWCs and that were used in the gap analysis are listed in bold font. The gap analysis is described in the Methods/Analysis and Findings sections.

1. **Ariel, B. (2016). Increasing cooperation with the police using body worn cameras. *Police Quarterly*, 19(3), 326-362.**

Type of Study: Non-random controlled trial

Research Question(s): Will citizens be more willing to approach and trust the police if BWCs have a legitimizing and professionalizing effect on the police?

Outcomes Measured: Assessed citizen reports of emergency incidents (911 calls) in a stratified sample of street segments within the six districts of Denver, CO that received BWC implementation; this measure was standardized as number of incidents, divided by street segment length (meters) and multiplied by 100 meters. Incidents measures 6 months pre-BWC implementation, and 6 months during BWC implementation.

Findings: BWCs were found to have a positive effect on citizen willingness to report in areas with low crime density, but no treatment effect found for the areas of higher crime density. Author suggests a possible socio-ecological explanation for why high crime density areas (“hotspots”) do not experience a treatment effect, as these hotspots tend to be busier street segments with high turnover and residents of a lower socioeconomic status.

Suggested Future Research by Authors/Recommendations: Author recommends further research into the socio-ecological influence on willingness to report. Author suggests that the rise in willingness to report in the lower crime density areas indicates that BWCs may have enhanced perceived police legitimacy.

2. **Ariel B. (2016). Do police body cameras really work? *IEEE Spectrum*, 4 May 2016.**

Type of Study: Randomized controlled field study (same as prior Rialto study published elsewhere)

Research Question(s): BWC impacts on use-of-force incidents and citizen complaints against Rialto police. The study involved all of the town’s 54 frontline police officers and ran for a year beginning in 2012. These officers were assigned either to treatment (camera-wearing) or control (not camera-wearing) conditions. During treatment shifts, officers were asked to take video of all their interactions with the public, to announce that the encounter was being recorded, and subsequently to store the footage on a secure cloud-based server. In control shifts, the officers were told not to use body cameras at all.

Outcomes Measured: Officially recorded use-of-force incidents and complaints lodged against Rialto police officers during the study period. They compared nearly 500 patrol shifts during which all police-public encounters were assigned to treatment conditions with a roughly equal number of shifts assigned to control conditions.

Findings: There were roughly 50 percent fewer incidents of force being used while the officers were wearing body cameras compared with control conditions (8 incidents as compared with 17). The eight times that the camera-using officers resorted to force was in response to violent behavior of the suspect. In 4 of the 17 instances in which officers not wearing cameras resorted to force, it was the officer who initiated physical contact. In addition, there was a 90 percent reduction in total number of citizens' complaints against police officers compared with the 12 months prior to the experiment.

3. Ariel, B., Farrar, W.A., & Sutherland, A. (2015). **The Effect of Police Body-Worn Cameras on Use of Force and Citizens' Complaints Against the Police: A Randomized Controlled Trial.** *Journal of Quantitative Criminology*, 31(3), 509-535.

Type of Study: Randomized Controlled Trial (RCT)

Research Question(s): Do BWCs reduce officer use of force? Do BWCs reduce citizen complaints against the police?

Outcomes Measured: Use of force was measured using officers' official written reports (measured as whether or not force occurred during the shift). Citizen complaints were measured by number of complaints gathered by Rialto Police Department (not disaggregated by type). Authors also measured total number of police-public contacts to compute incident rates per 1,000 contacts. Experiment conducted for 12 months.

Findings: Authors found that control shifts were approximately twice as likely to use force than experimental shifts (roughly a 50% reduction); authors also found that complaints against the police dropped from .7/1,000 contacts to .07/1,000 contacts (roughly a 90% reduction). Both findings were statistically significant.

Suggested Future Research by Authors/Recommendations: Authors suggest replication, as this was the first study to assess the effects of BWCs on police use of force and citizen complaints.

4. Ariel, B., Sutherland, A., Henstock, D., Young, J., & Sosinski, G. (Forthcoming). **The Deterrence Spectrum: Explaining Why Police Body-Worn Cameras 'Work' or 'Backfire' in Aggressive Police-Public Encounters.** *Policing: A Journal of Policy & Practice*, DOI:10.1093/POLICE/PAW051.

Type of Study: Thought/Theory Piece

Research Question(s): Why do BWCs seem effective in deterring unwanted behavior in some situations and not others?

Outcomes Measured: Summary of Rialto Study (Ariel et al., 2015) and its replications, which measured police use of force, citizen complaints against the police, assaults against officers, and timing of officer BWC activation.

Findings: The authors use deterrence theory to argue that the perceived likelihood of apprehension (plus the swiftness and severity of punishment) is what contributes to the effect of BWCs on use of force. The authors theorize that BWCs offer minimal deterrence when officers are given wide discretion, as cameras may not be activated and/or recording may not be announced. Maximum deterrence is caused when little/no discretion is given to officers, though the authors warn that this can become over-deterrence when officers are limited from using force at all. Over-deterrence can

lead to an over-bureaucratic or “cold” policing style, with no understanding or empathy used by the officer, to avoid any negative feedback from their supervisors for using discretion in any way. “Inertia” is the name given by the authors to when this over-deterrence causes officers to become avoidant of any conflict.

Authors advocate for “optimal deterrence,” which is the name given to the balance between minimum and maximum deterrence, where officers must follow BWC protocol but are given enough discretion to feel free to use proportional force or leniency.

Suggested Future Research by Authors/Recommendations: Authors recommend testing BWCs in a department before implementing them, and advocate an evidence-based policing commitment for departments.

5. Ariel, B., Sutherland, A., Henstock, D., Young, J., Drover, P., Sykes, J., Megicks, S., & Henderson, R. (2017). “Contagious Accountability”: A Global Multisite Randomized Controlled Trial on the Effect of Police Body-Worn Cameras on Citizens’ Complaints Against the Police. *Criminal Justice and Behavior*, 44(2), 293-316.

Type of Study: RCT; data from same multisite study from Ariel et al. 2016a and 2016b

Research Question(s): Do BWCs reduce complaints against the police due to their deterrent effects on both officer and citizen behavior?

Outcomes Measured: Number of complaints filed against officers for the 12-month duration of the study; number of complaints filed against officers in the 12 months before the RCT. Only measured total number of complaints; no access to type of complaints. Officer shifts used as unit of analysis (experimental shifts were those shifts that were randomly selected for BWC use by officers).

Findings: Found an overall 93% reduction (1,539 reduced to 113 across seven experimental sites) in complaints during BWC use, as compared to the 12 months before BWC use. Overall reduction found to be statistically significant, though no between-group differences were found to be statistically significant. Authors suggest their “contagious accountability” framework, where the treatment effect of BWCs is diffused across shifts and sites, due to what the authors posit is regular exposure to the cameras’ deterrence effects.

Suggested Future Research by Authors/Recommendations: Authors suggest that the contagious accountability effect is a two-stage process, where the officer first warns the citizen of the recording, and then the BWC has a proceeding deterrence effect due to both parties’ awareness of its presence. Authors recommend that practitioners encourage a verbal warning of BWC recording by the officer at the beginning of any interaction. Authors recommend that future studies look into specific types of complaints that are affected by BWC use.

6. Ariel, B., Sutherland, A., Henstock, D., Young, J., Drover, P., Sykes, J., & Henderson, R. (2016). Wearing body cameras increases assaults against officers and does not reduce police use of force: Results from a global multi-site experiment. *European Journal of Criminology*, 13(6), 744-755.

Type of Study: RCT

Research Question(s): Do BWCs reduce officer use of force? Do BWCs reduce the number of assaults against officers?

Outcomes Measured: Authors measured officer use of force (whether it occurred; number of times per shift). “Force” defined as any restraint beyond a verbal command. Authors also measured assaults

against officers (whether it occurred; number of times per shift). Data gathered from 10 RCTs across eight police agencies, all of which used shifts as unit of analysis.

Findings: No overall effect found for BWCs on police use of force. However, BWCs were found to lead to an overall increase of assaults against officers. Removing the smallest two studies still led to an overall increase, though this positive effect was no longer found to be statistically significant.

Suggested Future Research by Authors/Recommendations: Further research must assess why BWCs reduced use of force in some places and some times, but not in others. Research must also explore the role of officer discretion when assessing BWC efficacy.

7. Ariel, B., Sutherland, A., Henstock, D., Young, J., Drover, P., Sykes, J., Megicks, S. & Henderson, R. (2016). Report: increases in police use of force in the presence of body-worn cameras are driven by officer discretion: a protocol-based subgroup analysis of ten randomized experiments. *Journal of Experimental Criminology*, 12(3), 453-463.

Type of Study: RCT

Research Question(s): Does officer discretion regarding when and where to activate BWC recording have an effect on officer use of force rates?

Outcomes Measured: Officer self-reported use of force; officer compliance with BWC activation protocol. Compliance was divided into three subgroups: research sites with high compliance, research sites with no compliance, and research sites where the control group was in compliance, but the experimental group was not (for the purposes of this study, the control groups were in compliance when they did not activate BWCs, and the experimental groups were in compliance when they followed strict protocol calling for BWC activation at every encounter upon police arrival to the scene).

Findings: High compliance was found to be associated with decreases in use of force (37%), whereas no compliance had no effect on use of force. In research sites where the control group was in compliance, but the experimental group was not, use of force was found to increase by 71%.

Suggested Future Research by Authors/Recommendations: Authors recommend that agencies consider amending policies to mandate officers to record every citizen interaction with BWC, and alert every citizen of BWC recording. Authors suggest that future research should examine the implications and outcomes of these policy suggestions.

8. Baker, M. A. & Bacharach, V. R. (Forthcoming). Police Officer-Civilian Confrontations Caught on Camera: The Influence of Contextual Frames on Judgements of Excessive Force. *American Journal of Criminal Justice*, DOI: 10.1107/s12103-017-9387-5.

Type of Study: Empirical (subjects answered surveys after random allocation to intervention)

Research Question(s): Do informational frames and demographic frames influence viewers' perceptions of police use of force when watching video footage of a police force event?

Outcomes Measured: Study 1 examines a video-only recording of a police-citizen interaction, divided into the following conditions: gender of officer, pre-warning frame (a warning before the video alerting the viewers that they will see an altercation with no information before or after the altercation), and post-warning frame (the same warning following the conclusion of the video). Subjects rated whether or not they perceived the officer's force as excessive.

Study 2 followed the same structure as study 1, but the warning frame provided an educational statement regarding police-citizen procedural policies, instead of a statement regarding the limitations of the footage.

Findings: Study 1 revealed no significant differences between conditions. However, survey respondent race/ethnicity was found to be significant, with non-white respondents being more likely to rate the officer force as excessive when compared to white respondents.

Study 2 found no significant differences between conditions. Like Study 1, survey respondents' race/ethnicity was found to be significant, and followed the same pattern as Study 1. This relationship remained significant after controlling for income, education, and prior arrest.

Authors suggest that the studies' frames and video footage may have been too brief to affect survey respondents' emotional responses and perceptions of the interaction in the footage.

Suggested Future Research by Authors/Recommendations: Authors suggest enhancing public education regarding police procedure. Future research should empirically examine whether increased public education has an effect on public perceptions of video footage of police use of force.

9. Balcetis E. (2006). Motivated visual perception: how we see what we want to see. Doctoral Dissertation, Cornell University.

Type of Study: Human participants in a laboratory

Research Question(s): How can perceptual systems represent the surrounding world in a way that does not represent reality? She proposes that the perceptual visual representations of which perceivers are consciously aware are biased by unconscious motivations, including wishes, dissonance reduction, and visceral needs.

Outcomes Measured: Participant answers to questions and surveys after being in different laboratory situations.

Findings: The human perceptual system is bombarded with sensory data but has limited ability to process it. Consequently, perceptual systems often create perceptual experiences that are inaccurate reconstructions of reality. Accuracy and speed of object identification are influenced by visual background information. Race-based stereotypes contribute to miscategorization of objects. Motivations of the individual influence their perception of the situation. Categorization, focus of attention, filtering relevant information from a noisy background, and afferent input work together to process the incoming information into a perceptual conclusion. This study tests the ability of motivations to influence three perceptual tasks: pre-perceptual activation of filters, direction of attention, and perceptual information processing. The author describes previous research and the consensus that much of cognition occurs outside of an individual's awareness or control. Also, as a result of the filtering mentioned above, the perceptual conclusion formed by an individual generally lacks much of the information that was available in the environment. The author describes three sets of experiments. In the first, participants shown an ambiguous visual figure reported seeing their desired interpretation. In the second, participants performed an aversive task under high or low choice conditions. Those with high choice conditions perceived travel distances as shorter and climbing slopes as less steep. In the third set of tests, desires such as hunger, thirst, and general preference resulted in a narrower focus of attention on the desired object. When comparing more desired with less desired objects, participants saw more desired objects as closer in distance.

10. Balcetis E. (2016). Approach and avoidance as organizing structures for motivated distance perception. *Emotion Review* 8(2):115-128.

Type of Study: Review

Research Question(s): The author reviews papers that describe how our distance perception is inherently tied to social experiences that evoke strong emotions and motivations.

Outcomes Measured: N/A

Findings: The author notes that summarizing the literature by categorization of specific emotions and affective objects do not produce consistently similar effects on distance perception. For example, disgusting objects may be perceived to be at either neutral or farther distances. The author proposes that these inconsistencies may be reconciled by using a taxonomy of components of affective responding: hedonic valence (degree to which they experience pleasure or displeasure), intensity of motivational response (level of activation, energy, or urge to act), and motivational direction (degree to which the situation provokes an impulse to approach or avoid). Based on the author's analysis, motivational direction does the best job of organizing the literature on motivated distance perception. The author concludes that, based on these studies, approach reduces perceptions of distance, but avoidance exaggerates these perceptions.

11. Balcetis E, Dunning D. (2006). See what you want to see: motivational influences on visual perception. *J. Personality and Social Psychology* 91(4):612-615.

Type of Study: Human participants in a laboratory

Research Question(s): Participants' motivational states (i.e., wishes and preferences) influence their processing of visual stimuli such that they tend to report seeing the interpretation that assigned them to outcomes they favored.

Outcomes Measured: Impact of motivational states on perception of ambiguous figures, as determined by participants' answers to questions and surveys during different laboratory conditions. Participants were shown ambiguous figures. For example, one figure could either be interpreted as a letter B or a number 13.

Findings: The participants tended to interpret the ambiguous figures in terms of outcomes that the participants favored. Therefore, the motivation of the individual influences their perceptual information processing even to include their pre-conscious processing of visual stimuli.

12. Balcetis E, Dunning D. (2010). Wishful seeing: more desired objects are seen as closer. *Psychological Science* 21(1):147-152.

Type of Study: Human studies in a laboratory

Research Question(s): Five studies in participants were asked to estimate the distance to a more desirable or less desirable object. They varied the visceral state of the perceiver or the social value of the object. They also tested the effects of the mood of the perceiver. They controlled for the strength of the participants' attitudes.

Outcomes Measured: They used several dependent measures including verbal, numeric estimate of the distance, action-based measures, or visual matching measures of the participants' distance perception.

Findings: The authors performed experiments that demonstrated that people viewing a scene involving desirable objects (defined as those that can fulfill immediate goals) perceive those objects as physically closer than less desirable objects. The authors state that being prepared to defend oneself against danger is more important than making use of an opportunity for reward. They conclude that undesirable objects that pose a threat and require immediate action could be perceived as closer in order to guide effective and essential action. Negative objects that are less likely to call

for immediate action might be seen as further away. Therefore, a police officer responding to an incident might view a perceived threat as physically closer than it might actually be. This could be a result of the call to respond stating that there is some threat or the officer perceiving an object or individual as a threat.

13. **Berdjis, N. (2016). *A Descriptive Study on Police Body Cameras and Civil Liability Cases* (Masters Thesis, University of Colorado, Colorado Springs. Kraemer Family Library).**

Type of Study: Empirical

Research Question(s): What is the effect of BWCs on civil liability payouts in Oakland, CA?

Outcomes Measured: The author compared mean differences of civil liability payouts from 2003-2009 (pre-BWC implementation) with payouts from 2009-2015 (post-BWC implementation) to examine whether BWCs had an effect in reducing civil liability payouts in Oakland, CA.

Findings: The author found that there was no effect of BWCs in decreasing civil liability payments. However, BWC implementation did seem to significantly decrease the number of civil liability cases (annual mean of 30.33 reduced to 17), as well as assaults against officers (annual mean of 225 to 128). The author concludes that the financial cost-effectiveness talking point of BWC proponents was not supported, but officer safety remains a valid reason to adopt BWCs.

14. **BJA (2015). *Body-Worn Camera Program Fact Sheet*. U.S. Department of Justice, Office of Justice Programs. Retrieved from <https://www.bja.gov/bwc/pdfs/BWCPIP-Award-Fact-Sheet.pdf>.**

Type of Study: Report

Research Question(s): N/A

Outcomes Measured: Summary of BJA grant funding to agencies adoption BWCs, as of May 2015

Findings: The BJA announced a \$20 million funding program for BWCs in May 2015 as a response to President Obama's expansion of community oriented policing training and funding. \$2.5 million was added later to expand the number of agencies who may receive grants and BWCs. 73 grants have been awarded (as of May, 2015), amounting to about \$19 million.

15. **BJA (2016). *Body Worn Camera Training and Technical Assistance*, Transcript of Interview with Mr. Tom Ellis, Hampshire PD Study Lead Researcher, University of Portsmouth. Retrieved from <https://www.bja.gov/bwc/BWCpodcast.html#video>**

Type of Study: Interview with Mr. Tom Ellis, Hampshire PD Study Lead Researcher, University of Portsmouth

Research Question(s): They focused on human camera interaction but did not have a control group.

Outcomes Measured: BWC impacts on cases of murders, rapes, and arson in terms of police officer perspectives.

Findings: They found that BWC did not have impact on cases of murders, rapes, and arson. The main impact of BWC was on "low level high volume, nuisance, public safety" cases. They found that officers believed that, when cameras were used, they were more than likely to get early guilty pleas so that they felt BWC made for a much more effective criminal justice process.

16. **Boivin, R., Gendron, A., Faubert, C., & Poulin, B. (2017). *The body-worn camera perspective bias*. *Journal of Experimental Criminology*, 13(1), 125-142.**

Type of Study: Empirical (subjects answered surveys after random allocation to intervention)

Research Question(s): Does camera type (BWC versus CCTV camera) affect participants' views of the appropriateness of police use of lethal force? Does population type (police cadets versus undergraduate students) affect participants' views?

Outcomes Measured: Camera type; population type

Findings: There was no significant variation of undergraduate students' views of appropriateness of lethal force or consequences to the officer when viewing the scenario as BWC footage versus CCTV footage. However, police cadets varied significantly by footage type in their views of consequences to the officer. Police cadets were also significantly more likely than undergraduate students to recall suspect details, and police cadets who viewed BWC footage were more likely to rate the officer as firing too soon, compared to police cadets who viewed CCTV footage of the same event. Authors suggest that BWCs may affect viewers' perceptions of distance, leading them to believe that suspects are further than they actually are. Authors also suggest that the more training a viewer has in evaluating police/suspect interactions, the more likely the viewer is to be affected by perspective bias. Alternatively, members of the general population – such as undergraduate students – may be less technical in their analysis of either type of footage.

Suggested Future Research by Authors/Recommendations: Authors suggest comparing BWC footage to other points of view (such as cell phone footage). Authors also suggest exploring alternative explanations, such as the possibility that viewers of BWC footage are more likely to empathize with the officer's viewpoint.

17. Brucato B. (2015). Policing made visible: mobile technologies and the importance of point of view. *Surveillance & Society* 13(3/4):455-473.

Type of Study: Thought Piece/Commentary

Research Question(s): The article explores the "negotiation of policing's new visibility by advocates for civilian monitoring and video documentation of police, on the one hand, and the use of cameras by police, on the other."

When determining whether BWC enhance police accountability, why are there differences of opinion and why do different studies have different outcomes?

Outcomes Measured: Whether a study shows police accountability is/is not improved by video of the police-citizen encounters

Findings: Brucato heavily criticized the Rialto study (the basis for several papers by their Chief of Police, Tony Farrar). Among his criticisms were that the author had been brought to Rialto to save the department from fiscal jeopardy and officer corruption and misconduct. If he had failed, the department would have been turned over to the County Sheriff. Therefore, there was a mandate for all officers to improve their behavior. There was also a possible conflict of interest as the author was responsible for managing the complaint review process and was in command. Therefore, attributing the reduction in use of force to the presence of the cameras was complicated by these confounding factors. Brucato notes that Miller published an article about the Albuquerque police in which complaints about use of force increased after the body worn cameras were implemented. Brucato also mentions how police officers can immediately show the video to the suspect and that this may encourage self-incrimination as they explain what is shown without benefit of legal counsel. Brucato notes how showing video to the plaintiff before trial may lead to a plea deal without the benefit of the full story from the plaintiff's point of view. Furthermore, the officer may be able to write their reports while viewing the video so that the observed events are described with their particular view

of the events. In general, Brucato argues that the use of body worn cameras by law enforcement allows them to present their interpretation of the images in a way that imparts a subjective bias favoring the officer's perspective and against the suspect's perspective. For example, Brucato states that, because police officers can immediately show the video to the suspect, it is possible that this may encourage self-incrimination as they try to explain what is shown without benefit of legal counsel. Brucato contends that showing video to the plaintiff before trial may lead to a plea deal without the benefit of the full story from the plaintiff's point of view. Brucato also maintains that the officer may be able to write their reports while viewing the video so that the observed events are described with their particular view of the events.

18. Buzsaki G, Mizuseki K. (2014). The log-dynamic brain: how skewed distributions affect network operations. *Nature Reviews Neuroscience* 15(4):264-278.

Type of Study: Review

Research Question(s): How do lognormal distributions of neural parameters at different physiological and anatomical levels affect cognition?

Outcomes Measured: N/A

Findings: The authors describe how there appears to be a skewed (lognormal) distribution of different parameters (e.g., synapses) at many physiological and anatomical levels in the brain. This suggests that such distributions are fundamental to its structure and function. They discuss how these different levels of skewed distributions may impact cognition. The Weber-Fechner law says that the response to a visual or auditory stimulus is proportional to the logarithm of the stimulus amplitude. This law has been found to apply to distance perception, time perception, reaction time, decision-making, and short-term memory error accumulation. Regardless of the language spoken, word usage and sentence lengths tend to follow a lognormal distribution. The authors state that an important consequence of skewed distributions being found at many different levels of organization in the brain is that a minority of neurons may effectively respond to most situations but to achieve the most accuracy most of the time requires a larger proportion of neural networks in the brain.

19. Capps, L.E. (2015). *Police Body-Worn Cameras: An Overview. The Police Chief, 32(2), 52-54.*

Type of Study: Literature Review/Report

Focus: The author examines reasons as to why the use of BWCs increased rapidly in such a short amount of time, with the primary reason being law enforcement agencies' desires to provide accurate details of police encounters. The author also examines several concerns:

- Lack of clear written policies in some law enforcement agencies surrounding BWC use
- Citizen and officer privacy
- Prosecutors and juries becoming dependent on camera feed evidence
- The use of videos against disliked officers by supervisors
- Camera footage not catching every angle or peripheral information that an officer uses to make decisions
- Difficulty with buy-in from some officers and communities

Conclusions: Comprehensive policies must be in place before BWCs are implemented. BWCs should not be seen as a panacea, and more research and replication must be done before any general conclusions are made.

20. Civile C, Obhi S. (2017). Students wearing police uniforms exhibit biased attention toward individuals wearing hoodies. *Frontiers in Psychology* 8:62, doi:10.3389/fpsyg.2017.00062

Type of Study: Random controlled trials with subjects randomly assigned to different categories for lab experiments.

Research Question(s): Assuming a link between clothing and cognition, the question was whether the police uniform itself might induce a bias in social attention

Outcomes Measured: Human subjects performed a shape categorization task in the presence of a distraction and reaction times were measured. Three experiments were performed. In Experiment 1, 28 participants wore either a police-style uniform or mechanic overalls, and performed a shape categorization task in the presence of a distractor that could be either: a black face, a white face, a person wearing a hoodie (considered to be associated with low socioeconomic status), or a person wearing a suit (considered to be associated with high socioeconomic status). In Experiment 2, they measured this socioeconomic bias using a modified Dot-Probe task as an alternate measure of attention bias. Experiment 3 was designed to measure attention bias comparing participants wearing the uniforms versus having the uniforms placed on a desk in front of them.

Findings: The results suggested that wearing a police-style uniform biases attention toward low socioeconomic status people. That is, individuals from low status groups might capture more attention than those from higher status groups. They speculate that the uniforms might exert their effects on cognition because of the power and cultural associations that they evoke in the person wearing the uniform.

21. Corbetta M, Shulman G. (2002). Control of goal-directed and stimulus-driven attention in the brain. *Nature Reviews: Neuroscience* 3:201-215.

Type of Study: Review

Research Question(s): What is the evidence for partially segregated neural pathways

Outcomes Measured: N/A

Findings: The authors review the evidence for partially segregated pathways in the brain, one of which is involved in preparing and applying goal-directed (top-down) selection for stimuli and responses, and the other (bottom-up) is specialized for detection of behaviorally relevant but unexpected stimuli. They propose that orienting (directing attention by selecting visual information) is controlled by these two interacting networks. The top-down selection network involves higher level thinking (cognitive processes) while the bottom-up selection network is driven by sensory stimulation. Novelty and unexpectedness reflect an interaction between cognitive and sensory influences, which controls where, how, and to what we pay attention in the visual environment.

22. Coudert F, Butin D, Le Metayer D. (2015). **Body-worn cameras for police accountability: opportunities and risks. *Computer Law & Security Review* 31:749-762.**

Type of Study: Review of deployment of police BWC in five countries

Research Question(s): Suitability of BWC as an accountability tool given the associated privacy threats, and discuss the societal impact of their deployment as well as the risk of function creep.

Outcomes Measured: Motivations for using BWC and assessing the consequences

Findings: The five countries included the US, the UK, France, Spain, and Belgium. The motivations for using BWC in these countries were similar: 1) need to make police more accountable; 2) the need for police officers to protect themselves against false accusations; and 3) the expected pacifying effect

on interactions between citizens and the police. The authors discuss three main issues: 1) to what extent are the BWC purposes (evidence, deterrence of violent behavior, and overall improvement of police functioning) legitimate; 2) are BWCs the best means to achieve these goals; and 3) whether BWC impacts on privacy can be limited through technical design. They note that the ability to use BWC recording as a source of evidence in court depends upon their authenticity, reliability, and admissibility. By authentic, they mean the use of features that affect the capacity of the recording to accurately depict the crime scene (especially camera placement, focal width, and battery life). They noted that camera placement is important because, if it records a different scene than the one the officer saw, the discrepancy weakens the BWC support for the officer's perception and widens the margin of possible interpretations of the images. They note that most BWC provide a large angle almost panoramic view, which could lead to the recording of irrelevant information. More importantly, if the angle differs from the human field of vision, there may be discrepancies between the recorded images and what an officer could actually see at the time. They mention a new technology called image stitching, which allows the combination of several different BWC recordings to reconstruct the larger scenery. Of course, this requires more than one camera and issues may be raised about the adequacy of the stitching. They note that the latitude of requirements for the officer to turn on or off the recording can impact the authenticity of the recording. As one example, if the BWC were turned on once acts of violence were occurring, the recording would not contain information about what may have led to the violence and thereby infer a distortion of the incident. There is also some concern that officers turning on and off the video may allow editing on the fly to censor behavior they don't want recorded. They conclude that BWC deployment should be accompanied by a continuous assessment of its consequences.

23. **Crow, M. S., Snyder, J. A., Crichlow, V. J., & Smykla, J. O. (2017). Community Perceptions of Police Body-Worn Cameras: The Impact of Views on Fairness, Fear, Performance, and Privacy. *Criminal Justice and Behavior*, 44(4), 589-610.**

Type of Study: Empirical

Research Question(s): What are public perceptions of the usefulness of BWCs and potential downsides of the devices? What are public perceptions of procedural justice and police performance?

Outcomes Measured: Residents of two Florida counties were surveyed regarding their perceptions of BWCs and police performance and procedural justice. The police agencies in the Florida counties had not yet adopted BWCs. Measures in the survey fell under several major categories, including: procedural fairness; police performance; crime concern; body-worn camera privacy concern; and body-worn camera benefit.

Findings: The majority of respondents (87.1% and 79.4%, respectively) agreed or strongly agreed that BWCs could improve both officer and citizen behavior. The majority also believed that BWCs could improve police legitimacy, though a small minority believed that BWCs would lead to citizen privacy concerns (11.4%).

Further analysis found a positive relationship between citizens' positive views of police performance and police interactions and their views of BWC benefits. Young, non-white respondents were less likely to see BWCs as beneficial.

Suggested Future Research by Authors/Recommendations: The authors suggest examining other factors that may influence citizen perceptions of BWCs, and suggest examining citizen perceptions of BWCs over time.

24. **Cubitt, T. I., Lesic, R., Myers, G. L., & Corry, R. (Forthcoming). Body-worn video: A systematic review of literature. *Australian & New Zealand Journal of Criminology*, DOI: 10.1177/0004865816638909.**

Type of Study: Literature Review/Report

Focus: The authors report on a literature search conducted between July and August 2015 to provide a state of the field report on BWC literature. They find two randomized controlled trials (Ariel and colleagues' Rialto study and Henstock and Ariel's Wolverhampton study), three examining officer perceptions of BWC devices, and six articles that they classify as "grey" literature evaluations (empirical evaluations that are not randomized controlled trials). These include:

1. Police Executive Research Forum (Miller et al, 2014); involved nationwide surveys, interviews, and observations; mainly found hesitancy regarding policy implementation and privacy concerns.
2. Victoria Police Dept., Canada, (Laur et al, 2010); involved surveys on officer perception; most officers (77.8%) agreed that BWCs should be implemented.
3. Renfrewshire/Aberdeen, Scotland (ODS Consulting, 2011); examined BWC effect on crime rates, early guilty pleas, complaint resolution, and reductions in assaults on officers. Found positive results, but cannot establish exact causal relationship.
4. Essex Police Dept., UK (Owens et al, 2014); BWCs found to increase criminal charge rates, but study had major limitations.
5. Isle of Wight, UK (Ellis et al., 2015); public interviews and law enforcement survey and also examined crime rates post-BWC implementation; found that the police had lower confidence that BWCs would reduce assaults on officers, but higher confidence that they would reduce complaints than the public. 15% reduction in complaints and 36% reduction in assaults on officers.
6. Phoenix Police Dept., AZ (Katz et al, 2014). Data comprised of incident reports, police databases and activity logs, official complaint data, self-report survey, key personnel interviews, and camera metadata, 67 weeks prior to BWC implementation and 67 weeks post. 53.1% reduction of complaints and 47.7% reduction of excessive force complaints found.

Conclusions: The evidence and quality of the evidence surrounding BWCs is currently weak, but the findings are consistent.

25. **Culhane, S. E. & Schweitzer, K. (Forthcoming). Police shootings and body cameras one year post-Ferguson. *Policing and Society*, DOI: 10.1080/10439463.2016.1275624.**

Type of Study: Empirical (subjects answered surveys after random allocation to intervention group)

Research Question(s): (Partial replication of Culhane, Boman, and Schweitzer [2016], below) Do presentation method (video, audio only, or transcript only) and situational factors (officer has orders from senior officer to enter or to wait for backup) affect viewers' perceptions of the justifiability of a police shooting? How do these findings differ from the previous studies by Culhane et al. (2016) one year after the events of Ferguson, Missouri?

Outcomes Measured: An online sample of U.S. citizens was randomly allocated into 6 groups. Subjects were told the same background information, but were given different presentation types and were told different situational factors, depending on condition allocation.

Findings: 42.8% of the overall sample rated the police shooting as justified. As with the previous studies by Culhane et al. (2016), subjects in the condition where the officer was told to enter the premises by a senior officer rated the shooting as more justifiable than subjects in the condition where the officer was told to wait for backup. Subjects in the video and audio only conditions were slightly

more likely to see the officer's shooting as justified, as compared to the transcript condition (though this result was not statistically significant). The interaction between officer's orders and presentation type revealed a significant likelihood for the shooting to be seen as less justified when the presentation was transcript only and the officer violated orders. Authors conclude that Study 2's findings in Culhane et al. (2016) may have been the result of charged media coverage, as the present study's findings are more similar to Study 1 in Culhane et al. (2016). Authors also suggest that it may be best to wait for an extent of time after a charged officer-involved shooting event before allowing citizens to view BWC footage.

Suggested Future Research by Authors/Recommendations: Authors suggest examining more situational and interaction factors in police shooting events that may influence citizens' perceptions. Authors also suggest examining the effect of public education about police procedure on their perceptions of police shootings.

26. Culhane, S. E., Boman, J. H., & Schweitzer, K. (2016). Public Perceptions of the Justifiability of Police Shootings: The Role of Body Cameras in a Pre-and Post-Ferguson Experiment. *Police Quarterly*, 19(3), 251-274.

Type of Study: Empirical (subjects answered surveys after random allocation to intervention groups)

Research Question(s): Do information type (video, audio only, or transcript), situational factors (officer on footage has orders from senior officer to enter premises, or is told to wait for backup), and suspect information (mental status) affect viewers' perceptions of the justifiability of a police shooting event?

Outcomes Measured: An online sample of U.S. citizens was randomly allocated into 18 conditions, according to the situational variables described above. The study was replicated before publication following the events of Ferguson, Missouri. The three information types (video, audio only, and transcript) portrayed the same police shooting incident. Subjects were then told background information (situational factors and suspect information) that varied depending on their condition group.

Findings: In Study 1, it was found that the majority (61%) of the sample overall felt that the shooting was unjustified. Subjects in the video and audio only conditions were significantly more likely to rate the shooting as justified, compared to subjects in the transcript only condition. Subjects in the condition where the officer was told to enter the premises by a senior officer rated the shooting as justified significantly more often than subjects in the condition where the officer was told to wait for backup.

In Study 2 (post-Ferguson), there was no change in the sample's overall ratings of the justifiability of the shooting event. Results of the officer's orders condition were similar to Study 1. However, in Study 2, subjects allocated to the video group were less likely to see the officer's shooting as justifiable as compared to the audio only and transcript conditions.

Suggested Future Research by Authors/Recommendations: Authors suggest that future research should empirically assess BWC footage of police shootings of minority suspects, and whether facts of the case affect public perceptions of the justifiability of police use of lethal force. Authors also point out that BWC footage only captures the officer's view of an event (and not the actions of the officer him/herself), and could bias post-event footage viewers against the suspect.

27. Drover, P. & Ariel, B. (2015). Leading an Experiment in Police Body-Worn Cameras. *International Criminal Justice Review*, 25(1), 80-97.

Type of study: Report

Focus: The authors examine the implementation process of BWCs for the West Midlands Police Force, beginning with four months of observation of implementation, and three months of observation post-implementation. The authors also discuss the details of conducting a randomized controlled trial.

Conclusions: The authors recommend evidence-based training and a centralized specialist evaluation team. The authors also address that, while police can lead a randomized controlled trial, the process is challenging.

28. Ellis, T., Jenkins, C., & Smith, P. (2015). *Evaluation of the introduction of personal issue body worn video cameras (Operation Hyperion) on the Isle of Wight: Final Report to Hampshire Constabulary*. University of Portsmouth: Institute of Criminal Justice Studies. http://eprints.port.ac.uk/16979/1/Operation_Hyperion_Final_Report_to_Hampshire_Constabulary.pdf

Type of Study: Report

Research Question(s): What are the effects of BWCs on crime rates, domestic violence case processing, complaints against the police, and public and officers' views of BWCs?

Outcomes Measured: Public and officer opinions, crime rates, domestic violence case processing, and complaints against the police were examined in response to BWC implementation.

Findings:

- **Public opinion:** overwhelmingly positive (84-96%) public attitude favoring BWCs (for gathering evidence, criminal ID, increasing convictions, improving training, improving disciplinary procedures). 82% believed (after implementation of personal issue BWCs) that all uniformed officers should wear BWCs
- **Officer opinion:** generally reflected the views of the public, though were significantly less confident than the public that BWCs would reduce assaults on officers. Frontline officers significantly more favorable towards personal issue BWC deployment than non-frontline (mostly investigative) officers. Most officers agreed that all uniformed officers should wear BWCs when on duty.
- **Crime rate changes:** 8.8% reduction in assault-related crimes one year after implementation of personal issue BWCs. Crime reduced overall by 2.5% in the rest of Hampshire but reduced by 5.8% on the Isle of Wight. Significant rise of domestic assaults on Isle of Wight (from 3 occurrences 1 year before implementation to 21 a year after).
- **Domestic violence processing:** 7 of the 10 domestic violence cases that were caught on BWC led to arrest, 4 of these led to charges (with one not guilty verdict); of the 11 cases without BWC footage, only 1 led to arrest.
- **Complaints against the police:** 15% reduction in lower level complaints after BWCs implemented (5% reduction in the rest of Hampshire with no BWCs). 11.5% reduction of serious complaints post-BWC (6.9% increase in the rest of Hampshire).

Suggested Future Research by Authors/Recommendations: The authors recommend different trainings to address the different needs of frontline and investigation officers. The authors also suggest that more research is needed on the impact of BWCs on assaults (including those against the police) and domestic violence.

29. Farrar T. (2013). The Rialto Police Department's body-worn video camera experiment: Operation "Candid Camera." Presentation on 29 April 2013. Jerry Lee Symposium.

Type of Study: Presentation of randomized controlled field study previously published.

Research Question(s): Effects of BWC on police use-of-force incidents

Outcomes Measured: Whether BWC use increases officer compliance with use-of-force policies

Findings: 61% of police departments used video cameras in patrol cars in 2007 (U.S. Department of Justice 2010). He suggested that cameras are likely to:

1. improve accountability
2. reduce complaints of police misconduct
3. save thousands of dollars in court costs
4. lower overtime costs for investigations and court appearances
5. ability to collect evidence for trial
6. increased professionalism by "forcing officers" to give more attention to following agency rules

He then presented the results of the Rialto study from January 2011 through February 2013 on the use of force by patrol officers. The Rialto results have been published elsewhere.

30. Farrar T and Ariel B. (2014). The Rialto Police Department's body-worn video camera experiment. Presentation

Type of Study: conference presentation of previously published paper on the Rialto BWC random control study that began in 2012

Research Question(s): Will wearing BWC reduce number of complaints against officers compared to the control group? Will wearing BWC reduce the number of use-of-force incidents compared to the control group?

Outcomes Measured: Complaints against officers, use of force incidents, and workforce scheduling.

Findings:

1. Reduction in use of force incidents from 61 to 25.
2. Of these 25 use of force incidents, 17 were control and 8 experiment participants.
3. Of these 8 use of force incidents on experiment days, all were recorded on BWC.
4. Reduction in complaints from 24 to 3 (0.7 per 1000 contacts to 0.07 per 1000 contacts).
5. Contacts increased from previous years (i.e., no backfiring effect).
6. Survey of all officers before and during experiment shows no changes in the officers' self-legitimacy.

31. Fox E, Lester V, Russo R, Bowles R, Pichler A, Dutton K. (2000). Facial expression of emotion: are angry faces detected more efficiently? *Cognition and Emotion* 14(1):61-92.

Type of Study: Human participants in a lab

Research Question(s): How quickly can a person detect a threat by looking at a face in the crowd?

Outcomes Measured: Participants determined whether faces among displays of schematic faces were all the same or whether one was different.

Findings: The results of the study were consistent with the evidence that human have multiple attention systems. A visual search is initially wide and diffuse over a particular region. Within this region, the brain gives priority to natural danger signals. If a threat or danger is present, then visual

engagement of that threatening object or person will be rapid while disengagement will be slow. If the object or person is perceived as non-threatening, then the initial engagement will be slow and disengagement will be rapid.

32. Fries, P., Reynolds, J. H., Rorie, A.E., Desimone R. (2001). Modulation of oscillatory neuronal synchronization by selective visual attention. *Science* 291:1560-1563.

Type of Study: Lab study of primates

Research Question(s): What are the underlying mechanisms for attention to select relevant stimuli from competing visual stimuli in crowded visual scenes?

Outcomes Measured: Neuron synchronization

Findings: Neurons activated by the stimulus from increased attention fired in a synchronized manner indicating a way to amplify behaviorally relevant visual signals from observing a scene.

33. Gaub, J. E., Todak, N. & White, M. D. (2017). *Beyond Patrol: Exploring the Perceptions of Policy Body-Worn Cameras among Officers in Specialized Units. ASU Center for Violence Prevention and Community Safety, Arizona State University, DOI: 10.13140/RG.2.2.28519.04007.*

Type of Study: Survey/Interviews/Focus Groups

Research Question(s): What are officers' perceptions of BWCs, when those officers are members of specialized units?

Outcomes Measured: Officers' concerns and perceived benefits of BWCs, as gathered from focus groups conducted with officers in specialized units from Spokane, WA and Tempe, AZ.

Findings: Officers from specialized units largely focused on the evidentiary benefits of BWCs, the training value, and how BWCs assist in showing officers' de-escalation techniques in the field. Officers concerns included: increased workload, public access to footage, and citizen perceptions of specialized work. One major difference from normal officers is how special units have work that inhibits the wearing of BWCs (undercover work, multi-agency task forces, working with confidential informants).

Suggested Future Research by Authors/Recommendations: The authors recommend considering the technical aspects of implementation for each unit and adjusting policy for each unit. The authors also state that leadership must understand the challenges each unit faces when incorporating BWCs, and must manage public expectations of what footage may be publicly available. Leadership must also recognize that BWCs may not be beneficial or appropriate for some units.

34. Gaub, J. E., Choate, D. E., Todak, N., Katz, C. M., & White, M. D. (2016). *Officer Perceptions of Body-Worn Cameras Before and After Deployment: A Study of Three Departments. Police Quarterly, 19(3), 275-302.*

Type of Study: Survey/Interviews/Focus Groups

Research Question(s): What are officers' perceptions of BWCs both before and after BWC implementation? Is there a difference across the three surveyed departments?

Outcomes Measured: The authors surveyed officers from Phoenix, AZ, Tempe, AZ, and Spokane, WA, both before and after the agencies implemented BWCs. Measures were grouped into the following categories: completing incident reports; use of evidence in court; citizen reaction; police officer behavior; comfort and ease of use; general perceptions; and overall perceptions.

Findings: Officers in all three departments agreed that BWCs have evidentiary value and will assist in prosecuting domestic violence cases. Officers in all three departments expressed concerns about physical comfort and ease of use. Phoenix officers were found to be more skeptical of BWCs and their effects on citizen and officer behavior. Spokane officers became more positive over time for most BWC effects, but became skeptical of BWC efficacy in domestic violence cases where victims refused to testify, and of BWC influence on citizen and officer behavior. Tempe officers were positive overall, but had increasing skepticism that BWCs could positively influence citizen behavior.

Suggested Future Research by Authors/Recommendations: The authors recommend that departments have officer buy-in before implementing BWCs.

35. **Goodall, M. (2007). *Guidance for the Police Use of Body-Worn Video Devices*. London: Home Office.**

Type of Study: Report

Focus: The author outlines recommendations for departments using BWCs, using the Plymouth Head Mount Project as a guide. The report gives guidance for legal issues, evidentiary uses, storage/retention/deletion of footage, use in court, use for reviewing potential misconduct, and health and hazard risks.

Conclusions: The benefits of the Plymouth Head Mount Project include (as of the time of publication): reduction in complaints (no figure given); officers report more awareness of how they interact with the public; favorable feedback that citizens positively adjust their behavior when they are aware that cameras are present; 1.2% decrease in violent crime; 26.9% increase in sanction detections for violent crime; 8.8% reduction in sanction detection attrition rate; 14.3% overall reduction in complaints against the police.

36. **Grady, R. H., Butler, B. J., & Loftus, E. F. (2016). What Should Happen After an Officer-Involved Shooting? Memory Concerns in Police Reporting Procedures. *Journal of Applied Research in Memory and Cognition*, 5, 246-251.**

Type of Study: Thought Piece/Commentary

Focus: Authors discuss RIF (retrieval-induced forgetting), which is when retrieval of a memory impedes the recall of memories associated with the retrieved memory. When officers are allowed to watch BWC footage before writing their reports, this footage may assist in officers' recall of events clearly captured on the footage, but may impede recall of other details not captured on camera. Additionally, post-event information (such as BWC footage) can negatively affect the accuracy of an officer's recall of what he or she actually noticed and thought during the event. It is a common phenomenon that people incorporate information learned post-event into their memories of the event, which may be misleading when video footage is unclear or does not capture contextual information. Authors also discuss the policy of having officers involved in shooting events wait for several days before writing their reports.

Conclusion: The authors conclude that, given what is known about the psychology of memory retrieval, departments should consider having officers write reports first before receiving additional information (such as BWC footage) or waiting for a period of time.

Suggested Future Research by Authors/Recommendations: Authors recommend more empirical research into the effects of report writing policies.

37. Grossmith, L., Owens, C., Finn, W., Mann, D., Davies, T., & Baika, L. (2015). *Police, camera, evidence: London's cluster randomised controlled trial of body worn video*. London, UK: College of Policing Limited and the Mayor's Office for Policing and Crime.

Type of Study: Randomized Controlled Trial

Research Question(s): What is the effect of BWC implementation on several measures of police and public behavior?

Outcomes Measured: Examined complaints against officers, officers' self-reported behavior, violent crime arrests, and officer and public perceptions of BWCs in 10 Metropolitan Police Service boroughs between May 2014-April 2015.

Findings: Complaints against officers reduced (though no statistical significance found); no overall impact of BWCs on officers' self-reported behavior or their stop and searches; no effect found on violent crime arrests; no evidence found that BWCs changed officer behavior when interacting with victims/suspects; London residents generally positive towards BWCs; Officers favored BWCs for professional development/training, use of intelligence, and info sharing.

The findings challenge the assumption that BWCs will affect police-public interactions and behavior, as no changes were found. Transparency and evidence regarding the justification for behavior are still positive aspects of BWCs.

Suggested Future Research by Authors/Recommendations: The authors recommend that BWC footage needs to be accessible (with all legal ramifications and guidelines considered) for there to be real transparency.

38. Hardy, S., Bennett, L., Rosen, P, Carroll, S., White, P., & Palmer-Hill, S. (2017). *The Feasibility of Using Body Worn Cameras in an Inpatient Mental Health Setting. Mental Health in Family Medicine, 13, 393-400.*

Type of Study: Non-Random Controlled Trial

Research Question(s): What is the feasibility of using BWCs in an inpatient mental health context?

Outcomes Measured: This pilot test of BWC examined complaints, incidents, feasibility of use, and staff and patient perceptions of BWCs.

Findings: Overall, staff wearing BWCs reported them as being comfortable and feasible to use. Fit adjustments were the main complaint of camera feasibility. Some operational difficulties were reported. The majority of staff who wore cameras reported positive perceptions regarding the usefulness of BWCs; staff who did not wear BWCs had more mixed perceptions. The majority of patients reported believing that BWCs would positively affect staff (68%) and patient (63%) behavior. Findings were varied on numbers of incidents, with violent incidents reducing in three of the studied wards, and increasing in two. Complaints occurred very infrequently, but at a lower rate than the same time in the previous year.

Suggested Future Research by Authors/Recommendations: The authors conclude that the test demonstrates that BWC use in an inpatient mental health setting is feasible. Future research is required to assess a cost-to-benefit ratio.

39. Harris D. (2010). *Picture this: body worn video devices as tools for ensuring Fourth Amendment compliance by police. Legal Studies Research Paper Studies, Working Paper No. 2010-13, April 2010, University of Pittsburgh School of Law.*

Type of Study: Law Review

Focus: This report reviewed several studies and focuses on Body Worn Video (BWV), which was defined as video and audio recording equipment "mounted to the side of the officer's head" and was used by police in the United Kingdom. The UK study found the following results: 1) that the evidence recorded in real time had more accuracy than other methods allowed and with much less doubt about what happened or what was said; 2) officers could make records more quickly, resulting in a more rapid resolution of cases through guilty pleas and allowing officers more time on the street; 3) when the public saw officers wearing BWV, this reduced public order offenses, and when such offenses were committed, they were resolved faster; 4) officers found recording of events via BWV especially helpful for the prosecution of domestic violence cases [how did this impact privacy issues?], and 5) when officers discharged firearms in the course of police business, the use of BWV created a finely-detailed record for investigation of these critical incidents. The author also cites studies that reported police violating the Fourth Amendment in thirty percent of their searches and seizures, yet 97 percent of these searches and seizures produced no evidence, citing Gould, J.B. and Mastrofski, S.D., 2004. Suspect searches: Assessing police behavior under the US Constitution. *Criminology & Public Policy*, 3(3), pp.315-362.

Conclusions: The author concludes that using BWV has the potential to transform search and seizure compliance provided that officers are required to record every interaction with citizens.

40. Hedberg, E. C., Katz, C. M., & Choate, D. E. (2016). Body-worn cameras and citizen interactions with police officers: Estimating plausible effects given varying compliance levels. *Justice Quarterly*, 34(4), 627-651.

Type of Study: 2nd Hand Randomized Controlled Trial (data used for this empirical study obtained from an earlier Randomized Controlled Trial)

Research Question(s): What is the effect of BWCs on complaints against officers, arrests, and suspect behavior/resistance to arrest?

Outcomes Measured: Examined outcomes from a treatment and control group from the Phoenix Police Department randomized controlled trial. Assessed complaints against officers, officer arrest behavior, suspect resistance/behavior, and officer compliance with BWC policy.

Findings: BWCs were not found to affect arrests or suspect behavior/resistance. BWCs were found to be significant in reducing complaints by 96%. Officers only activated their cameras in 32% of all incidents.

Suggested Future Research by Authors/Recommendations: The authors recommend monitoring BWC compliance and examining the effect of BWCs when more officers are compliant with their use policies.

41. Henstock, D. (2015). Testing the Effects of Body Worn Video on Police Use of Force during Arrest: A Randomised Controlled Trial (Masters Thesis, Wolfson College, Cambridge). <http://www.crim.cam.ac.uk/alumni/theses/Darren%20Henstock.pdf>

Type of Study: Randomized Controlled Trial

Research Question(s): What is the effect of BWCs on police use of force, suspect injuries, and officer injuries?

Outcomes Measured: Use of force, suspect, and officer injuries were measured for both treatment and experimental groups (study used shifts as unit of analysis) in the Birmingham South Local Policing Unit.

Findings: The study found a 48% reduced likelihood of force being used beyond compliant handcuffing. BWCs led to fewer suspect injuries, but a 250% increase in injuries to officers wearing BWCs (however, the overall occurrence was low, with the BWC group receiving seven injuries while the control group received two).

42. **Henstock, D. & Ariel, B. (Forthcoming). Testing the effects of police body-worn cameras on use of force during arrests: A randomised controlled trial in a large British police force. *European Journal of Criminology*, DOI: 10.1177/1477370816686120.**

Type of Study: Randomized Controlled Trial

Research Question(s): What is the effect of BWCs on police use of force?

Outcomes Measured: Examined BWC effects on a random allocation of shifts over six months in the Birmingham South Local Policing Unit. Measured use of force through officers' reports.

Findings: The study found that, when removing "compliant handcuffing" from their definition of use of force, BWCs reduced the occurrence of low-level uses of force (effects were not significant for more serious uses of force). When compliant handcuffing was left as a measure for use of force, BWC effects leveled out.

The authors suggest three possible explanations for this finding:

1. BWCs may *increase* tensions between some officers and some suspects.
2. BWCs increased accountability in police reporting, so treatment officers were more likely to report compliant handcuffing than control officers, when the groups handcuffed at roughly the same rate.
3. Unintended consequence of BWC's observation effect: officers more likely to stick to regimented orders and not use their discretion

Suggested Future Research by Authors/Recommendations: The authors recommend that future research pay close attention to types of use of force measured.

43. **Ho, J. D., Dawes, D. M., McKay, E. M., Taliencio, J. J., White, S. D., Woodbury, B. J., Sandefur, M. A., Miner, J. R. (2017). Effect of Body-Worn Cameras on EMS Documentation Accuracy: A Pilot Study. *Prehospital Emergency Care*, 21(2), 263-271.**

Type of Study: Empirical (Observational Study)

Research Question(s): Does BWC footage assist in accurate reporting among a sample of EMS paramedics?

Outcomes Measured: A sample of ten volunteer paramedics wore head-mounted BWCs during a staged scenario. Following the scenario, subjects completed reports from their memory of events. After writing their reports, subjects were allowed to view their BWC footage as often as they wanted to in order to verify the accuracy of their reports. The study used Microsoft Word's track changes function to record the changes made by the subjects after viewing the footage.

Findings: All paramedics in the sample were found to have made changes to their reports following their review of their BWC footage. Thirteen major, fifty-one moderate, and seven minor edits were tracked across the sample. The authors discuss that BWC footage review before report documentation may be advisable due to natural memory error (particularly when stress and fatigue

makes memory recall more difficult). However, the authors recognize that the demands of emergency response work may make footage review before documentation difficult.

Suggested Future Research by Authors/Recommendations: The authors raise some possibilities of how to use BWC in a paramedic setting.

44. **Hung, V., Babin, S., & Coberly, J. (2016). *A Primer on Body Worn Camera Technologies* (NIJ Contract No.: 2013-MU-CX-K111/115912). Laurel, MD: John Hopkins University Applied Physics Laboratory.**

Type of Study: Report

Focus: This report examines the results of a market survey of BWC vendors and discusses considerations of implementation and integration of BWCs and legal implications. Requests for information were sent to all known BWC vendors to obtain an overall picture of the types of products and technology available on the market. As for the discussion of considerations for integrating BWCs into law enforcement agencies, the report discusses implementation planning, cost considerations, data access/security/storage/management, training, and policy considerations. Legal implications include privacy, footage availability and the Freedom of Information Act, and state wiretapping laws.

Conclusions: While the BWC market is growing at an unprecedented rate, legal issues relating to BWCs have not yet been fully discussed and clarified. Adoption of BWCs without full consideration of policy development, implementation, and legal considerations may cause more negative consequences than positive outcomes.

45. **Jennings W, Fridell L, Lynch M, Jetelina K, Reingle Gonzalez J. (2016). *A quasi-experimental evaluation of the effects of police body-worn cameras (BWCs) on response-to-resistance in a large metropolitan police department*. *Deviant Behavior*, DOI: 10.1080/01639625.2016.1248711**

Type of Study: Case control study

Research Question(s): BWC impact on police response to resistance in Tampa, FL

Outcomes Measured: Propensity score matching technique.

Findings: The study involved 60 police officers with BWC and 60 officers without BWC. They compared the frequency of response to resistance during a 12-month period that ended in February 2015. They found an average number of incidents using physical force was 3.05/12 months before BWC wearing and 2.73/12 months with BWCs. However, the standard deviations were large (3.69 before BWC and 3.78 after BWC). The authors also noted that the 60 officers that wore BWC had an 8.4% decrease in the mean number of physical force incidents compared to before they wore BWC. The 60 officers that never wore BWC had a 3.4% increase in mean number of physical force incidents during this same time period.

46. **Jennings, W. G., Fridell, L. A., & Lynch, M. D. (2014). *Cops and cameras: Officer perceptions of the use of body-worn cameras in law enforcement*. *Journal of Criminal Justice*, 42(6), 549-556.**

Type of Study: Survey/Interviews/Focus Groups

Research Question(s): What are officers' opinions regarding BWCs?

Outcomes Measured: The study examined whether Orlando Police Department officers believed their department should adopt BWCs, whether they would feel comfortable wearing BWCs, whether they believed BWCs would make them safer, and whether they believed BWCs would affect officer and citizen behavior.

Findings: Officers were generally in strong agreement that Orlando Police Department should adopt BWCs (62.7%) and that they would be comfortable wearing BWCs (77%). A minority (18.7%) believed BWCs would make them safer. Forty percent believed that BWCs would improve citizen behavior, but only 19.8% believed BWCs would improve officer behavior. Officers were mixed on whether BWCs would impact their use of force, but were in general agreement that BWCs would reduce complaints against themselves and fellow officers.

47. Jennings, W. G., Lynch, M. D., & Fridell, L. A. (2015). Evaluating the impact of police officer body-worn cameras (BWCs) on response-to-resistance and serious external complaints: Evidence from the Orlando police department (OPD) experience utilizing a randomized controlled experiment. *Journal of Criminal Justice, 43*(6), 480-486.

Type of Study: Randomized Controlled Trial

Research Question(s): What is the effect of BWCs on how officers respond to suspect resistance?

Outcomes Measured: Officers in Orlando Police Department were randomly allocated into treatment and control groups. Officers in Orlando Police Department are required to record any response to resistance (any instance where the officer uses physical force), and these official records were used as the dependent variable. Serious citizen complaints were also gathered for 12 months pre-implementation and 12 months post-implementation.

Findings: BWCs were found to reduce response to resistance (officer use of physical force) by 53.4%. Serious citizen complaints reduced by 65.4% when compared to the control group.

48. Kahan D, Hoffman D, Braman D. (2009). Whose eyes are you going to believe? Scott v. Harris and the perils of cognitive illiberalism. *Harvard Law Review 122*(3):837-906.

Type of Study: Legal review

Focus: The authors examine difference in interpretations of the same video evidence, using a dash cam video of the police chase that resulted in the Scott v. Harris court case and showed it to different viewers. In the Scott v. Harris court case, the suspect claimed that the officer used unnecessary force by ramming his car as he was fleeing a chase. The suspect (Scott) became a quadriplegic as a result of this incident and sued the police. Scott held that the officer violated the Fourth Amendment when he deliberately rammed his car when he refused to pull over for speeding and instead fled the officer. The authors showed this video to a sample of 1350 citizens and obtained their reactions to the video. The question was whether the video showed the officer was justified in ramming the suspect's car or not. There was no consensus on the video and the authors found that opinions on what the video showed depended on who the viewer was. However, a majority of these people interpreted the video as the fleeing motorist posed a danger serious enough to justify the use of deadly force (i.e., ramming the car). This is what the Court had decided in this case. Other viewers viewed the conduct of the officer chasing the motorists as the factor that caused the situation to become dangerous and that the ramming of the car was unnecessary and unjustified.

Conclusions: The authors concluded that the Court was incorrect in privileging the officer's view over all other possible views because this deprived the opportunity for other interpretations of the video to be presented at trial. It also resulted in those that disagreed with the majority perception to view the Court decision as not being legitimate.

49. Katz, C.M., Choate, D.E., Ready, J.R., & Nuño, L. (2014). *Evaluating the Impact of Officer Worn Body Cameras in the Phoenix Police Department*. Phoenix, AZ: Center for Violence Prevention & Community Safety, Arizona State University.

Type of Study: Non-Randomized Controlled Trial

Research Question(s): What is the effect of BWCs on citizen complaints and domestic violence case processing?

Outcomes Measured: This non-randomized controlled trial examined the effects of BWCs, using one patrol area of Phoenix Police Department as a control group, and one patrol area as the treatment group. The study examined officer BWC policy compliance, arrests, citizen complaints, domestic violence case processing (whether charges were filed) and domestic violence case outcomes (whether resulting in a guilty plea).

Findings: Low officer compliance was found for BWC activation policy. Officer arrests rose by 17% and citizen complaints dropped by 23% in the experiment group. Those officers who wore cameras and experienced a complaint against them were significantly less likely to have the complaint sustained, compared to officers in the control group. Domestic violence cases were more likely to result in charges filed (37.7%) and a guilty plea/verdict (4.4%) for the BWC group.

Suggested Future Research by Authors/Recommendations: The authors recommend developing a citywide plan, considering the needs of the prosecutor's office, developing BWC training, and monitoring officer BWC activation policy compliance.

50. Kyle, M. J., & White, D. R. (2017). The impact of law enforcement officer perceptions of organizational justice on their attitudes regarding body-worn cameras. *Journal of Crime and Justice*, 40(1), 68-83.

Type of Study: Survey/Interviews/Focus Groups

Research Question(s): What is the effect of officers' views of organizational justice on their perspectives of BWCs?

Outcomes Measured: The study surveys a convenience sample of officers from two small-to-mid-sized U.S. law enforcement agencies, and measured officers' perspectives on BWCs using the scale items developed by Jennings and colleagues (2014). Organizational justice was operationalized through several measures grouped into the subcategories of procedural justice, interpersonal justice, and informational justice.

Findings: Officers' perceptions of organizational justice were found to be significant in affecting officers' views of BWCs. Agency implementation of BWCs, officer rank, and gender were all found to be significant as well.

Suggested Future Research by Authors/Recommendations: The authors recommend that law enforcement administrators be open in communication before implementing BWCs and seek officer participation in the policy process. Authors also recommend using BWC video as a training tool to assist officers in seeing the benefits of BWC.

51. Lamme V, Zipser K, Schiller P. (1996). Contextual modulation in primary visual cortex. *J. of Neuroscience* 16(22):7376-7389.

Type of Study: Lab study using monkeys

Research Question(s): The effects of context on the interpretation of texture displays in macaque monkeys.

Outcomes Measured: They conducted experiments in which the contextual modulation was created by stimuli outside of the receptive fields of visual neurons. In particular, they were interested in describing how a neuron's response to direct receptive field stimulation could be influenced by patterns appearing entirely outside the receptive field.

Findings: They found that contextual modulation correlated with the perceptual experience of different kinds of texture displays. However, the contextual modulation effects vanished at about 10 degrees diameter outside the receptive field. This is relevant to how the visual system models the three-dimensional world. Image filtering is insufficient to cause this and instead the distal three-dimensional structure is inferred from reflected traces of contour and texture in retinal images. Because we have a relatively fixed vantage point viewing a scene, our visual system makes inferences about forms that are not directly visible, including the manner in which surfaces continue beneath objects that we cannot see through.

52. **Letourneau, D. S. (2015). Police body cameras: implementation with caution, forethought, and policy. University of Richmond Law Review, 50, 439-474.**

Type of Study: Legal review related to use of video in police interactions with citizens

Focus: This article describes an initial implementation policy designed to maximize the benefits and minimizing the negative impacts of the use of BWC by law enforcement. The author describes perceived benefits and anticipated challenges of increased BWC use. One concern is that the video recordings may contain hearsay statements yet make the officer actions a matter of public record. Therefore, all BWC recordings could be admitted to evidence as public record even though the contents may be hearsay and even if the officer is not present in court. Witness testimony may be perceived just as a back-up to the video evidence. The author concludes that a jury watching the BWC video may come to improper conclusions, such as making a finding based only on their perception of the recording while ignoring other evidence. The author mentions one case (Scott v. Harris) in which there have been differences in the ability of judges to make a finding based on a police video record. The lower court found that factual questions still existed after viewing the video, but the Supreme Court found that the video alone was sufficient for summary judgment.

Conclusion: Policies and implementation must be carefully designed to fit the local context of the agency and community, and must consider privacy concerns and other potential consequences.

53. Lin Z, Han S. (2008). Self-construal priming modulates the scope of visual attention. Quarterly J. Experimental Psychology 62(4):802-813.

Type of Study: Human participants in a lab

Research Question(s): The hypothesis that self-concepts characterizing people from different cultures can mediate variation in visual attention.

Outcomes Measured: Reaction times and accuracy in a visual pronoun discrimination task with and without priming.

Findings: Cultural differences influence many basic cognitive processes, including attention. Self-construal refers to the extent to which the self is defined independently of others or interdependently with others. Visual attention is thereby influenced depending on whether you define yourself independently or interdependently. The authors demonstrated how people may be primed with a pronoun technique to cause a shift from interdependent to independent self-construal and vice versa.

54. Lum, C., Koper, C.S., Merola, L.M., Scherer, A., and Reioux, A. (2015). Existing and Ongoing Body Worn Camera Research: Knowledge gaps and opportunities. Report for the Laura and John Arnold Foundation. Fairfax, VA: Center for Evidence-Based Crime Policy, George Mason University.

Type of Study: Comprehensive review of the BWC literature and made additional efforts to find studies that were just begun or about to be started as of December 2015.

Research Question(s): What are the gaps in previous and ongoing research?

Outcomes Measured: What types of studies are being performed.

Findings: They found 12 existing empirical studies and 30 ongoing research projects. They were looking for gaps in research. The most common research explored BWC impacts on the quality of officer-citizen interactions as measured by complaints and surveys. They did not identify any studies comparing BWC video with human perception of what occurred. They noted that almost of the ongoing BWC research was in the area of law enforcement, but these gaps were identified:

- Officers' compliance with 4th Amendment standards (0 studies);
 - Implicit or explicit bias and differential treatment by police (i.e., based on race, age, gender, ethnicity, etc.) (0 studies);
 - Police officer job satisfaction and retention (1 study);
 - Citizen (non-suspect) compliance to commands and officer authority, such as in cases of large events or crowds (1 study);
 - Citizen, victim, or witness willingness to call the police (1 study);
 - Citizen willingness to continue to cooperate with police as witnesses or victims (1 study);
 - Attitudes related to privacy concerns (1 study);
 - Crime and fear of crime, insofar as BWCs change police and citizen actions in ways that might lead to increases or decreases in crime (0 studies);
 - Intelligence gathering efforts (1 study);
 - The investigation of critical incidents, officer-involved incidents or officer-involved shootings or deaths (1 study);
 - Improving training (2 studies);
 - Changes in agency policies related to use of force and police-citizen interactions (0 studies);
 - Accountability and disciplinary systems, including internal investigations (1 study);
 - Complaint resolutions and lawsuits against the police (1 study);
 - Police managerial systems and supervision (0 studies);
 - How the effects of BWCs vary based on agency policies and/or state laws (1 study);
 - Technical aspects of BWCs, including how BWC footage is stored and used (1 study).
- They concluded that the largest research gap was the lack of empirical research on the impact of BWC videos in the courts. However, they found several reported findings suggesting that BWC video may not be viewed as "objective" accounts of police-citizen interactions. Instead, the BWC video evidence may be perceived differently by members of the public based on individual characteristics. They found no research related to:
- The impact of BWCs on prosecutorial behavior and practice, including alterations to charging patterns, types of plea bargains offered, prosecutorial discovery obligations, witness preparation, motions, strategy/presentation in court, or policies of prosecutors' offices.

- The impact of BWCs on defendant/defense behavior and practice, including changes to plea decisions, requests for bench/jury trials, motions (such as for dismissal or for the exclusion of evidence), or defense strategy or presentation in court.
 - The impact of BWC evidence on decision makers (judges and jurors), such as on assessments of witness credibility, potential questions of police coercion, an individual's consent to police to search, the likelihood of guilt, sentencing, or expectations about the availability/credibility of evidence.
 - The impacts of evidentiary issues surrounding BWC footage, such as the effects of loss, failure to record, technical issues, security failures, or destruction of footage on exclusions of evidence, dismissals or acquittals.
 - The potential legal impacts of failure to warn individuals that a recording is being made (or a citizen who denies consent to be recorded), as well as the legal impacts of recording in private places on exclusions of evidence or outcomes.
 - The impacts of increases in video evidence on court resources, efficiency, the need for training or specialized expertise or case processing time.
 - The impact of BWC footage on court processes or outcomes generally, including case dismissals, convictions, sentences, or appeals.
- Although they did not identify it as a gap, they did not mention any study that concerned the differences between BWC video and human perception of the officer-citizen interaction.

55. MacLeod C, Mathews A. (1988). Anxiety and allocation of attention to threat. *Quarterly J. of Experimental Psychology* 40A(4):653-670.

Type of Study: Human participants in a lab

Research Question(s): Anxiety-related attention bias exists and selectively favors the processing of threat-related information. The question is whether this bias is due to the current emotional state of the perceiver or a more enduring cognitive difference associated with mood. If it is the perceiver's emotional state, then any attention bias may be a secondary consequence of mood. If the latter is true, then this bias may be due to an underlying vulnerability to negative mood states and subsequently implies an enduring tendency for some to pay more attention to aversive stimuli.

Outcomes Measured: The authors studied subjects categorized as either high-trait or low-trait, depending on their native level of anxiety as measured on trait-anxiety scores. These subjects were then tested on their attention bias during situations that provoked anxiety and those that did not.

Findings: They found that the trait-anxiety level alone was not sufficient to account for the observed patterns of attention response to threat stimuli directly related to a specific stressful event. Both high and low anxiety trait subjects reported an equivalent increase in their anxiety levels in response to stressful situations. However, the anxious subjects increased their tendency to allocate attention toward the threat stimuli, while the less anxious subjects shifted their attention away from the threat stimuli. The authors conclude that one cannot predict attention bias to relevant stress stimuli based on either trait or state anxiety alone, but that there is an interactive effect.

56. Makin, D. A. (2017). **Avoiding the Technological Panacea: the Case of the Body-Worn Camera.** In Moriarty, L.J. (Ed.), *Criminal Justice Technology in the 21st Century, 3rd Edition*, pp. 86-102. Springfield, IL: Charles C Thomas Publisher, LTD.

Type of Study: Thought/Theory Piece, Commentary

Focus: This commentary emphasizes the need to look historically at police technology in order to push BWCs to becoming transformative technology instead of merely symbolic technology. Throughout the four eras of policing technology (see Soulliere, 1999), several technologies have emerged as transformative (the police vehicle, the computer); however, modern technologies have not been used to their full potential due to funding issues. Body-worn cameras have emerged much like in-car cameras, and the early adopters were driven by a desire to improve police practice. These early implementers recognized that BWCs are not a panacea, but that their benefits to police practice outweigh the costs.

Conclusions: Body-worn cameras can slowly transform policing if they are adopted due to their benefits for police and not solely viewed as an accountability mechanism.

57. **Makin, D. A. (2016), When the Watchers Are Watched: An Interpretive Phenomenological Analysis of Body-Worn Cameras. *Journal of Qualitative Criminal Justice & Criminology*, 4(1), 113-151.**

Type of Study: Empirical

Research Question(s): What themes arise from officer interviews both pre- and post-implementation of BWCs?

Outcomes Measured: N/A

Findings: *Pre-implementation:* Negative themes that emerged included distrust and resentment towards supervisors; fears of increased workload that takes officers away from patrol; fears of being distracted by BWC; fears that BWC may not capture the details of an event; fears that BWC video may undermine officers' credibility; concerns about technological issues leading the BWC to fail to record critical events; fears of removal of discretion. Positive themes included the belief that BWCs would reduce personal liability and would improve professionalism.

Post-implementation themes: increased workload; worries of potential inaccuracy of reports written; reduction of liability; frustration of adding new policy to routine; mental second-guessing as to whether the camera was turned on during an interaction; self-correcting; improved training; improving professionalism.

A positive catalyst event assisted in the acceptance and approval of BWCs among officers in the department.

58. Mayor Rawlings-Blake's Working Group. (2015). Mayor Rawlings-Blake's Working Group on the Use and Implementation of Body-Worn Cameras: Draft Recommendations, City of Baltimore, February 18, 2015.

Type of Study: Mayor's Office Working Group Report based on meetings conducted following the death of Freddie Gray.

Research Question(s): Recommendations on the implementation and use of BWC

Outcomes Measured: The working group analyzed community perspectives, privacy and legal issues, and police operations and policy regarding the potential benefits and limitations of BWC.

Findings: As for limitations, they noted that BWC may not fully capture what an officer sees, hears, or does. They cite an example of an officer twisting their head to see something in peripheral vision that a camera (whether it is located on the hat, glasses, or lapel) cannot see. They mention the audio capabilities of a camera may be limited by the sound of static as the officer runs. Also, in the chaos of the chase, the BWC may become inoperable or fall off. They also refer to the PERF study that indicated benefits to transparency and resolving questions about the officer-citizen interaction. They cite the

Rialto study as an example of benefits of BWC. The focus of the report was on recommendations for use of BWC by the city of Baltimore instead of differences in perceptions.

59. McClure, D., La Vigne, N., Lynch, M., Golian, L, Lawrence, D., & Malm, A. (2017). *How Body Cameras Affect Community Members' Perceptions of Police: Results from a Randomized Controlled Trial of One Agency's Pilot*. Washington, DC: Urban Institute.

Type of Study: Empirical (surveys)

Research Question(s): How do BWCs affect public perceptions of local police officers and their local departments? Do BWCs affect public satisfaction with interactions (when community members are aware of the recording)? How do officers vary in their BWC activation practices? Do BWCs affect officer behavior?

Outcomes Measured: Police officers of a Southwestern city were assigned into three conditions: control, BWC assignment, and BWC assignment with a script to follow at the beginning of every encounter (to inform community members of their being recorded). Officers' arrest and BWC activation were also collected. Community members were then surveyed about their interactions with officers from all groups and rated their satisfaction with the encounter, their recall of whether a BWC was present

Findings: Forty-three percent of community members surveyed did not remember whether the officer they encountered was wearing a BWC. Half of those that claimed to remember a BWC were incorrect in their recall. Officers informing community members that they were being recorded had no effect on accuracy of community member recall.

Officers in the condition of BWC with script were found to activate their BWCs at a higher rate. However, officers who activated their cameras less frequently were the most likely to respond to calls for service. Officers assigned BWCs were also found to make fewer arrests than those without BWCs.

Suggested Future Research by Authors/Recommendations: Authors state that BWCs, while helpful, are not a simple fix. More research is needed to determine how departments use BWCs and whether the devices are beneficial to certain departments and their communities.

60. Merola, L., Lum, C., Koper, C. S., & Scherer, A. (2016). *Body Worn Cameras and the Courts: A National Survey of State Prosecutors*. Report for the Laura and John Arnold Foundation. Fairfax, VA: Center for Evidence-Based Crime Policy, George Mason University.

Type of Study: Survey/Interviews/Focus Groups; Report

Research Question(s): What are prosecutors' views of using BWC evidence in court?

Outcomes Measured: A national survey of prosecutors' offices inquired about prosecutors' use of BWC evidence; support for BWC use; and concerns surrounding BWC evidence.

Findings: Two-thirds of state prosecutors' offices were found to be already working with BWC evidence, and 79.5% respondents supported BWC use. The majority (54%) also believed that BWC evidence could increase preparation time, and 59.5% were concerned with redaction. The majority (64.4%) expressed a need for infrastructure updates (such as new technology to view BWC footage) and 46.3% agreed that more resources were needed.

The majority (58.3%) agreed that BWC evidence would increase conviction rates and the frequency of plea bargains (62.3%). The majority (66.9%) were concerned that jurors would come to expect BWC evidence and would have a negative view of cases without BWC evidence. Forty-eight percent worried

that BWC footage may not be fully objective, and only 42.3% believed that BWCs would increase officer/citizen respect and trust.

61. Mesa Police Department. (2013). *On-officer body camera system: Program evaluation and recommendations*. Mesa, AZ: Mesa Police Department.

Type of Study: Non-Randomized Controlled Trial

Research Question(s): What is the effect of BWCs on civil liability, citizen complaints, and criminal prosecution?

Outcomes Measured: Officers were split into two equal groups (treatment and control) and data was collected between October 2012 and September 2013. The study examined complaints, use of force, and BWC activation. A survey was also conducted to assess police officers' perceptions of BWC benefits.

Findings: The experimental group was found to have a 40% reduction in complaints and 75% reduction in officer use of force. No figures are provided for litigation reduction. Officers who volunteered to wear BWCs were found to be 60.5% more likely to activate BWCs than assigned officers.

The survey found the majority (80%) of officers believed BWCs would improve evidence quality, would cause officers to act more professionally (77%), and make officers more cautious when making decisions (81%). Less than half (45%) believed that cameras would make citizens more respectful, and very few (no figure given) believed that BWCs would increase officer safety.

As for BWC activation, there was a 42% decrease in BWC activation when policy allowed for discretion in activation, compared to the six months of mandatory activation during the evaluation.

Suggested Future Research by Authors/Recommendations: The report recommends mandatory BWC activation policies.

62. Microsoft. (2016). *The Insider's Guide to Police Body-Worn Video*.

Type of Study: Guide to Police BWC video with regards to policy development

Research Question(s): N/A

Outcomes Measured: N/A

Findings: This document discusses considerations for BWC policy development. They describe the process of using this video as criminal justice information as three-fold: collecting, protecting, and managing the data. The document then describes the details of each of these parts of the process as it relates to policy development.

63. Miller, L. & Tolliver, J. (2014). *Implementing a Body-Worn Camera Program: Recommendations and Lessons Learned*. Washington, DC: Office of Community Oriented Policing Services.

Type of Study: Report

Focus: This report examines the state of the field regarding the use of BWCs in law enforcement, particularly BWC policies. The benefits of BWCs are first addressed, including the reduction of complaints, identifying and addressing internal department issues, and evidence documentation. Privacy considerations are then discussed, and approaches are discussed regarding determining when officers should record, two-party consent states, and data retention, storage, and release. The authors also briefly introduce the question of whether to allow officer review of BWC footage before writing reports, due to concerns about officer memory and recall. Issues of cost are also discussed.

Conclusions/Recommendations: The report concludes that – when implemented well – BWCs can increase police accountability, transparency, and professionalism. However, police agencies need to consider whether BWCs are a feasible option, and implementation must be done carefully and with fully developed policies in place.

64. **Morrison C. (2016). Body camera obscura: the semiotics of police video. Georgia State University College of Law Legal Studies Research Paper No. 2016-17.**

Type of Study: Law Review (descriptive critique of the use of video evidence in assessing the lawfulness of police violence)

Research Question(s): An exploration of the legal and cultural ramifications of the legal use of visual evidence with regard to violence in police-citizen encounters.

Outcomes Measured: N/A

Findings: The author describes how BWC increasing transparency rests on the assumption that video recordings of violent encounters between police officers and civilians reveal the objective truth about these interactions. However, the contributions of BWC video are in reality more ambiguous. Video evidence requires interpretation by the viewer. Cognitive psychologists recognize at least four types of biases on the part of the viewer. They use the term "naive realism" to define the belief that video evidence is an objective record of reality, combined with a lack of awareness of the implicit cultural biases of the viewer. Because video alone is incomplete and lacks context, viewers are more likely to fill in the gaps with their subjective views and biases. Viewers will also be oblivious to the perspective bias that might cause them to identify with one party or another, usually the police officer in the case of BWC. Another cognitive bias is called the unavoidability of subjectivity. This is related to naive realism but refers to the fact that, as soon as an image is used as a means of communication, the viewer cannot avoid using their subjective worldview to interpret what they see. Depending on this worldview, the same video may be interpreted very differently. For example, videos of police confrontations with black citizens are not viewed in a vacuum but possibly within the context of the perspective that blacks are more dangerous than whites. The unavoidability of subjectivity refers not only to differences in socio-political values, but also the superimposition of the viewer's past experiences. The third type of cognitive bias is called fragmentation of perspective and refers to the fact that any video footage is necessarily fragmentary. For example, a particular camera video will eliminate everything below, above, or behind the camera. It will not record objects or people that are blocked, too far away, or too dimly lit. It will not record what happened neither before the camera was activated nor after the recording was ended. One example of a video recorded with a chest-mounted camera shows the torso of a man in a red shirt flailing his arms and appears to show his fist coming at the camera. Most viewers found this video threatening, but a view from further away showed the man was simply performing a silly dance. The fourth type of cognitive bias is called identification bias. When a video is being viewed, the images are seen from the perspective of the officer and the viewer is sharing the experience of that perspective. In filming a movie, this is known as a point-of-view shot and the purpose is to get the viewer to empathize with the subject, typically the protagonist, by showing what they see. That is why this video perspective is frequently used in gaming. In video games involving first-person shooters, the video gives the illusion that it is showing the viewer's hands on their gun. Makers of video games have harnessed the persuasive potential by creating the feeling of immersion, identification, and interactivity. Therefore, a judge or jury viewing BWC video may become biased by seeing the officer as the protagonist based on this bias.

The author then provides a description of the science of semiotics, which is the study of how images and other signs make meaning. Semiotics assumes that this meaning is constructed via the interplay of images or text and the viewer or reader.

65. Morrow, W. J., Katz, C. M., & Choate, D. E. (2016). Assessing the Impact of Police Body-Worn Cameras on Arresting, Prosecuting, and Convicting Suspects of Intimate Partner Violence. *Police Quarterly*, 19(3), 303-325.

Type of Study: 2nd Hand Randomized Controlled Trial (Empirical Analysis using data from Previous RCT)

Research Question(s): How do BWCs affect intimate partner violence (IPV) case processing?

Outcomes Measured: Examined IPV case processing and outcomes of the non-random controlled trial conducted in Phoenix Police Department.

Findings: Little overall difference in case processing was found pre- and post-BWC implementation. An examination of posttest differences found BWC treatment group cases to be significantly more likely to result in an arrest (40.9% vs. 34.3%), have charges filed (37.7% vs. 26%), have cases furthered (12.7% vs. 6.2%), result in a guilty plea (4.4% vs. 1.2%), or result in a guilty verdict (4.4% vs. 0.9%), when compared with the control group.

66. Muller H, Rabbitt P. (1989). Reflexive and voluntary orienting of visual attention: time course of activation and resistance to interruption. *J. Experimental Psychology* 15(2):315-330.

Type of Study: Human studies of visual attention in a laboratory setting

Research Question(s): Three experiments were performed. Experiment 1 measured the time course of reflexive and voluntary orienting mechanisms by directly comparing peripheral and central-cuing conditions. This was meant to show whether reflexive orienting is more effective and less interruptible than voluntary orienting. Experiments 2 and 3 were designed to test directly the interruptibility of the two orienting mechanisms hypothesized to underlie the time course data of Experiment 1.

Outcomes Measured: Probability of correct position-correct same-different responses when human subjects were given advance cues indicating the probable locations of targets that they had to discriminate and localize. Interruptibility was indexed by the degree to which orienting in response to cues had interference from task-irrelevant (i.e., uninformative) peripheral flashes. Direct peripheral cues (brightening of one of four boxes in peripheral vision) and symbolic central cues (an arrow at the fixation point indicating a probable peripheral box) were compared.

Findings: This paper is often cited for distinguishing between two mechanisms involved in directing visual attention in a scene. Reflexive orienting is triggered by peripheral visual cues, is automatic, and cannot be voluntarily suppressed. Voluntary orienting is initiated by visual cues being processed cognitively but can be suppressed so that the initiation of this orienting mechanism is not obligatory. Spatial orienting of visual information thereby addresses the same limited capacity visual attention by these two mechanisms. The reflexive mechanism cannot be prevented from producing an orienting response and proceeds autonomously once it is activated. The voluntary mechanism is more complex and involves different processes. Interference with voluntary orienting can occur with resource demands from competing cognitive tasks, but most importantly occurs when the reflexive orienting mechanism is activated.

67. National Institute of Justice. (2012, September). "A Primer on Body Worn Cameras for Law Enforcement," *JustNet*, p. 5, accessed September 9, 2015, <https://www.justnet.org/pdf/00-Body-Worn-Cameras-508.pdf>

Type of Study: Report

Focus: This report addresses the purported benefits of BWCs (evidentiary uses, officer safety, professionalism, reduction in citizen complaints, and officer support) and policy guidelines. Considerations are provided for states that are single and double-consent states.

Conclusions/Recommendations: The report recommends that agencies look to neighboring agencies that have deployed cameras, and that agencies conduct a pilot deployment, fully develop policies, procedures, training plans and input/feedback systems, before implementing BWCs.

68. Nieuwenhuys A, Canal-Bruland R, Oudejans R. (2012). Effects of threat on police officers' shooting behavior: anxiety, action specificity, and affective influences on perception. *Applied Cognitive Psychology* 26:608-615.

Type of Study: Human study using police officers in an indoor setting.

Research Question(s):

Outcomes Measured: Participants' subjective ratings of anxiety on a scale of 0 to 10 by using a visual-analogue scale; beat-to-beat analysis of participants' heart rate, actual shooting distance, perceived shooting distance.

Findings: The distance between an officer and a suspect is important in the officer determining how to respond. For example, the officer may verbally order a knife-wielding person to drop the knife when they are standing a large distance from the officer but may draw their gun or even shoot if the suspect is very close. The authors show that, in threatening situations, the officer's determination of distance may not be as accurate as they assume. Threat-induced increases in anxiety tended to result in officers deciding to shoot an approaching knife-wielding suspect sooner. Perceptual accuracy in judging the distance to the suspect consistently underestimated the actual distance regardless of the degree of the threat level. Two types of responses were tested: 1) actual shooting with a gun firing colored soap cartridges; and 2) shouting "now" when the officer decided to shoot. The distance accuracy using the first response was better than that for the second response, but both underestimated the actual distances from the threat.

67. Nowacki, J. S., & Willits, D. (Forthcoming). Adoption of body cameras by United States police agencies: an organisational analysis. *Policing and Society*, DOI: 10.1080/10439463.2016.1267175.

Type of Study: Empirical

Research Question(s): What kinds of organizational variables influence law enforcement agencies' adoptions of BWCs?

Outcomes Measured: Organizational variables were obtained from the Law Enforcement Management and Administrative Statistics (LEMAS) 2013.

Findings: Larger departments were found to be less likely to adopt BWCs. Departments that already used technology widely were seen as positively and significantly related to BWC adoption. A greater number of specialized units in a law enforcement agency were also significantly related to BWC adoption. Additionally, agencies with formal policies for officer behavior (such as foot pursuit policies

and vehicle cameras) were found to have greater odds of adopting BWCs than those agencies that did not have formal policies.

The authors suggest that agencies with larger budgets have more resources and may therefore be better insulated from external pressures to adopt BWCs or other policies.

69. ODS Consulting. (2011). *Body Worn Video Projects in Paisley and Aberdeen, Self Evaluation*. Glasgow: ODS Consulting.

Type of Study: Non-Random Controlled Trial

Research Question(s): What are the effect of BWCs on crime rates, guilty pleas, complaints resolutions, and assaults on officers?

Outcomes Measured: This experiment in Aberdeen and Renfrewshire examined crime rates, guilty pleas, complaints, assaults on officers, and surveyed public perceptions about BWCs.

Findings: Total crime rates reduced by 26% after BWC implementation in Aberdeen and by 13% in Renfrewshire. A higher rate of guilty pleas was also found for BWC cases in both divisions. As only seven complaints and four assaults on officers occurred during the study, there was no way to see the effect of BWCs on these measures.

The survey of public perceptions revealed 49% of Renfrewshire respondents felt safer due to BWCs, and 64% believed that BWCs would help reduce crime. Sixty-four percent also thought that all police and wardens should wear BWCs. In Aberdeen, 37% respondents reported feeling safer due to BWCs, and 57% believed they would reduce crime. Seventy-six percent of Aberdeen respondents supported BWC use by all officers.

70. Owens, C. & Finn, W. (Forthcoming). *Body-Worn Video through the Lens of a Cluster Randomized Controlled Trial in London: Implications for Future Research*. *Policing: A Journal of Policy & Practice*, DOI:10.1093/POLICE/PAX014.

Type of Study: Report

Focus: The report provides a summary of findings from the randomized controlled trial of the Metropolitan Police Service. The findings included a significant reduction in complaints (though impact across the 10 boroughs with BWCs varied). Other positive uses of BWCs emerged from the study, such as officers narrating events while using them for further evidentiary benefit, and the use of footage for training purposes. Varying citizen reactions to the knowledge of being filmed were found, with some growing more cooperative and others growing more aggressive when told of BWC recording.

Conclusions: The overall findings suggest that individual and contextual differences play a major role in the overall effects of BWCs.

71. Owens, C., Mann, D., & Mckenna, R. (2014). *The Essex Body Worn Video Trial: The impact of BWC on criminal justice outcomes of domestic abuse incidents*. London, U.K.: College of Policing. https://www.bja.gov/bwc/pdfs/BWV_ReportEssTrial.pdf

Type of Study: Randomized Controlled Trial

Research Question(s): What is the effect of BWC on domestic violence case outcomes?

Outcomes Measured: This four-month randomized controlled trial of Essex examined domestic violence case outcomes in those cases that were recorded by BWCs as compared to those that were not recorded.

Findings: No significant differences in overall sanction detections were found between the BWC group and control group. However, BWCs affected the type of sanction detection: 81% of the sanction detections were charges in the treatment group (as compared to 72% in the control group). The authors recognize that low activation rates of BWCs may have had a substantial impact on the findings.

72. **Pagliariella, C. (2015). Police Body-Worn Camera Footage: A Question of Access. *Yale Law & Policy Review*, 34, 533-543.**

Type of Study: Law Review

Focus: The author discusses the high cost of storage, the ideal retention times of footage, and how footage is to serve both police and public interests. Both police and privacy advocates are largely concerned about the privacy issues that come with BWCs, and departments vary widely on how accessible they make footage (if at all)?

Conclusions: The author recommends that citizens captured in a BWC recording should be allowed a copy within a reasonable amount of time, even if other citizens and/or officers in the footage do not consent. The author calls for recognizing citizens' rights as the primary focus of BWC discussions. The author also recommends giving law enforcement agencies more discretion with the footage request comes from third parties not in the requested footage, and when the redaction process is reasonably believed to be costly. Lastly, the author encourages market competition for secure BWC footage storage, as a single database is a security risk.

73. Parker A. (2007). Binocular depth perception and the cerebral cortex. *Nature Reviews Neuroscience* 8:379-391.

Type of Study: Review

Research Question(s): The author discusses the role of binocular neurons in different perceptual tasks.

Outcomes Measured: N/A

Findings: The horizontal distance separating our right from left eyes means that each eye receives a slightly different image. The brain is able to detect even small differences in order to perceive distance accurately. The creation of a complete stereoscopic image in the brain is a multi-stage process involving two neural pathways. Understanding these pathways is important for determining contributions to perceptual judgments about stereo depth.

74. Parker A, Newsome W. (1998). Sense and the single neuron: probing the physiology of perception. *Annu. Rev. Neurosci.* 21:227-277.

Type of Study: Review

Research Question(s): Progress in understanding links between neural activity and perception.

Outcomes Measured: N/A

Findings: Studies ranged from comparing statistically defined neural and behavioral thresholds to the use of electrical stimulation to intervene directly in perception. They conclude that studies should be performed in sensory systems with different perceptual tasks. Studies should also be done comparing neural and psychological processes during simple decision-making.

75. Payne B. (2001). Prejudice and perception: the role of automatic and controlled processes in misperceiving a weapon. *J. Personality and Social Psychology* 81(2):181-192.

Type of Study: Human participants in a lab

Research Question(s): Two studies were performed to examine the effects of certain visual cues on the perceptions of the presence of weapons.

Outcomes Measured: Accuracy of identification of object as a tool or a gun; speed of identification of object as a tool or a gun.

Findings: Study participants were white undergraduate students: 24 women and 7 men. Priming was done by using digital photographs of white or black male faces followed by targets that were either hand tools or guns. One experiment evaluated the accuracy of the identification of the target as either a tool or a gun. The study participants were more likely to misidentify the target as a gun when primed with a black person's face. The second experiment evaluated the speed of identification of the target as either a tool or a gun. In this experiment, participants were required to respond within 500 ms. This response deadline introduced pressure to respond as might be the situation with law enforcement officers responding to a call and was expected to increase the overall error rate. While the first experiment showed response times were faster with black face priming than with white, the second experiment showed the accuracy was worse with black face priming than white when response deadlines were imposed. The authors recommend two possible approaches to reducing this bias: minimize the automatic psychological association of black people with guns and maximize cognitive control.

76. Pelfrey Jr, W. V., & Keener, S. (2016). Police body worn cameras: a mixed method approach assessing perceptions of efficacy. *Policing: An International Journal of Police Strategies & Management*, 39(3), 491-506.

Type of Study: Survey/Interviews/Focus Groups

Research Question(s): What are officer perceptions, concerns, and expectations of BWCs?

Outcomes Measured: This study conducted a survey and focus groups with a university police department pre-BWC implementation to examine officer perceptions. Measures included officers' perceptions of BWCs and use of force, citizen complaints, and citizen behaviors.

Findings: The majority (65.8%) of officers disagreed/strongly disagreed that BWCs would reduce officer use of force, and 76.9% officers felt that BWCs would not reduce citizen complaints. The majority (79.9%) of officers disagreed/strongly disagreed that BWCs would improve citizen behavior. However, 59.8% believed that all officers in the PD should wear BWCs, and 67.1% believed the advantages of BWCs outweighed the costs.

Administrators cited transparency as a primary reason to adopt BWCs, and believed that BWCs would be an additional step in reducing use of force. Body-worn cameras were also seen as an objective and helpful way to investigate complaints.

77. Perkins, G. (Forthcoming). Lights, Camera, Action! Body-worn Cameras: Challenges and Opportunities in Police Research. *Policing*, DOI:10.1093/POLICE/PAX002.

Type of Study: Thought/Theory Piece, Commentary

Focus: This commentary focuses on the challenges of researching BWCs, especially in international contexts (the study primarily focuses on South Africa).

Conclusions: The author encourages researchers to not solely rely on BWC footage to research policing.

78. Phillips, S. W. (Forthcoming). **Eyes are not Cameras: The Importance of Integrating Perceptual Distortions, Misinformation, and False Memories into the Police Body Camera Debate.** *Policing: A Journal of Policy & Practice*, DOI:10.1093/POLICE/PAW008.

Type of Study: Thought Piece/Commentary

Focus: The author discusses that, while BWCs provide an objective recording of events, officers can experience perceptual distortions in crisis events and therefore their perceptions may not match the BWC footage. Regardless of the training that officers receive, officers rarely deal with crisis events, and are therefore just as prone to perception and identification error as the average civilian.

Conclusion: Because officers must make split-second decisions in crisis events, the high scrutiny given to reviewing police video when determining whether an officer behaved correctly may not be the best way of reviewing officer behavior. It cannot be assumed that any officer testimony that disagrees with BWC footage is a lie.

Suggested Future Research by Authors/Recommendations: The BWC discussion must recognize that there is discrepancy between what objectively occurs (as recorded on BWC footage) and what the officer perceived to have occurred.

79. Prenzler T, Porter L, Alpert G. (2013). Reducing police use of force: case studies and prospects. *Aggression and Violent Behavior* 18:343-356.

Type of Study: Review of seven cases of BWC use by police

Research Question(s): The possibility of reducing violence in citizen-police interactions and controlling police use of force at levels that may result in injury and threaten public trust in the police.

Outcomes Measured: They selected seven cases to review: Oakland Police, Metro-Dade Police, New York Police, Portland Police, Tasmania Police, Victoria (Australia) Police, and England/Wales police.

Findings: Video recordings can be useful to identify and deter excessive force, as well as countering false allegations. However, they concluded that a key step is to diagnose the nature and causes of excessive or unnecessary force. Overall, equipping officers at the individual level with the appropriate skills, and providing a framework of internal and external accountability, seemed to be the keys to reducing negative behavior and outcomes

80. **President's Task Force on 21st Century Policing (2015). Final Report of the President's Task Force on 21st Century Policing.** Washington, DC: Office of Community Oriented Policing Services.

Type of Study: Report

Focus: Among other topics addressed, the Task Force examines BWC use in Pillar (chapter) 3. The report refers to Ariel and colleagues' (2015) Rialto study as using the "gold standard" of research designs (the randomized controlled trial), and points to some of the study's findings as cause to consider BWCs as an effective accountability tool.

Conclusions: The Task Force recommends that law enforcement agencies develop clear policies and follow the Bureau of Justice Assistance's BWC Toolkit for guidance on BWC implementation. The Task Force also recommends that public record laws be updated to ensure release of footage is protected under certain instances, and that communication with the community is necessary for transparency and building public trust.

81. Ramirez, E.P. (2014). *A Report on Body Worn Cameras. Manning & Kass, Ellrod, Ramirez, Trester LLP; A Report for the Bureau of Justice Administration.* Retrieved from [https://www.bja.gov/bwc/pdfs/14-005_Report BODY WORN CAMERAS.pdf](https://www.bja.gov/bwc/pdfs/14-005_Report_BODY_WORN_CAMERAS.pdf).

Type of Study: Report

Focus: The author recognizes that the findings of Ariel and colleagues' (2015) Rialto study are being used nationwide as the reason why police should begin to use BWCs. However, certain issues need to be considered, such as privacy and officer discretion over when to activate BWCs. The author argues that cameras should record continuously throughout officers' shifts, but also recognizes that this could present privacy concerns for officers, and therefore a balance must be struck.

Conclusions: Body-worn cameras are a useful tool in positively affecting police and public behavior, but some issues – such as questions of privacy and video access – must be addressed.

82. Ready, J.T. & Young, J.T.N. (2015). *The impact of on-officer video cameras on police–citizen contacts: findings from a controlled experiment in Mesa, AZ. Journal of Experimental Criminology, 11(3), 445-458.*

Type of Study: 2nd Hand Randomized Controlled Trial (Data for study used in original RCT)

Research Question(s): What is the effect of BWCs on officer behavior? How do BWC activation policies affect police perceptions of BWCs?

Outcomes Measured: Officer behavior was measured through stop-and-frisk incidents, arrests, and officer-initiated contacts. These measures were examined while controlling for BWC activation policies (mandatory versus discretionary).

Findings: Officers with BWCs were found to conduct significantly fewer arrests and stop-and-frisks than the control group. Officers with BWCs also issued significantly more citations for minor ordinance violations than the control group. Officers with BWCs also initiated significantly more citizen contacts than the control group. Officers with BWCs were also more likely to rate the devices as more helpful in citizen contacts than control group officers (even when controlling for mandatory and discretionary activation).

83. Richards, P., Roberts, D., Britton, M., & Roberts, N. (Forthcoming). *The Exploration of Body-Worn Video to Accelerate the Decision-Making Skills of Police Officers within an Experimental Learning Environment. Policing, DOI:10.1093/POLICE/PAX017.*

Type of Study: Thought piece/Theory piece/Commentary

Focus: The authors focus on the usefulness of BWCs for training, particularly officer decision-making in a training environment. The authors assert that training officers in decision-making in a classroom context isolates them from real-world decision-making situations. Body-worn camera footage can assist in providing footage of real situations to officers in training.

Conclusions: Body-worn camera footage should be integrated into police decision-making training in an educational environment.

84. Rowe, M., Pearson, G., & Turner, E. (Forthcoming). *Body-Worn Cameras and the Law of Unintended Consequences: Some Questions Arising from Emergent Practices. Policing, DOI:10.1093/POLICE/PAX011.*

Type of Study: Thought Piece/Commentary

Focus: The authors discuss “unintended consequences” of BWC implementation, including how some officers report growing more anxious about using force and potential for risk when hesitating on use of force decisions, and how citizens may no longer wish to offer tips or intelligence to officers, as they assume they’re being recorded. The authors also discuss the problem of officers viewing BWC footage before giving a statement, as the officer may then observe things in the footage that they may not have actually noticed or perceived during their actual experience of the event (and thus what the officer initially wrote on their report). The resulting inconsistency could lead to harsher prosecution or the defense using BWC footage to attack the credibility of an officer.

Conclusion: Randomized controlled trials, while helpful, cannot provide the full picture of the effects of BWC adoption.

Suggested Future Research by Authors/Recommendations: More ethnographic research needs to be conducted to gain a fuller picture of the effects of BWCs.

85. Roy A. (2014). On-officer video cameras: examining the effects of police department policy and assignment on camera use and activation. Master of Science Thesis, Arizona State University.

Type of Study: Case control study of law enforcement officers on the job

Research Question(s): How does departmental policy (mandatory or discretionary) and assignment of officers to a camera program (mandatory or voluntary) affect officer behavior and their opinions of their BWC.

Outcomes Measured: Camera activations by officers over a ten month period, nature of the crime incident, officer shift and assignment, presence of bystanders and backup, other situational factors.

Findings: This dissertation studied the effects of police department BWC policy and assignment on officer behavior and opinions of BWC. They measured camera activations by line officers in the Mesa Police Department during police-citizen encounters over a ten-month period, covering 1,675 police-citizen interactions involving BWC. They also looked at the nature of the crime, how the interaction was initiated, officer shift, assignment, presence of bystanders and backup, and other situational factors. They then performed bivariate and multivariate logistic regression analyses to examine how departmental policy (mandatory versus discretionary activation policy) and officer assignment (voluntary versus mandatory assignment) affected willingness to activate the cameras, as well as officer and citizen behavior during these interactions. They found that the police department BWC activation policy was a stronger predictor of BWC use than whether an officer was assigned to a BWC program. When there were bystanders and other police officers at the scene, BWC assignment was no longer a predictor variable. The author thought that the increase use of BWC when there are bystanders may be due to the officer wanting to have their own videotaping as their version of what happened and because bystanders may not show the entire interaction. However, when other officers were also present, the use of BWC decreased. The author suggested that having more officers present provided better corroboration of their view of the interaction. Roy also found that day shift officers were less likely than "grave shift" officers to activate their BWC, possibly because of increased criminal activity or different types of criminal activity during that shift.

86. Sandhu A. (2017). 'I'm glad that was on camera': a case study of police officers' perceptions of cameras. Policing and Society, DOI: 10.1080/10439463.2017.1285917

Type of Study: Qualitative study

Research Question(s): Police perceptions of cameras

Outcomes Measured: Officer opinions

Findings: This Police on Camera study (POC) was conducted in Edmonton, Alberta, Canada, between June 2013 and January 2014. The findings showed that participating police officers feel resentment towards cameras and photographers, but then express a favorable opinion of conducting police work in view of cameras. They find that doing so tends to lead to the use of video footage to defend police actions against criticism and complaints. Sandhu concludes that the argument that police officers' responses to cameras are due to them wanting to avoid being recorded is not necessarily true. Instead, the officers tend to optimize the video footage by showing how it discredits complaints and provides a view of the interaction that is favorable to the police. Some of this may be due to the relatively high degree of autonomy an officer may have over what is and is not recorded. Therefore, this study showed that police officers could be changing their attitudes toward BWC once they learn how to make use of their high visibility by leveraging BWC video to discredit complaints.

87. Slaughter V, Stone V, Reed C. (2004). Perception of faces and bodies: similar or different? *Current Directions in Psychological Science* 13(6):219-223.

Type of Study: Review of other studies of perception of faces and bodies.

Research Question(s): How do detection and recognition differ?

Outcomes Measured: N/A

Findings: They categorized two types of perceptual tasks: detection and recognition. Detection is the ability to determine whether a particular visual stimulus is a face or body versus something else. Detection is considered the earlier stage of visual processing. Recognition is a later stage and concerns discerning distinctions among individual persons, specific body postures, and specific facial expressions. Their review led them to conclude that detection tasks use basic visual processing and may depend upon spatial properties of the image. In contrast, recognition tasks use multiple complex processes that analyze configuration, identify individuals, and assign meaning. They suggest further work should consider the importance of motion because it is possible that facial image processing may depend more on static information while body image processing may involve motion.

88. Smykla, J. O., Crow, M. S., Crichlow, V. J., & Snyder, J. A. (2016). Police body-worn cameras: perceptions of law enforcement leadership. *American journal of criminal justice*, 41(3), 424-443.

Type of Study: Survey/Interviews/Focus Groups

Research Question(s): What are the perceptions of law enforcement command staff and leadership regarding BWCs?

Outcomes Measured: This study surveyed law enforcement command staff from 36 law enforcement agencies in a southern U.S.

Findings: The majority (66%) of respondents were supportive of BWCs overall; however, the majority believed that BWCs may negatively influence officer effectiveness, in that they may make officers less likely to feel free to use necessary force. The majority did believe that BWCs would assist in evidence gathering.

Overall, command staff seemed supportive of BWCs, but skeptical of the touted benefits of BWCs.

89. Sousa W, Coldren Jr J, Rodriguez D, Braga A. (2016). Research on body worn cameras: meeting the challenges of police operations, program implementation, and randomized controlled trial design. *Police Quarterly* 19(3):363-384.

Type of Study: Description of the technical, political, and administrative challenges of implementing a BWC randomized controlled trial with the Las Vegas Metropolitan Police Department.

Research Question(s): What are the challenges of police operations, program implementation, and randomized controlled trial design?

Outcomes Measured: N/A

Findings: One of the difficulties in using the RCT design was that they could not find a reliable way of keeping the "treatment" and "control" officers separate from each other, which meant that RCT requirements were violated. They decided to proceed anyway and attempt to document any officer interactions they found. Technical difficulties in implementing the RCT included a lack of docking stations for the officers to upload their video at the end of their shifts. Political issues complicated the RCT. For example, BWC use was made voluntary because of conflicts between the political pressure to deploy BWC quickly but the demand to address internal police officer and union concerns. Several influential officers were vocal about their opposition to the BWC implementation on the grounds that this video would be used against the police. Furthermore, the administrative entity responsible for implementing the BWC program was also part of the Professional Standards Division so this heightened concern that BWC video would be used against the police. Fortunately, this latter concern was addressed by moving the administrative part of the BWC program from Professional Standards to the Patrol Division. The RCT was implemented from March 2014 through February 2015. There was a problem with attrition of officers participating in the study, with those in the "treatment" group dropping out at a somewhat higher rate than those in the "control" group. It is important to note that the actual RCT results were not presented in this paper, just the challenges in implementing the RCT in the context of a new BWC program. The authors also noted that most of the challenges were also present in the Rialto RCT study by Ariel et al. (2015).

90. **Sousa, W. H., Miethe, T. D., & Sakiyama, M. (2015). *Body Worn Cameras on Police: Results from a National Survey on Public Attitudes*. University of Nevada Las Vegas: Center for Crime and Justice Policy.**

Type of Study: Survey/Interviews/Focus Groups

Research Question(s): What are public opinions regarding BWCs? What is the level of awareness that the public has of BWCs?

Outcomes Measured: This national survey examined respondents' awareness of BWCs (e.g. had they heard of them; do they know if their local police use them), overall support for BWCs, and public beliefs regarding advantages and disadvantages of BWCs.

Findings: The majority (88%) of respondents were aware of BWCs, and 85% supported BWCs in general. The majority of respondents also believed that police would behave more respectfully towards citizens, suspects, and victims when wearing BWCs, and that BWCs would reduce police use of force, citizen false complaints, and police misconduct. A minority (49%) believed that BWCs would make citizens more respectful of the police and would reduce racial tension between police and minorities (36%). Few respondents agreed with the measures for negative BWC outcomes, such as violation of privacy or citizen fears of cooperation.

The majority of respondents supported BWC use for all levels of law enforcement, as well as other public service workers, such as TSA officers, school security officers, private security guards, firefighters, and EMTs.

91. Sousa, W. H., Miethe, T. D., & Sakiyama, M. (Forthcoming). Inconsistencies in Public Opinion of Body-worn Cameras on Police: Transparency, Trust, and Improved Police–Citizen Relationships. *Policing: A Journal of Policy and Practice*.

Type of Study: Survey/Interviews/Focus Groups

Research Question(s): What are public perceptions regarding the benefits of BWCs?

Outcomes Measured: This survey of a national sample of U.S. residents examined overall support of BWCs, and how respondents believed BWCs could affect police transparency, use of force, police-citizen relations, citizen trust, and racial tensions.

Findings: The sample was overall very supportive of BWCs (85%). The majority (91%) believed that BWCs would help improve police transparency, reduce excessive use of force (80%), improve police-citizen relationships (66%), and increase trust in police (61%). A minority (36%) believed that BWCs would decrease racial tension between police and racial/ethnic minorities.

The authors observe that, while the public seems supportive of BWCs and believe that they will increase transparency, the public varies on how they believe BWCs will affect trust and police-citizen relations.

92. Tankebe, J., & Ariel, B. (2016). Cynicism Towards Change: The Case of Body-Worn Cameras Among Police Officers. Hebrew University of Jerusalem Legal Research Paper No. 16-42. Available at SSRN: <https://ssrn.com/abstract=2850743> or <http://dx.doi.org/10.2139/ssrn.2850743>

Type of Study: Survey/Interviews/Focus Groups

Research Question(s): What are the overall levels of police cynicism towards BWCs? What are the potential causes of cynicism towards BWCs?

Outcomes Measured: This study surveyed a sample of police officers from seven law enforcement agencies in England and Northern Ireland. Measures included organizational commitment, internal procedural justice, and perceptions of BWC impacts on police integrity, public receptivity, moral performance (relationships with management and work performance), and crime prevention.

Findings: The majority of officers (65.8%) believed that the public would view BWCs as a violation of privacy, and believed offenders to be the least receptive of BWCs (81.3%). Officers believed BWCs to promote integrity, but 41.2% were cynical about the ability for BWCs to impact police misconduct. The majority of officers believed that BWCs would impact their moral performance, with 65.4% believing BWCs would reduce their discretion and 67.9% feeling that BWCs would demand more time managing data instead of out on patrol. Forty-six percent believed that their colleagues would not support BWCs. Lastly, 71% did not believe BWCs would make them safer on patrol, and 49.2% did not believe that BWCs would help prevent crime.

Assessing the influence of organizational commitment and procedural justice on levels of cynicism revealed that a higher level of organizational commitment is related to lower levels of cynicism towards BWCs. No relationship was found with internal procedural justice. The authors conclude that organizational commitment is a strong predictor of officer cynicism towards BWCs, but the causal factors of low organizational commitment are unexplored.

93. Timan, T. (Forthcoming). Policy, design and use of police-worn bodycams in the Netherlands. To appear in Leenes, R. E., Purtova, N. N., & Adams, S. A. (Eds.), *Under Observation: The Interplay between eHealth and Surveillance*. Dordrecht, Netherlands: Springer.

Type of Study: Thought Piece/Theory Piece/Commentary

Focus: This study concerns function creep, where a technology – like BWCs – is adapted for one purpose, but evolves in its use to take on more surveillance purposes. When considering the Dutch BWC, the officially stated purposes were to reduce violence against the police, record offenses, register disturbances, promote security for officers, and use footage for evidence. However, interviews of stakeholders and officers revealed that cameras were being used as CCTV devices more than for officer safety purposes. Footage became primarily an evidence-gathering tool, in spite of the other reasons for the adoption of BWCs.

Conclusions: the author recognizes that it is difficult to identify function creep in a device that is being used experimentally, but advises that close examination of stated functions, as compared to actual functions, is necessary to identify any early warnings of function creep.

94. Wallentine K, Scarry L, Fredericks G. (2017). Should cops see body cam video before giving UOF statements? Force Science News, Remsberg C, ed. 8 Feb 2017, www.forcescience.org

Type of Study: Roundtable discussion

Research Question(s): Whether officers should be allowed to watch BWC video before giving statements on use-of-force (UOF) incidents.

Outcomes Measured: N/A

Findings: Although it is commonly believed that video captures exactly what happened at the scene, video images may be significantly deceptive because of recording and storage technology. For example, video is encoded using compression algorithms to reduce the size of the data while fooling the human eye to not notice any missing pixels or scenes. BWC video may seem to have recorded continuous action when some of what appears to be new images are actually repeated frames taken from the previous recording to compress the data. The dropped images are not immediately obvious and the resulting video may give the illusion of action not necessarily representative of what actually occurred. The authors use the example of a video that appeared to show increased levels of force that didn't exist. A working knowledge of sophisticated video forensic techniques (e.g., macroblocking analysis and time tree analysis) is needed to identify the reliable images and tag the images that are not reliable.

Officers who review their own BWC footage may write their reports to accommodate the video by unintentionally changing their memory based on the illusion that every image is complete and factual. Once they have viewed this video, they cannot delete it from their minds. Plaintiffs' attorneys may then ask whether their testimony includes only perceptions of the event at the time force was used or is their testimony based on what they perceive is supported by the recording. There was disagreement as to whether the former is better than the latter. There was also discussion of whether an officer viewing their BWC video before giving UOF testimony violates the spirit of the Supreme Court decision against 20/20 hindsight in the 1989 *Graham v. Connor* case. The authors concluded that:

1. To avoid potentially damaging pitfalls, officers and their attorneys need special expertise about the nature and limitations of video recordings, regardless of when they're viewed, and
2. Departments must be actively educating their communities *now* about the surprising realities of video footage to preserve trust in the face of future controversial episodes.

95. Wasserman, H. (2014). Moral panics and body cameras. *Washington University Law Review* 92:831-843.

Type of Study: Commentary

Research Question(s): What are the limits of BWC and video evidence in general

Outcomes Measured: N/A

Findings: The author makes the point that the details of implementation determine the effectiveness of BWC. Department policies should consider public discussion and cover how the cameras are to be deployed and used. Both department policies and officer training should provide clear and specific guidelines. They should include when and when not to record and when officers should obtain consent (e.g., victims, witnesses). If this includes situations in which the officer is allowed their own discretion, then consideration should be given to the potential for abuse, complaints, and lawsuits. There is a concern that the lack of video evidence may be interpreted as suspicious and suggestive of misconduct. Also, any ambiguity in the video evidence may result in controversy. Wasserman suggests that BWC not be touted as a magic solution to police misconduct, excessive force, etc. Instead, there should be better recognition of the limitations of video evidence and the complexity of implementation.

96. White, M. D., Gaub, J. E., & Todak, N. (Forthcoming). Exploring the Potential for Body-Worn Cameras to Reduce Violence in Police-Citizen Encounters. *Policing: A Journal of Policy and Practice*, DOI: 10.1093/police/paw057.

Type of Study: Randomized Controlled Trial

Research Question(s): What is the effect of BWCs on officer use of force, citizen complaints, and officer injuries?

Outcomes Measured: This study examined the implementation of BWCs in Spokane, WA over three years (28 months pre-RCT, 6 months during the RCT, and 6 months following). Measures of use of force, complaints, and officer injuries were provided by the Spokane Police Department.

Findings: Use of force decreased by 8% in the treatment group and 17% in the control group. Once the control group was given BWCs, their use of force dropped by 50%. However, the treatment group increased in use of force at this time. Both groups experienced similar complaints rates, though the complaints for the control group increased post-RCT and then dropped by 50% once BWCs were assigned. No statistically significant change was found in either group for officer injuries.

The authors discuss possible reasons for the increase in use of force and complaints in the treatment group post-RCT and suggest that over time, the officers returned to their pre-BWC behavior. The authors therefore state that they found no evidence for Ariel and colleagues' "contagious accountability" effect, as the control group did not show reductions during the RCT, and only experienced reductions in use of force and complaints after they were assigned cameras.

97. White, M. D., Todak, N., & Gaub, J. E. (Forthcoming). Assessing Citizen Perceptions of Body-Worn Cameras after Encounters with Police. *Policing: An International Journal of Police Strategies & Management*, Doi: 10.1108/PIJPSM-07-2016-0105.

Type of Study: Empirical (community member survey)

Research Question(s): How often are citizens aware that they are being recorded? What are citizens' attitudes towards being recorded? Is there a civilizing effect of BWCs on citizen behavior during a police-public encounter?

Outcomes Measured: A survey was conducted of 249 Spokane citizens that were recorded on police BWCs during a prior police-citizen encounter (between the months of June and November, 2015).

Citizens were asked whether they were aware they were being recorded, as well as their general feelings towards BWCs (whether officers should wear them, whether benefits outweigh costs, whether they believed BWCs would make officers behave more professionally, and whether they believed that BWCs would make citizens act positively).

Findings: Twenty-eight percent of respondents were aware of being recorded. 86% agreed that officers should wear BWCs; 77% agreed that BWC benefits outweigh costs; 76.6% agreed that BWCs make officers act more professionally, and 70.2% agreed that BWCs make citizens act more positively. Of the 28% that was aware of being recorded, only 10% agreed that BWCs made them act more cooperatively. The authors therefore found low support for the civilizing effect of BWCs on community members.

Suggested Future Research by Authors/Recommendations: The authors recommend that future research explore responses from citizens who interacted with both BWC-wearing officers and officers without BWCs to compare citizen behavior during these interactions. Future research should also capture officers' ratings during police-citizen encounters, as well as how compliant officers are with following BWC activation policies.

98. White, M. D. (2014). Police Officer Body-Worn Cameras: Assessing the Evidence. Washington, DC: Office of Community Oriented Policing Services.

Type of Study: Review of five empirical studies

Research Question(s): What do these studies say about perceived benefits and concerns regarding BWC use by law enforcement:

1. Plymouth Head Camera Project (England)(Goodall 2007)
2. Renfrewshire/Aberdeen Studies (Scotland)(ODS Consulting 2011)
3. Rialto (California) Police Department (Farrar 2013)
4. Mesa (Arizona) Police Department (MPD 2013)
5. Phoenix (Arizona) Police Department (White 2013)

Outcomes Measured: Perceived benefits and concerns regarding BWC use by law enforcement

Findings: They conclude that the benefits are 1) increase in transparency and citizen views of police legitimacy; 2) a civilizing effect resulting in improved behavior among both police and citizens; 3) evidentiary benefits that expedite resolution of citizen complaints or lawsuits (i.e., improves evidence for arrest and prosecution); and 4) more opportunities for police training. The perceived concerns include: 1) citizen privacy; 2) police officer privacy; 3) officer health and safety; 4) funding for training and policy development; 5) substantial commitment of finances, resources, and logistics. They concluded that independent research on BWC technology is urgently needed because claims by both advocates and critics have not been tested.

99. White, M. D. (2016). Do body-cameras increase use of force by police and assaults against officers? In View: Commentary on Outcomes, Bureau of Justice Assistance, Office of Justice Programs, US Dept. of Justice.

Type of Study: Commentary on two studies of BWC by Ariel et al.

Research Question(s): Do BWC increase use of force by police and assaults against officers?

Outcomes Measured: N/A

Findings: White reviews two 2016 papers published by Ariel et al. and concludes that BWCs do not increase the use of force by police officers or assaults on police officers. The first Ariel et al. paper had

inconsistent results on use of force by officers but the second paper suggested that these inconsistencies could be explained by when the BWC were activated. That is, when the officers activated BWC at the beginning of their citizen encounters and advised the citizen of the video recording, then use of force by the officers declined significantly. When the officer did not do this, then use of force by the officers increased substantially. White concludes that these studies make valuable contributions to the study of BWC, but that there is no evidence from their research that demonstrates that BWCs cause officers to use force more frequently, or that BWCs cause citizens to be more aggressive toward officers. He noted that different studies concluded use of force increased with BWC while other studies found the opposite. Ariel et al. combined these results to say that there was no effect on use of force overall. However, White noted that this could be explained by what policy the officers followed, such as activation at the beginning of the citizen encounter and advising the citizen of this activation. Failure to follow policy could have caused the results in which there was increased use of force. White disputes the findings of Ariel et al. regarding assaults against officers being increased by BWC use. Instead, White argues that officers may be more likely to report an assault against them when they have BWC video to corroborate their claim. Before the use of BWCs, the officers may have experienced low level assaults but decided reporting them was not worth the trouble. Finally, White argues that police departments that are professional, procedurally just, and transparent likely won't see a drop in citizen complaints or use of force by the officers because there does not need to be. Therefore, the absence of declines in complaints and use of force should be considered a sign of success instead of failure.

100. Willits, D. W. & Makin, D. A. (2017). **Show Me What Happened: Analyzing Use of Force through Analysis of Body-Worn Camera Footage.** *Journal of Research in Crime and Delinquency*, DOI: 10.1177/0022427817701257.

Type of Study: Empirical analysis of use of force incidents

Research Question(s): How can BWC footage be used as a data source for police research? How long do officers take when interacting with suspects before employing force? How long is force applied once it is employed?

Outcomes Measured: This study divides time into time to force and duration of force, as coded through examining police use of force instances captured on BWC footage. Police incident information was obtained through the same agency. Suspect resistance, suspect impairment (such as intoxication), and suspect demographics were gathered as independent variables.

Findings: Police were quicker to apply force to males and non-resisting suspects. Police were found to be slower to apply force to White suspects compared to Black suspects, though in this sample it was found that race may not be as strong a determining factor as gender and resistance.

Male suspects were found to have a greater risk of higher levels of force than female suspects. Police were found to be more likely to use higher levels of force in instances where the initial contact took longer or the time to force was longer in an interaction. Incidents with numerous BWC videos associated with them were more likely to have higher levels of force.

Suggested Future Research by Authors/Recommendations: The authors recommend further analysis of police use of force instances, using BWC footage as a data source to capture contextual predictors for police use of force.

101. Young, J. T., & Ready, J. T. (2016). A Longitudinal Analysis of the Relationship between Administrative Policy, Technological Preferences, and Body-Worn Camera Activation among Police Officers. *Policing*, 1-16.

Type of Study: Empirical analysis of field contact reports

Research Question(s): Is officers' activation of their BWCs affected by policy? Is officers' activation of their BWCs affected by their assignment?

Outcomes Measured: This study of police officers in a randomized controlled trial examines whether policy (mandatory versus discretionary) and assignment into the experimental group (voluntary versus compulsory) affects officer BWC activation. Data were gathered through officers' self-report (field contact forms).

Findings: Voluntary officers were significantly more likely to activate their BWCs (67.4%) than compulsory assigned officers (51.4%). For the volunteer group, the activation rate of BWCs during the mandatory policy was .71, which decreased by 13% when the policy was changed to discretionary activation. For the compulsory group, the activation rate during the mandatory policy was .66, which decreased by 43% when the policy was changed to discretionary.

Suggested Future Research by Authors/Recommendations: The authors recommend that law enforcement agencies adopt mandatory activation policies. The results also suggest that law enforcement supervisors use volunteer officers to assist with gaining other officers' buy-in.

102. Young, J. T. N. & Ready, J. T. (2015). Diffusion of Ideas and Technology: The Role of Networks in Influencing the Endorsement and Use of On-Officer Video Cameras. *Journal of Contemporary Criminal Justice*, 31(3), 243-261.

Type of Study: Survey/Interviews/Focus Groups

Research Question(s): What influence to law enforcement officers' peers have on officers' perceptions of BWCs?

Outcomes Measured: This study surveyed officers' perceptions of BWCs, as well as their use of BWCs, how they frame BWCs to other officers, and how often they share information about BWCs to other officers.

Findings: No support was found for the hypothesis that officers are more likely to see BWCs as legitimate as they increase their use of BWCs. A correlation was found between how an officer frames his/her camera with how other officers in the shared-incident network frame their BWCs. Limited support was found for hypotheses 3 (officers who share more incidents with other officers are likely to change their framing of cameras) and 4 (officers in densely shared incident networks are more likely to change their framing of cameras).

Suggested Future Research by Authors/Recommendations: Authors suggest that Law Enforcement Agencies (LEAs) considering BWC implementation should identify officers who are supportive of BWCs early on and use them to influence other officers. Authors also suggest that mandatory activation policies may speed acceptance, as more officers will share BWC incidents and thus change their frames.

Appendix B: Article Descriptive Statistics

The following section provides the descriptive statistics for the gap analysis of the 75 BWC articles that were identified according to the procedures described on page 8 of this report. Articles were coded by date published, author, research team type, primary study type, and primary research foci of each study. For those studies that were RCTs or non-randomized controlled trials, average study length was also recorded. These descriptive statistics are depicted in Table B-1 of this appendix and illustrated in Figure 5 on page 22 of this report. Table B-2 below illustrates the descriptive statistics of the studies that were identified as being RCTs or non-randomized controlled trials (reference information for these studies is presented in Tables 1 and 2 on pages 19-20 of this report).

Table B-1: Descriptive Statistics of Entire Sample of Articles (N=75)

Category	Freq. / \bar{x}
Date of Publication	-
2007-2014	12
2015	16
2016	21
2017	9
Forthcoming	17
Most Frequently Published Author	-
Ariel	9
Henstock	6
White, M.	5
Young	5
Todak	5
Choate	4
Katz	4
Sutherland	4
Lynch	4
Sakiyama	4
Drover	4
Research Team Type	-
Academic	43
Partnership	21
Agency	5
Master's Thesis	3
Consultant/Consulting Team	2
Practitioner	1
Primary Study Type	-
Randomized Controlled Trial	7
Secondary Randomized Controlled Trial	7
Non-Random Controlled Trial	5

Category	Freq. / \bar{x}
<i>Other Analytic Method</i>	11
<i>Survey/Focus Group/Interviews</i>	13
<i>Observational Study</i>	2
<i>Literature Review/Report</i>	15
<i>Commentary or Thought/Theory Piece</i>	10
<i>Law Review</i>	5
Primary Foci of Studies	-
<i>Use of Force</i>	22
<i>Citizen Complaints</i>	26
<i>Crime Rates</i>	4
<i>Assaults on Officers/Officer Injuries</i>	5
<i>Suspect Resistance</i>	3
<i>Arrests</i>	6
<i>Criminal Prosecution</i>	4
<i>Domestic Violence Case Processing</i>	5
<i>Officer BWC Activation</i>	8
<i>Officer Perception of BWC Devices</i>	16
<i>Citizen Perception of BWC Devices</i>	9
<i>Implementation and Implementation Process</i>	14
<i>Evidentiary Uses of BWCs</i>	6
<i>Officer Perceptions of Incidents (Recorded by BWC)</i>	6
<i>Citizen Perceptions of Incidents (Recorded by BWC)</i>	5
<i>Allowing BWC Review before Writing Reports</i>	3
<i>Privacy Concerns</i>	6
<i>Cost and Resources</i>	4
<i>Other</i>	17
Average Length of Study in Months (if Randomized or Non-Randomized Controlled Trial)	9.18
Replication	6

Table B-2: Descriptive Statistics of Randomized and Non-Randomized Controlled Trials of BWCs (N = 12)

Category	Freq. / \bar{x}
Average Study Length (in Months)	9.18
Country	-
<i>United States</i>	6
<i>United Kingdom</i>	5
<i>Multisite</i>	1
Primary Foci of Studies	-
<i>Use of Force</i>	6
<i>Citizen Complaints</i>	8
<i>Crime Rates</i>	1
<i>Assaults on Officers/Officer Injuries</i>	1
<i>Suspect Resistance</i>	1
<i>Arrests</i>	3
<i>Criminal Prosecution</i>	2
<i>Domestic Violence Case Processing</i>	2
<i>Officer Perceptions of BWC Devices</i>	3
<i>Citizen Perceptions of BWC Devices</i>	1
<i>Citizen Willingness to Report</i>	1
<i>Implementation and Implementation Process</i>	1
<i>BWC Efficacy in a Mental Health Setting</i>	1