TRULEO

CELEBRATING POLICE PROFESSIONALISM

Paterson Police Department Earns Huge Improvement in Professionalism

Paterson Police Department (PPD) used Truleo's Body-Worn Camera (BWC) analytics and observed the following improvements in professionalism in 2023 compared to 2022:

3x increase
in highly professional language

50% increase
in camera activations

57% increase
in officers introducing themselves

50% reduction
in unprofessional officer language

These improvements also correlated with a **58% increase in interactions containing expressions of community gratitude**, a strong indicator that the improvement in professionalism observed is felt by community members.

> "This data will help the Paterson Police Department achieve its goal of providing effective public safety services to the people of Paterson. Officers have been receptive to the technology and are rising to the challenge to further increase professionalism as they go about their duties protecting and serving the people of Paterson."
>
> **Isa M. Abbassi**
> OFFICER IN CHARGE
> PATERSON POLICE DEPARTMENT

Measuring Policy Impact in Paterson through BWC analytics

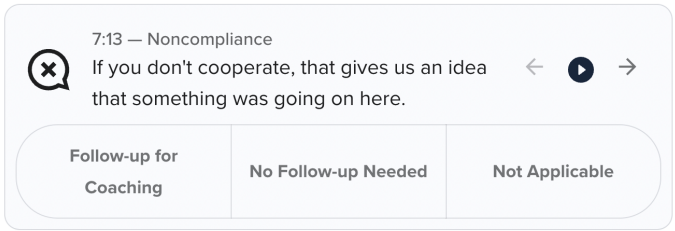
Automated BWC analytics offer a way for departments to examine all of their footage in order to identify positive interactions that bolster professionalism training and rectify unprofessional behavior, fulfilling the potential of BWCs.[1]

In September of 2023, the Paterson Police Department launched their Strategic Plan in an effort to rebuild public trust and improve recruitment and training of officers. PPD implemented Truleo's BWC analytics to study equivalent time frames before and after the implementation of their Strategic Plan. Table 1 summarizes the comparative results.

In addition to the improvements in professionalism, Truleo was also able to validate the use of a new initiative where officers are encouraged to provide contact cards to community members. Truleo's analytics automatically flagged language indicating compliance within the month the policy went into effect and confirmed this language was virtually absent in 2022.

Truleo Detects, Supervisor Confirms

Context matters when making a determination of how professional an officer acted. Truleo's interface provides supervisors with review queues that enable them to quickly validate determinations made by Truleo's models. All data in this study was validated by one or more supervisors using Truleo's user interface (example below).



How Truleo Analyzes Professional Language

Truleo scores each call on professionalism and provides the opportunity for supervisor review on the analysis. High professionalism is driven by officers explaining their actions before they take them,[2] a behavior that improves compliance and outcomes.

HIGH PROFESSIONALISM
An officer (1) uses at least 25 words of explanation before using force (including abstaining from force) and (2) refrains from using unprofessional language (directed profanity, insults, and threats)

STANDARD PROFESSIONALISM
All interactions that are not high professionalism or unprofessional

UNPROFESSIONAL
An officer uses directed profanity, insults, or threats in an interaction AND a supervisor confirms that the behavior is unprofessional

How Truleo Removes Bias

Patrol officers demonstrate a wide variety of professional behaviors, but not all are easily measurable. Truleo's analytics provides a way to measure professionalism objectively for several reasons.

LANGUAGE-ONLY: Focusing on language removes bias that can arise from tone, cadence, pitch, faces, emotions or other subjective measures.

TRAINABLE: Departments can identify language that leads to better outcomes and train their officers to utilize these communication tactics.

UNDERSTANDABLE: Community members are unambiguous that explanations are professional, as opposed to subjective characteristics like tone.

Table 1. Summary of metrics from BWC analysis demonstrating an improvement in professionalism

Instances of professional and unprofessional interactions flagged by Truleo's models and confirmed by human supervisors across videos over the two analyzed time periods. Each metric has units of "number of interactions" and percentage changes are based on the increase or decrease of the 2023 metric compared to the 2022 metric.

	Unprofessional Language	High Officer Professionalism	Officer Introductions	Community Gratitude
2022	101	35	4343	11384
2023	50	153	6850	18073
Percentage Change	-50.4%	+337%	+57.7%	+58.8%

Data Science Methods

Data Collection and Analysis

In this study, Truleo analyzed available BWC footage from two 3 month periods (October - December of 2022 and October - December of 2023) across all PPD patrol officers. Truleo's natural language processing models flagged critical events and labels relating to professionalism within BWC transcripts at a sentence and phrase level and calculated the total instances of each target label across each time period. There were no significant differences in the number of officers at PPD across the two time periods, enabling direct comparison of the flagged instances. Table 1 summarizes these results.

The data for this study were collected via an API provided by the department's evidence management system. Videos delivered via the API were fed through an audio extraction pipeline such that only the audio information of the video was retained in temporary memory for analysis. Audio was fed through machine-learned speech recognition models to obtain words and timestamps of valid speech in the audio file. Video files that contained only noise or silence were discarded during the audio analysis process.

BWC activations were measured by analyzing the total number of videos produced per officer, video duration per officer, and once-daily activations per officer of the BWC. All three of these metrics increased in the 2023 time period compared to 2022.

Many accuracy metrics are available for BWC analysis models, including precision, recall, f-beta, and conventional "accuracy". For this study, precision was chosen as the metric of accuracy to be optimized across all models. By nature, BWC videos will not capture all events as the quantity of video depends on an officer physically turning on their BWC. This puts an undetermined limit on recall, which is the ability of a model to correctly identify all events or labels that may have occured in all known interactions. Late activation and early termination of BWC video by the officer can exacerbate these issues. Knowing that all interactions may not be captured, precision (the number of true positives discounting false positives, ignoring false negatives) is the best metric as relative values can be compared with confidence.

Officer Identification and Accuracy

Subsequent analysis on the audio was conducted to diarize the audio into anonymous speakers, and a language-based model was used to identify which of the anonymous speakers was likely to be the officer wearing the camera. In testing, this model performed with an 85% level of precision. The marked segments were then further validated into an officer voice identification model through human validation and applied across the dataset to further improve officer identification accuracy to human levels.

The remaining speakers were aggregated into community member audio. The same approach was used across all analyses, enabling confident comparisons of relative differences acknowledging that absolute numbers may be affected by precision errors.

After officer / community member identification, the resulting text was analyzed via natural language processing (NLP) models that identified certain events and labels.

Natural Language Processing Events and Labels

NLP models were trained from data sets where humans tagged segments of transcribed text with relevant events and labels, with a target inter-annotator agreement level exceeding 90%. Events were output via an intent classification model taking a segment of text from 1 to 50 words from a single utterance of a single speaker and outputting a single label. Labels were output via either an intent classification model or a named entity recognition model that tags one or more words with a specific entity tag.

Events were defined as language that indicated an event occured in a BWC interaction, whether from the community member or the officer.

Labels were classified as professional or unprofessional language. Professional language was dissected into the use of explanation ("Just to make sure we're all safe, please don't reach into your pockets"), officer introductions ("Hi I'm Officer Joe from the Police Department"), offering of a business card with contact information ("Here's my business card with my badge number and phone number"), and other similar phrasing. Unprofessional language was dissected into the use of directed profanity ("f*** you" as opposed to "f*** that"), insults (racial slurs), and threats ("I'm going to kill you").

In testing, the NLP precision for all events and labels in the study was over 90%. All labels were then human-verified for accuracy and adjusted as deemed agreeable by humans with a target inter-annotator agreement level exceeding 90%. The professionalism level of a call was determined to be high if an officer provided more than 25 words of explanation (label) before an arrest or use of force (events) and also refrained from unprofessional language (labels). The professionalism level of a call was determined to be unprofessional if an officer used unprofessional language (labels) directed towards a community member.

Citations

1) **Lum, C. et al.**, "Body-worn cameras' effects on police officers and citizen behavior: A systematic review", Campbell Systematic Reviews 2020 (https://onlinelibrary.wiley.com/doi/10.1002/cl2.1112)

2) **Tyler, T.** "Legitimacy and Procedural Justice: A New Element of Police Leadership", 2014 (https://www.ojp.gov/ncjrs/virtual-library/abstracts/legitimacy-and-procedural-justice-new-element-police-leadership)