THE UNIVERSITY OF CHICAGO

Police Broadcast Communication: Analyzing how speech-emotion affects police communication

By

Syama Gopan

July 2022

A paper submitted in partial fulfillment of the requirements for the

Master of Arts degree in the

Master of Arts Program in the Social Sciences

Faculty Advisor: Christopher M Graziul, Ph.D.

Preceptor: Marshall Jean, Ph.D.

1. Abstract

Broadcast Police Communication (BPC) is sociologically significant because it provides a framework wherein power, social relationships, effective communication, cooperation, and interdependence can all be investigated simultaneously and in real time. The most prevalent type of BPC is one that involves a patrol unit and/or a police dispatcher making contact with a law enforcement officer (LEO). The average length of these dialogues is less than 2 seconds, yet they provide background for analyzing the interplay of power and dominance amongst the participants at the micro-, meso-, and macro-scales.

The idea of dominance differs across the social and computational sciences. Dominance in the social sciences is centered on interpersonal behaviors that are indicators of micro aggressions. They are typical of social hierarchies, and the attitudes/behaviors contribute to the stabilization and perpetuation of social hierarchies. On the other hand, dominance in Speech Emotion Recognition (SER) is defined as the nonverbal vocal characteristics that indicate one's sense of power or submission in conversations. Acoustic characteristics such as fundamental frequency (voice pitch), formant frequency (frequency peak in voice that results from an acoustic resonance of the human vocal tract), loudness, breeziness in voice, speech rate, vocal variability etc. play key roles in the perception and assessment of dominance in human conversations. The evaluation of dominance characteristics can explain how aspects of control/submission might direct the conversation and, as a result, guides the outcome of the dialogue. The study revealed that context and structure of the BPC affects how participants listen to and interpret BPC messages. The low overall reliability of the labels for dominance between the annotators highlighted the importance of familiarity with the radio codes in individual’s response to radio communication.

2. Introduction

Research on criminal justice is difficult due to the dearth of reliable information on police activities. There are multiple reasons for the same. First, most police organizations do not maintain a systematic record of pursuits (Wells and Falcone 1997). Moreover, information on activities such as police shootings or use-of-force is organizationally sensitive, controversial, and thus often kept out of public view. Available scholarship on policing often excludes the work of dispatchers as an area of focus, despite the fact they mediate communication between citizens and police officers by facilitating the link between emergency telephone (911) calls and the radio systems used to direct officer responses to these calls.

The channel of communication in a 911 call runs from the citizen to the dispatcher, and then to the police officer (or service provider). The flow of information varies by region and city. A call taker, for example, mediates between citizens and dispatchers in Chicago, which boasts the fastest among the US cities' 911 response time of 1.2 seconds (Chicago Police Department 2022). Dispatchers, on the other hand, serve as the first responders in a number of regions, including Marian County, West Virginia, and Kentucky. The dispatchers thus represent a vital part in the communication link between citizens and officers. They collect information from the citizens, liaise between the citizens and law enforcement officers (LEOs), and provide adequate information and direction to LEOs to assist them in handling the emergency while ensuring LEOs' and citizens' safety. Therefore, dispatchers can influence police behavior, perceptions of police, cooperation with police, and the quality and quantity of criminological data (Simpson 2020).

Broadcast police communications involve three key actors: Citizens, dispatchers, and LEOs. Citizens can call 911 to seek emergency services or to report any threats or violent incidents. The 911 call takers/dispatchers typically begin by asking "What is your emergency?" (Or "Where is your emergency?")

(Yandell 2010) . Subsequent questions are intended to triage the emergency, identify suitable services, and offer information to responders (Police/Medical/Fire services) so they can respond (Neusteter, et al. 2019). The dispatchers then enter a series of priority and descriptive codes in their Computer Aided Dispatch (CAD) systems that tell the responders what response is desired (Lee, Lee and Hoover 2017).

3. Literature review

Scholarship on dispatcher calls highlights the complexity and difficulty of this job: A dispatcher must not only absorb the information provided by the citizen, but they must also analyze, evaluate, and assess the severity of the situation (Antunes and Scott 1981; Ekblom and Heal 1982). Literature reveals the unique aspects of the calls that make the dispatcher's job so vital: The calls are ambiguous, infrequent, incoherent, unconfirmed, suspicious, and chronologically disoriented (Antunes and Scott 1981; Ekblom and Heal 1982; Tracy and K 1998; Vaughan and Brantingham 2016). Due to the high volume of calls, dispatchers must often handle multiple calls simultaneously and rapidly (Simpson 2020). The pieces of literature reveal the unique aspects of the calls that make the dispatcher's job so vital.

Dispatchers split their time between answering calls from the citizens and dispatching calls to the LEOS, while also ensuring that there is enough time to assist the LEOs who is already in service. Therefore, the dispatchers condense and summarize the information that flows through radio communication. This requires a great deal of multitasking and interpretation work (Simpson, 2021). Furthermore, as emergency calls are made in times of stress, and the conversations are emotionally charged showing signs of distress, fear, and anxiety, the dispatchers must be cognizant of the callers' emotional state and sensitivity (Smith, Holmes and Burkle 2019)

Judgement by dispatchers: Effect and repercussions

Figure 1: The process of calling the police (Simpson, 2020). The process begins the moment a citizen decides whether an activity warrants assistance from the law enforcement agencies or not.

The fundamental understanding of dispatchers' responsibilities has opened up research into the importance of dispatchers' judgment of calls, how they influence LEOs' assessment of the situation, and, most critically, their impact on callers. A vast array of literature examining the sensitive and complicated character of the dispatchers working in police broadcast communication is now available in the fields of Sociology, Psychology, Criminology, and Cognitive Sciences.

There is evidence suggesting that the ease by which police-dispatcher communication can be compromised leads to adverse and unintentional consequences for the citizens (Vargas, Preito-Hodge and Christofferson 2019) such as placing racial minorities at a greater risk of having their identities disclosed. Research suggests Black and Latino's communities face greater vulnerability vis-à-vis dispatchers revealing their identity compared to non-Hispanic white communities (Vargas, Preito-Hodge and Christofferson 2019): “Approximately one of every ten calls made to police in zones serving racial minorities disclosed identifiable information about the caller—12 percent for blacks (44 of 371 calls), 8 percent for Latinos (11 of 148)”.

In the primarily non-Hispanic white dispatch zone, however, not a single call revealed personal information. Furthermore, research suggests minority adolescents are hesitant to call 911 in an emergency because of the harassment they experienced on past calls. (Taylor 2020). There is evidence to suggest that digital vulnerability with respect to 911 calls is a serious concern for people of color, by the intentional/unintentional disclosing of their identity over the broadcast communication. This undesired activity puts many members of the community at contact with the criminal justice system, thus exacerbating the issue of discriminatory policing towards the black community (Vargas, Preito-Hodge and Christofferson, 2019).This is problematic because it jeopardizes citizens' trust in law enforcement, especially given the diverse socio-ethnic context of the US. Police communication plays a critical role in law enforcement.

Effective communication is the pathway to building trust with the citizens, creating an environment of mutual respect between the law enforcement professionals and citizens, and most importantly effectively tackling a crisis situation. A key element in effective police communication is the ability to communicate to people from diverse backgrounds. In the case of US, this aspect is more so important now than ever. The

2020 US census data estimated that two people chosen at random will have a 61.1% chance of belonging to different ethnic and racial minority groups. The Diversity Index shows an increase in the population of racial and ethnic minorities in comparison to the 2010 DI of 54.9%. The census data points to not only the increment in the presence of minority groups (who constitutes the majority now) but also the need for the social-political-economic institutions to respond to this changing trend. Recent awareness in an affective and humane police communication has triggered the law enforcement agencies across the country to initiate programs targeted at bringing an attitudinal change while communicating with the citizens, at an institutional level. For instance, Minnesota has initiated an in-depth crisis prevention training for their police officers, by emphasizing on empathy and active listening to de-escalate (a police technique stressing on non-usage of force to contain a situation) a crisis situation. Similarly, the Chicago Police department has also updated their de-escalation protocols. In addition, some departments are incentivizing their officers for their ability to communicate with diverse groups. A San Diego police employee receives an additional 3.5% for his/her bilingual ability, whereas it is up to a 5% pay hike for an officer in Salem, Oregon. These initiatives exemplify a commitment of US police departments towards an active, empathetic, humane, pragmatic, effective, and tolerant communication towards their diverse citizen groups.

While these endeavors from the law enforcement agencies are certainly assuring, it is still puzzling to fully grasp the complexity of activities that take place in the radio communication. How do dispatchers identify the citizens, if no facial cue is involved in the calls? We have a vast array of literature pointing to the role of lexicon and prosody in a speech that gives a listener cues about the speaker. They can be emotion, special dialects, voice modulation, vocal characteristics such as intonation, pitch or intensity, or situational contexts. In the last few years, there has been a growing interest in the study of Speech Emotion Recognition (SER), where scholars of diverse disciples explore how emotion affects listener's judgment of a

particular conversation, and consequently the reliability and repercussions of such judgments (Cowie and Cornelius 2003; Akçaya and Oğuz 2020; Rellecke, et al. 2011).

Dominance

The idea of dominance differs across the Social and Computational Sciences. Dominance in the Social Sciences is centered on interpersonal behaviors. They are typical of social hierarchies, and the attitudes/behaviors contribute to the stabilization and perpetuation of social hierarchies. A functional theorization was proposed by Psychology researchers Jim Sidanius, Erik Devereux, and Felicia Pratto in 1992- *Social Dominance Theory* (SDT). SDT studies the intergroup relations, and how group-based hierarchies are perpetuated. According to SDT, group-based inequalities are maintained through three mechanisms: Institutional Discrimination Aggregated individual discrimination, and behavioral asymmetry (Pratto, Sidanius and Levin 2006). Institutional discrimination results from the presence of policies and practices within institutions that leads to the gradual and systematic oppression of subordinate groups. The systematic oppression rises from denial of resources and opportunities of the subordinate groups. As a result they gain fewer life chances- social and economic prosperity, as the privileged groups. Moreover, prevalent cultural ideologies give intellectual and moral justification for the intergroup discriminatory behaviors intergroup. The aggregated individual discrimination stems from the small, often subtle gestures and actions of one individual against the other. The SDT categorize the often overlooked everyday insults as intrusive micro aggressions. The aggregated individual discrimination and the institutional discriminations are mutually feeding. Lastly, the dominance of one group over the other is produced and perpetuated by the behaviors of the respective members, coined ‘behavioral asymmetry’. The behavior can reflect in the asymmetrical in-group biases, ideological asymmetry, or self-debilitating behaviors of the

members. Here, power of one group manifests through dominance over the other (subtle actions or strategies).

SDT is pivotal in informing us of the linkage between systematic aggression of certain groups/individuals over the others and how they manifest in micro everyday practices.

This understanding becomes even more pronounced when they are read in the context of culture formation and the reinforcement of social structure. Latane (1996) suggests that social structures are formed from the differential ability of individuals/groups to influence each other. The micro everyday practices, as mentioned above, give rise to local patterns of consensus about practices, meanings for interactions, attitudes, and values. If this ideation of dominance is right, then we can deduct that social dominance has the ability to influence the norms and behaviors in a social setting, considering the fact that individuals differ, and the society is a "self-organizing complex system composed of interacting individuals". This is significantly vital to this project since it makes us take into account how dominant traits influence the norms and patterns of communication in BPC. Though, dominance manifests inmultiple ways ina social setting, the scope of this project looks at dominance only in the purview of relational communication.

Dominance in Communication and Speech

Dominance is a complex concept with very little consensus in its conceptualisation (Bernstein 1981). Most scholarship acknowledge the conceptual confusion and operational problems in studying dominance (Bernstein 1981; Burgoon, Johnson and Koch 1998). Part of the reason has been its close proximity and overlap with related topics such as authority, power, control, offense/defense, and competition. While some scholars claim the dominance to pervade all communication (Maxim 1978), others suggest that

dominance is only one of the many aspects that determine the total relationships between individuals (Chalmers and Rowell 1971). In the biological sciences,dominance has been defined as the control of one animal over the other, and that dominance is characteristic of alpha animals-a desired trait (Kaplan 1976).

In the context of interpersonal relationships, Burgoon classfies dominancen-submission as one of the tweleve fundamental parameters on which people define and understand their interpersonal realtionships (Burgoon, Johnson and Koch 1998). Burgoon's argument is pillared on the undersatnding that dominance is a relational and interactional phenomenon. It is also built on the axiomatic that the interplay of dominance requisites two or more players; dominance can "only be declared in relation to the response of another" (Burgoon, Johnson and Koch 1998: 65). On the lines of Burgoon's arguments, dominance can be equated with a sense of importance and control in communication (Thayer 1967; Mehrabian 1996).

In face-to-face personal interactions, such as those with friends, salespeople, etc., the dominant person typically comes across as the "stronger." He has the power to persuade people, win their compliance right away, and, if necessary, exert control over them. Such people are frequently described by others as "forceful," "masterful," "strong," "confident," "authoritative," and "sure of himself", and associated with feelings of safety, security, personal tightness, and self-confidence (Cheng, et al. 2016). The dominant personality would seem to move forward in a realistic, task-oriented manner and exhibits feelings of sufficiency in handling any challenges that may arise (if these readings point dominance to a dutiful sense of morality, the dominance canbe seen as a desirable attribute in police radio communication). On the other hand, people with low dominance are submissive. They find it hard to assert themselves in conversations, and tend to be easily influenced by others .

While this binary classification of domianance as strong and confident, and submission as a sign of weakness appears reductionist in nature, there is evidence to suggest otherwise. In the paper, " A personality scale for dominance", the authors try to identify the dominant traits that are subtle. They acknowledge that while some of the associated traits of dominance such as confidence and assertiveness are immediately obvious. Or in other words, they deal explicitly with "matters of superordination, control, strength, and ascendancy" (Gough, McClosky and Meehl 1951: 362). However, they also suggest that some traits of dominance are subtle and even contradictory. For example, if a person talks about something wherein he/she acted cowardly, it might not be a sign of weakness,on the other hand, therefore appears more unabated and free to act in a straightforward manner. By admitting the weaknesshe eludes confidence, posie, and self-assurance (Gough, McClosky and Meehl 1951). Instead, the person conveys a message of resolve and devout optimism. Gough'swork was insightful,for it called to a close scrutiny our normative understanding of dominance.

Dominance in Voice & Relational style of interaction in radio communication

Non-verbal features can change or convey meaning to interpersonal relationships. Humans have the ability to emote and send/receive relational messages through body language, facial expressions, gestures, and even hair colour. Dominance, therefore, can exert in multiple ways in the realm of communication. The special interest to us is how dominance manifests in communication through vocal cues. Vocal cues are the non-verbal feature of a speech. Dominance can reflect in the vocal cues through perceptual attributes such as loudness or pitch, or contextual variables such as topic or gender of the speaker (Tusing and Dillard 2000). In other words, a speaker whose vocal cues exhibit dominance in one scenario may not do so in another context.

Literature on dominance informs us of the vocal attributes that constitute dominance, how they can be measured, and the irregularities that happen during the process. A key element in determining vocal dominance is gender. Studies from biological sciences and computational sciences suggest that men's voice may have evolved as dominance signal (Puts, et al. 2007) (Immelmann 1975) .The difference in physical features(longer vocal tracts and vocal folds in men) cause men to have lower fundamental frequency and closer spacing of formant frequencies(amplitude peaks in speech spectrum) than women (Titze, 2000). On the other hand, submission is characterised by higher frequency (Ohala, 1982) . These information offer context and pointers for approaching dominance in BPC. Do women and male speakers communicate differently in BPC? Does gender or professional status influence the outcome of the radio communication differently?

Arvind Karunakaran's recent work based on his 24 months of observations of the 911 dispatch process is pivotal in identifying the significance of status dynamics and relational dominance in broadcast communications. Karunakaran's work claims that dispatchers have high functional authority in 911 emergency coordination, yet have low professional status in comparison to sworn police officers. Further, the problem of low status is exacerbated with the interplay of nominal characteristics of gender and race. The study also revealed high frequency of non-compliance of the police officers to the service requests raised by the dispatchers (Karunakaran 2022). The non-compliance, coupled with the failure of POs to comply with the radio discipline (such as abrupt cutting off of the dispatcher call, frequent interruptions of the dispatcher), stressful environment, and the low professional status puts the dispatcher in a mentally and emotionally challenging state.

This raises relevant research questions. To what extend does the social dynamics of status and authority affect the compliance, and subsequently the efficacy of Emergency Management Organizations such as

911? How does status and authority influence the professional and personal wellbeing of the dispatchers? What are its repercussions on the service seekers (citizens)?

Research Question

In this context, my research will narrow down on how emotion affects the judgment of the dispatcher that might be consequential in an adverse impact on the minority youth. Linguistics and Psychology inform that the listener comprehends a speech both from lexicon and prosody. Here, the lexicon denotes the words and language of the speech. Prosody points to the emotion in the speech (happy, sad, stressed, annoyed, etc.). The thesis will explore the following question:

- **Does dominance express itself differently in BPC than other contexts where dominance has been studied before?**

4. Data Source and methods

The primary source of data is the Chicago Police Broadcasts, of approximately 165000 audio files (each about 30 minutes length) recording communications between dispatchers and LEOs between 8/1/2018 and 7/31/2019. For the analysis, a sample of two audio recordings, from the Zone 1, between 1/7/19-1/13/19 was chosen.

The key variables of the study are the labels produced by annotating the audio files for attributes typically considered to be dominant or submissive. Labels generated by two annotators have been used in this study. To enable the external annotators to label the audio files successfully, a protocol document is designed (refer to appendix A1.). This document describes how to annotate markers of dominance in police broadcast communications for the qualitative coding purposes. In addition to the general guidelines

to be followed in the process of annotation, the protocol also lays out 23 codes that aid the annotator in identifying the attributes associated with dominance/submission in the radio communication.

Scale development

The objective of scale development and qualitative coding is to measure systemic aspects of BPC from the individual behavior of the speakers in the radio communication. Therefore, the method of analysis is concerned with form and structure of communication, as well as the referent (dominance). While choosing the codes, focus has been given on the observable ongoing aspects of interpersonal communication (how dispatchers/LEOs speak and act in the radio communication), rather than on internal consequences (what dispatchers/LEOs might be thinking).

The 23 codes (represented by three letters), used for the qualitative coding, are developed from two main literature sources. In the first source [1], "The Nature and measurement of interpersonal dominance", the authors employ 56 attribute-based and 32 behaviors-based items to detect characteristics associated with dominance. The attribute checklist assesses dominance through the use of impressionistic qualities. They are suitable for global assessments of identifying dominant traits in a social encounter. For instance, being authoritative or assertive, are attributes generally associated with dominance. They are an assessment of how a dominant person *is*. On the other hand, behavior based traits are an assessment of how a dominant persons *does*. For example, a dominant person stops and thinks what to say when posed with a question (Burgoon, Johnson and Koch 1998). In the second source [2], a 60 item scale is employed to study political behavior and political leaderships. The authors developed the scale to understand how certain people reach leadership position and influence people (Gough, McClosky and Meehl 1951). These two sources form the bedrock of the qualitative coding employed in this study.

Moreover, they study also borrows its underlying guiding principles from the two sources mentioned above. The principles are:

- Dominance does not mean domineering. Though both concepts may overlap at times, their meaning and implications have to be kept distinct. For example, a leader may show dominant traits (such as confidence, assertiveness) without being domineering (bossy).
- While generating labels, the annotators must stick to the definitions laid out in the annotation protocol, and limit their subjective judgments of the radio communication (for details, refer to the annotation procedure in Appendix A1.)
- Professional roles and their functionality (such as an LEO) should not be read synonymous with dominance. While developing the protocol, attention was given to delineate into positions of prestige/authority with the personal traits of dominance.

Table 1: A 23 item scale developed to identify the attribute based and behavior based dominance relevant to radio communication.

Feature	Literature Source *	Code	Type of coding instrument	Purpose/meaning of the code
Argumentative	[1]	ARG	Attribute-based	The speaker expresses divergent or opposing views. Does the dispatcher and LEO agree?
Assertive	[1][3]	ASR	Attribute-based	Sounds decisive, positive and insistent.
Aggressive	[1]	AGV	Attribute-based	Shows signs of uncooperation, sounds confrontational and hostile in conversations. Look for signs of quarrel or disagreements
Authoritative	[1][2]	ATT	Attribute-based	Speakers sounds assured. The speaker confirms the information he/she passes being factual and accurate
Confident	[1][2]	CNF	Attribute-based	Speaker is calm, composed and self-assured
Responsive	[1]	RSP	Attribute-based	Responds calmly and positively to a question posed. Shows readiness to provide more information
Energetic	[1][2]	ENR	Attribute-based	Speaker shows great deal of zeal and enthusiasm in the conversation. Ask onself if the speaker is lively and fully engaged in the conversation, and his mind on the task and job.
Forceful	[1]	FRC	Attribute-based	Besides being self-assured, does the speaker sound pushy/bossy?
Loud	[1]	LOD	Attribute-based	Strongly audible. Show signs of exceptional volume or intensity
Expressive	[1]	EXP	Attribute-based	
Cautious	[1]	CAU	Attribute-based	The speaker is attentive and careful. Does the speaker asks for additional information? Does the speaker confirms/checks the message he/she receives?
Hesitant	[1]	HST	Attribute-based	The speaker is uncertain and reluctant. He/she stalls the conversations. He/she sounds diffident
Timid	[1]	TMD	Attribute-based	The speaker is nervous and reticent. He/she sounds modest and diffident.
Mild	[1]	MLD	Attribute-based	The speaker talks in a gentle tone. The voice is light and feeble. The speaker soounds calm.
Passive	[1]	PSV	Attribute-based	the speaker is compliant and unassertive. He/she is docile and shows lack of interest in the conversation.
Quiet	[1]	QIT	Attribute-based	The speaker is inaudible or indistinct. He/she talks in muffled and faint voice, during any part of the conversation. The trail end of the conversation fades off
The person does more talking than listening	[1][2]	TLK	Behaviour-based	
The person stops to think what to say in conversat	[1][2]	STP	Behaviour-based	The speaker assertively asks for time before responding
The person is relaxed and at ease in conversation:	[1]	RLX	Behaviour-based	
The person is nervous in conversations	[1]	NRV	Behaviour-based	
The person is task oriented in conversations	[1]	TSK	Behaviour-based	The speaker gives clear instructions/information in a tone that is audible and comprehensible
The person shows poise in conversations	[1]	PSE	Behaviour-based	
The person acts impatient during conversations	[1]	IMP	Behaviour-based	The speaker shows impatience while talking. Or the speaker talks fast and is not comprehensible

5. Results and Discussions

The warrior mentality and aggressive policing

The research question of the study is based on the hypothesis that the communication between the dispatcher and LEOs shows traits such as aggression, invasion, and assertion. This hypothesis was framed by the existing literature on policing, as well as the general masculinized image of the crime-fighting officer.

This image can be attributed to the change in the demeanor and organizational socialization of cadets as they get trained in police academies. Maanen and Schein (1977) define organizational socialization as the process by which an individual acquires the social knowledge and skills necessary to assume an organizational role. (Van Maanen and Schein 1977: 211). Policing scholars have found evidence on how the organizational structure of the police, and the academy training of the police expects the cadets to internalize a tough demeanor (Manning 1977; Ray 2019). Research suggests that the cadets' attitudes change as they go through the training (Oberfield 2012). Simon suggests that the training academies "encourage officers to master the use of violence in an unpredictable and dangerous world" (Simon 2021: 5). The training cadets receive in academies changes how they perceive discretion and fairness (Moskos 2009). As a result, officers "learn to treat every situation as a deadly force encounter in the making" (Stoughton 2014: 228).

The perception of police as tough, armed, and aggressive can be compared to the perception of police as warriors. Simon describes the "warrior police" as an amalgamation of two opposite roles: *community protector* and *aggressive criminal-fighter* (Simon 2021: 1). Simon points out that warrior mentality is not just performative, but rather, was a process that cadets and officers highly valued and internalized. The

latter part emphasizes the authority of police to initiate violence if needed, in order to stop crime. This conceptualization is widely followed by the police academies, to encourage the cadets to think of violence as a moral necessity (Hopper 1977). Scholarship on policing also flags the problems associated with warrior policing. The concept of warrior policing shows a commitment to masculinized performances rooted in heterosexuality, white supremacy, and patriarchal structures (Carlson 2019; Shapira and Simon 2018; Young 2003).

The perception of the aggressive police is shared by the public as well as the force themselves (Brunson 2007). In a survey conducted by the Pew Research Center, one-in-five police officers reported that they felt frequently frustrated and angry (Morin, et al. 2017). Moreover, these officers admitted to becoming more callous towards people since taking the job. They were also found more likely to resort to aggressive tactics while dealing with emergency situations (Morin, et al. 2017).

Expected Results

The inter-annotator reliability gives insights into the level of agreement between the two annotators. It can be done by calculating the Cohen Kappa Coefficients for the different parameters of the label. As the labels contain three parameters- gender, role of the speaker, and dominance attributes- inter-annotator reliability was calculated all of them. I expected Kappa scores for the gender to be the highest, and role to be the lowest. I also expected the Kappa scores for the labels to fall in between that of gender and role. The results confirmed these hypotheses.

The inter-annotator reliability is highest for gender, with a Cohen Kappa coefficient of 0.952, and least for role of the speaker vis-à-vis Dispatcher or LEO, with a Cohen Kappa coefficient of 0.189.

Table 2: Cohen's Kappa denotes inter-annotator reliability for gender and role of the speaker

Parameter	Kappa Coefficient
Gender	0.952
Role	0.189

The low reliability for the role of the speaker could be attributed to the annotators' differing levels of radio communication annotation experience. One annotator had high familiarity transcribing radio communication, while the other had no experience. A lack of familiarity could make understanding the structure/content of BPC audio difficult. The difficulty can result in the comprehension of messages, as well as the transcription and annotation of labels of those messages. This is because of the nature of the form of radio communication. The messages in radio communication are short and precise. They contain emotionally disturbing content. Moreover, police communication uses languages that is more task oriented, and is a subset of the English language but different from the conversational English. They use specific radio codes. These radio codes convey domain specific meaning. For instance, consider the following conversation between the dispatcher (DP) and the police officer (PO):

DP: 1042, are you 10-8 for DIST-1 at [address]?

PO: 234, dispatch, yes I'm 10-8.

Here, DP and PO address each other using their call signs. Call signs can be unique combination of letters and numbers that represents a particular operator, officer, station or vehicle in communication. Such call signs are domain specific, and make little sense to an annotator with no experience in radio

communication. Moreover, in the above example, the dispatcher is inquiring if the PO is available for service at the given location, to which the latter replies in affirmative. 10-8 denotes that the PO is available for service/assignment. Similarly, other codes such as 10-9(request to repeat last conversation), 10-12(informing the LEO that visitors are present), 10-15 (passing information to the dispatcher that the prisoner in custody), 10-20 (asking for location), and 10-23 (asking to stand by), though highly functional in emergency scenarios due to their brevity, create confusion and ambiguity for annotators. A thorough understanding of these radio codes can make the annotation much easier and accurate. However, since one of the annotators had no experience with the radio communication, there may be incoherence in the categorization of professionals by the annotators.

This however, emphasizes the role of human experience and significance of context. Given the lack of reliability between the annotators in understanding the radio communication, it is worth exploring how reliably the LEOs and dispatchers react to and share vital information under stressful conditions. This highlights the significance of reactive coping mechanism of the speakers in response to stress. This can be understood better under the light of Spencer's Phenomenological Variant of Ecological Systems Theory (PVEST). PVEST gives a framework to understand the perceptual processes that happens when you take in information that allows one to make sense of one's context/ecology. In other words, how one reacts to stress depends on one's level of vulnerability. The vulnerability is determined by the net balance or imbalance between the supports/privileges and risks/challenges. Contextualizing PVEST in BPC, the ability of the participants in the radio communication to reliably share vital information is important because if the dispatchers or LEOs do not understand what is being said then it could endanger the lives of citizens. The ways in which officers and dispatchers describe incidents may affect the quality of police encounters with citizens, especially the vulnerable and minority groups.

The ability of the dispatchers/LEOs to accurately understand messages should be further investigated. The identification of linguistic patterns in the BPC is a unique opportunity and a novel approach to give insights into reflexive decision-making by institutional actors experiencing acute stress, and how language shapes in-the-moment decision making processes in the instance of high uncertainty.

Unexpected Results

To examine the similarity and differences in the labels used by two annotators, Cohen's kappa scores were calculated. Out of the 23 labels, three labels were not used by either of the annotators (Table 3). The labels "Aggressive", "Argumentative", and "does more talking than listening" are the attributes associated with dominance (Gough, McClosky and Meehl 1951; Burgoon, Johnson and Koch 1998). By allowing the other person in the conversation less time and space to speak, these attributes indicate signs of an aggressive conversational style.

Table 3: Dominance labels not used by either annotator

Labels not used by either of the annotators
Argumentative
Aggressive
The person does more talking than listening

The absence of these labels in the preliminary analysis suggests that both the dispatcher and LEO contribute to utterances in BPC. A detailed examination is warranted to understand the extent and limit of

their contributions. Nevetheless, it can be argued that both the dispatcher and LEO listen to the other participant, and engage in a non-argumentative manner of conversation.

A comparison of labels used by both the annotators show a low overall reliability of dominance labels. The Cohen's kappa scores vary between -0.0591 and 0.343 (Figure 2). Only kappa scores above 0.4 are considered to be even moderately acceptable.

The low reliability could be attributed to multiple reasons. As described in the previous section, there is a need for familiarity with the radio codes for the annotator to understand the radio communications. This is vital to decide if an utterance displays the traits associated with dominance or not. As is the case, one annotator had high familiarity transcribing radio communication, while the other had no experience. This difference could have led to the lack of similarity in the codes used for labeling per utterance, and therefore in the low overall Cohen's Kappa scores.

Figure 2: Cohen's Kappa (κ) scores denoting inter-annotator reliability for different labels

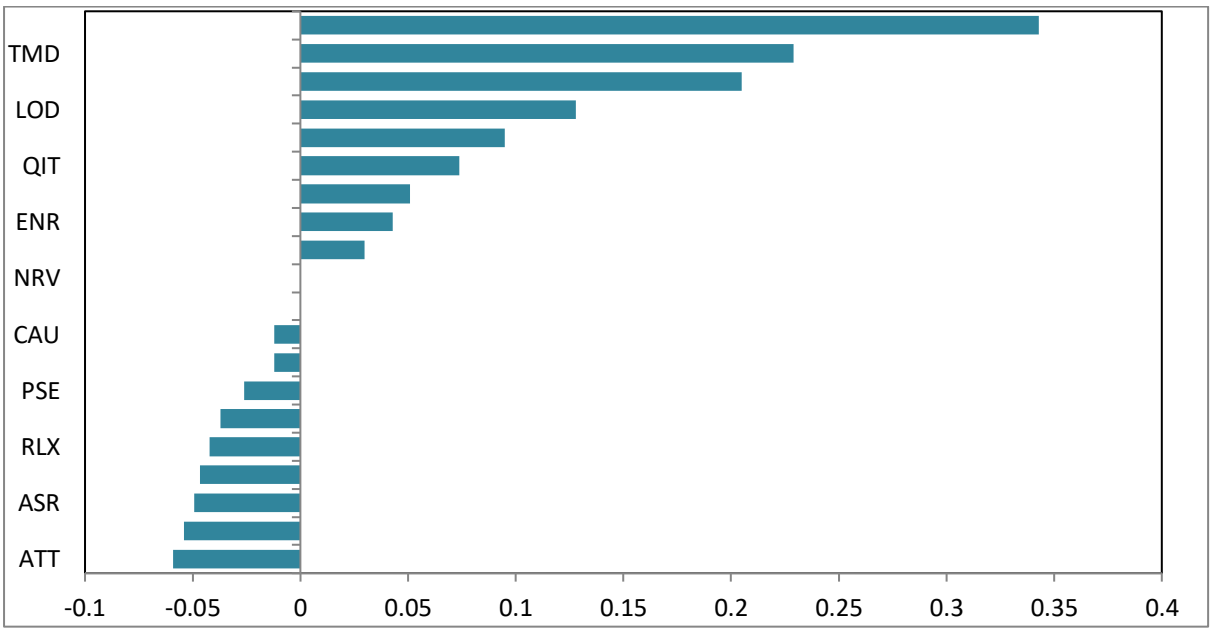


Figure 3: Comparison of different labels used by both annotators

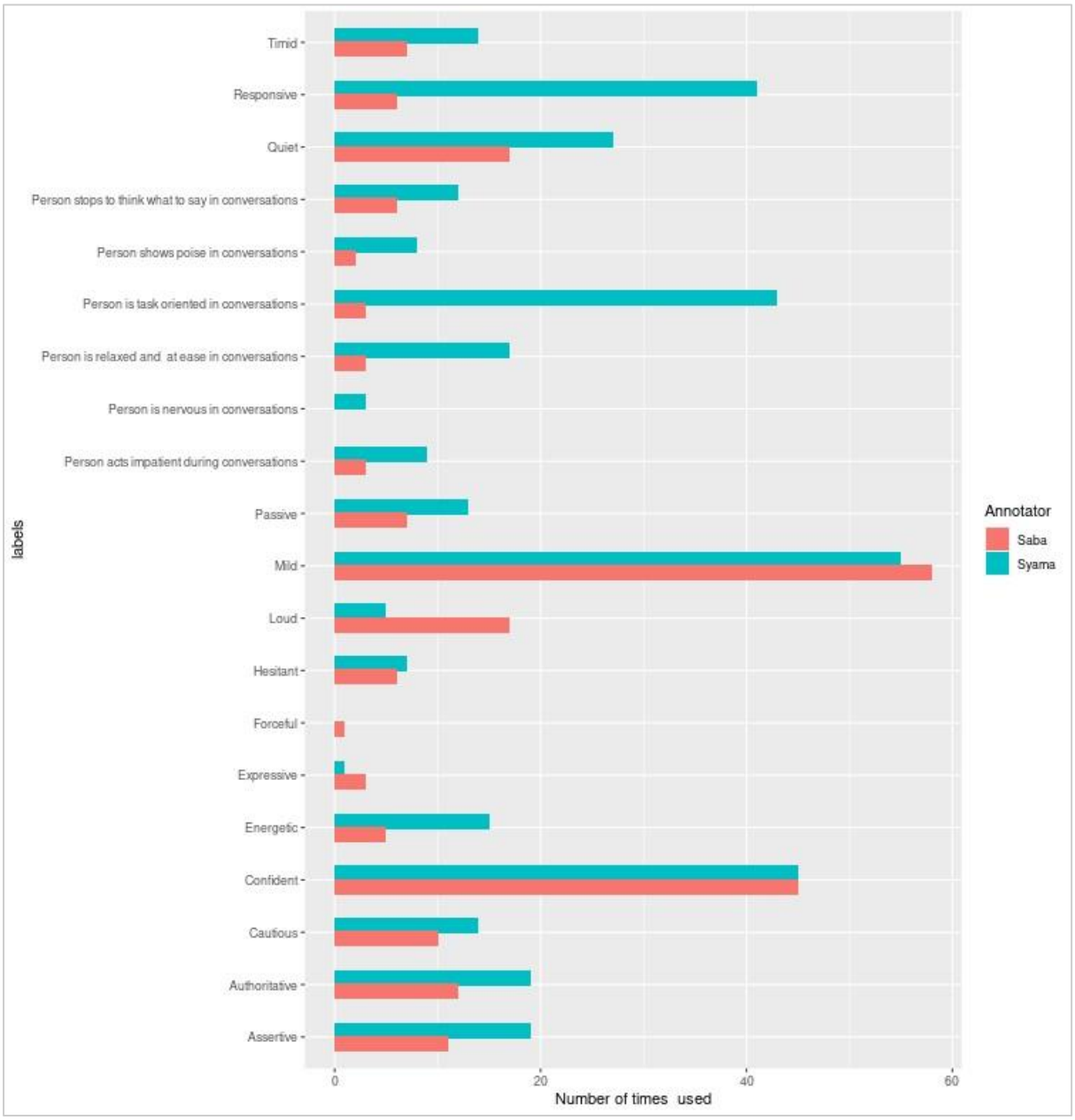
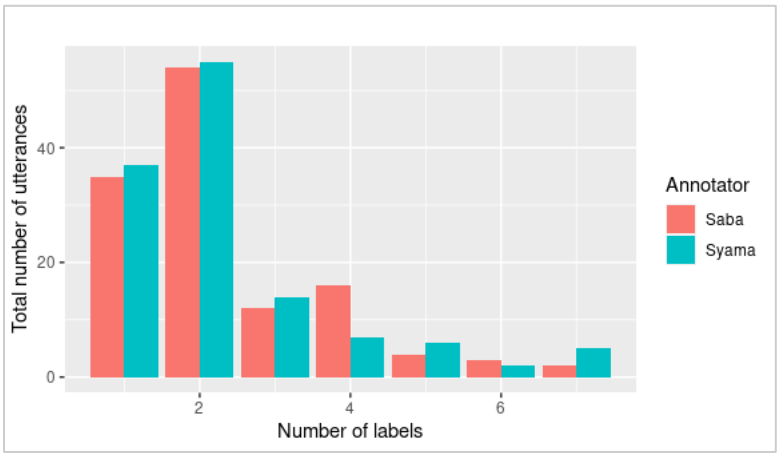


Figure 4: The number of labels used by an annotator per utterance



Moreover, the dominance labels used for annotation were adopted from sources that had very low overlap with police activity and response. As a result, even though the traits used for annotation expressed dominance, the dominance in BPC could be unique and different. They might not be characteristic of the contexts where dominance has been studied before. Dominance has been studied in a variety of contexts, from ecological perspectives on the dominance traits of alpha animals to political science on the leadership traits of State leaders. However, there are no instances where dominance in BPC has been studied in the past. Hence, the low reliability of labels between the annotators point to the unique opportunity to understand dominance in the context of BPC.

There was a high prevalence of “Confident” and “Mild” attributes. This is unique to BPC. The “Confident” is a trait that is positively associated with dominance, whereas “Mild” is negatively associated. A comparison of the labels used by the annotators show a high preference among both the annotators to use “Confident” and “Mild” frequently. Moreover, there is also a tendency to use them together. This suggests that even as the speaker (LEO/Dispatcher) is self-assured and composed, he/she talks in a gentle tone and is calm. This runs counter to how people typically perceive emergency and police communications, which

are meant to be filled with urgency, aggression, and invasion. On the contrary, this study finds no pattern of urgency in paralinguistic content. The high prevalence of mild demeanor in BPC, despite the fact that it is a stressful environment, warrants further investigation, according to this preliminary analysis.

6. Broader Implications and Directions for Future Research

An understanding on how dominance unfolds in BPC opens many possibilities for future research. As dominance in BPC takes place in ways different from other contexts where it had been studies before, it is of interest to examine what parameters affect dominance and how they manifest. For instance, does gender of the speaker affect the way a message is conveyed in BPC? If the dispatcher is a female and the LEO a male, does the interaction unfold differently than a case where both dispatcher and LEO belong to the same sex? Moreover, further investigation is also warranted to understand how dominance traits vary across the LEOs and dispatchers. A comparison of dominance traits displayed between the LEO and the dispatcher is possible from the available data. The study has broader applications as it gives unique opportunities to understand power imbalances and interactional practices. It can be examined if dominance cause or contribute to status-authority asymmetry between the LEOs and the dispatchers. Lastly, but prominently, an understanding of BPC can throw light on how ways of police communication impacts encounters involving vulnerable groups such as male youth of color (MYoC). This study shows the capacity to record how law enforcement officers/dispatchers act or respond to service calls. This is real-time data and hence rich in potential.

7. Appendices

A1. Dominance Analysis in BPC- Protocol Document for Annotation Process

Scope:

This document describes how to annotate markers of dominance in police broadcast communications for the qualitative coding purposes.

Purpose: Ideally, this document will…
(a) Describe the optimal workflow

(b) Include a list of case-specific issues and how to handle them

Terms:

Utterance	A discrete series of words uttered by the same speaker
Speaker diarization	Task of determining "who spoke when?" in an audio recording that contains an unknown amount of speech and/or number of speakers
Audio segmentation	Task of determining when speech begins and ends
LEO	Law enforcement officer (also colloquially includes dispatchers)

Annotation strategy:

Our ability to accurately annotate recordings is unknown. In the context of noisy, compressed audio recordings, accuracy is about more than just consistency (i.e., annotations by different people yielding the same results). The ambiguity around what sounds as how to interpret what you are hearing may represent real ambiguity in how policing professionals interpret the emotion conveyed in the communication.

For example, you may notice that certain utterances show strong signs of dominance such as "confidence" or "assertiveness" while other may be less apparent. In the less apparent case (or in doubt), it is always

advisable to annotate even if there is only a slight trace of a particular trait. Believe in your judgment, and label it. When multiple annotators work on the same audio, the multiple interpretations that are generated will create a repository of rich human-generated data.

This strategy helps to better train an automatic speech recognition model by providing plausible alternative interpretations of the same utterance. Using only one annotation assumes there is only one possible interpretation of the audio, and that assumption is often untenable given the nature of our data, particularly while studying a trait such as dominance which is subjective and inter personal.

Annotation process:

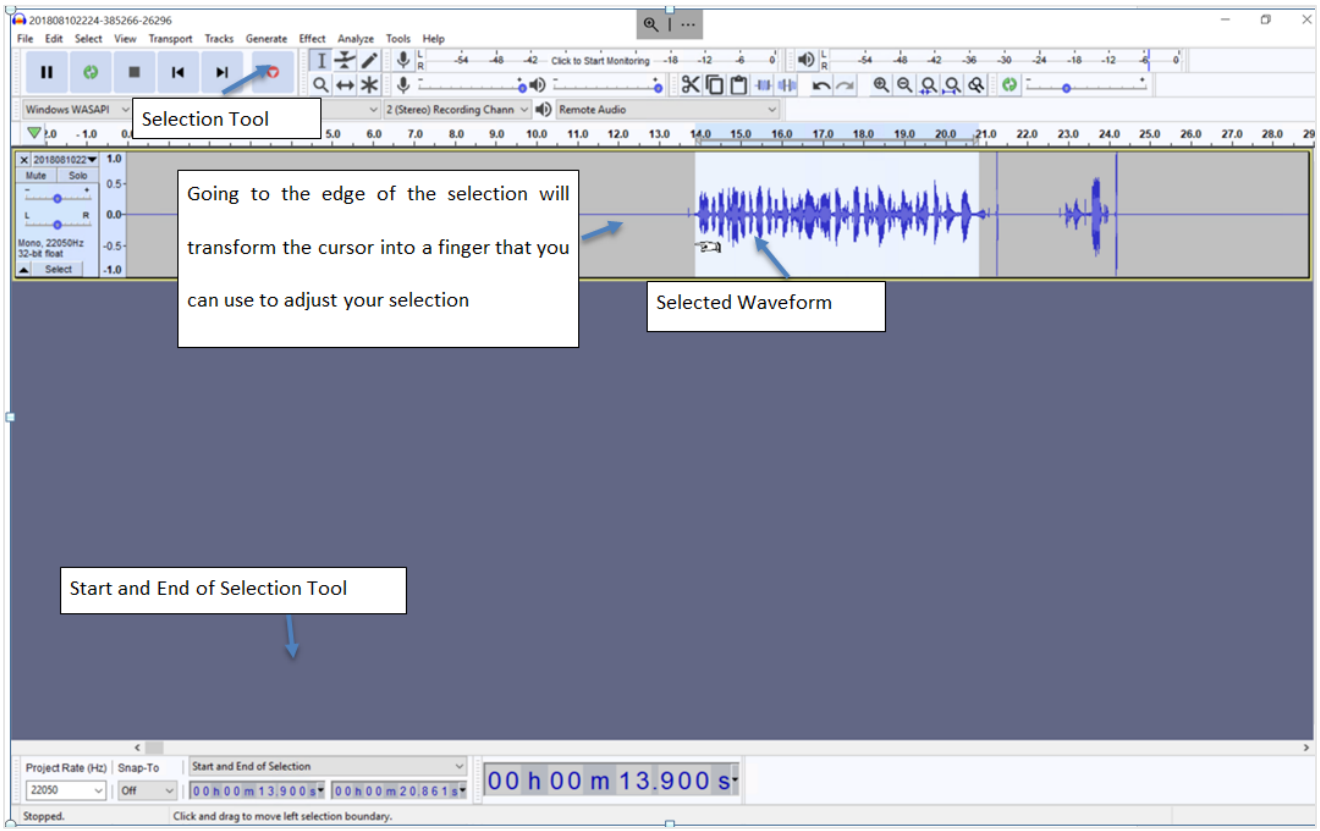
General guidelines: Use upper case at all times

Steps to follow:

- Open an assigned audio file using Audacity
- Save the audio file as a 'Dominance Project' (.aup) file. This will allow you to save your labels and settings in case you need to return to the file at later time. The project file name should be the same as the audio file, but with your initials at the end.
- Segment Audio File

Once an utterance has been identified, identify its start/stop time such that 100-200 milliseconds of silence exist before it begins and after it ends. This may not be easy to do. Just make a reasonable effort, as getting it close is typically good enough.

Figure 5: Segmenting and labeling an audio file using audacity



The best way to accomplish this is using audacity's selection tool to trace over an area of the audio where you can see a clear waveform. The selection tool allows you to adjust the size of your selection without deselecting the entire utterance. It is good to listen as many times as you need to the audio and adjust the selection tool to properly identify the start and stop time of the audio. You can also adjust your selection using the 'Start and End of Selection 'tool by manually typing the start and end times of the utterance down to the millisecond.

- Label Audio File

The purpose of the process is to identify the feature/emotion present in the utterances, and label them with the corresponding code. There are 23 possible features to identify from. To guide you to do that, please find the code book given at the end of this session.

There may be multiple features present in one utterance. For example, an utterance may sound CONFIDENT (CNF) as well as ASSERTIVE (ASR). Ensure that all of the features are labeled, even if their co-occurrence is less likely. For example, an utterance may sound ATHOURITATIVE (ATT) and MILD (MLD). If the utterance matches descriptions of both of these features, continue labeling the codes nevertheless.

Begin the process by adding a label to your selected utterance. You can accomplish this by pressing **ctrl + b** or using the audacity menus **Edit>Labels>Add Label at Selection.** Furthermore, you can see a list of all labels you create in order by accessing the menu at **Edit>Labels>Edit Labels.**

Listen to the utterance and try to identify the emotion/feature in the speech. Cross check if your identification matches the description of the feature in the above code book. If so, label the utterance with the corresponding three letter code. For example, if the speaker sounds CAUTIOUS, check whether the utterance satisfies the description of the feature: “The speaker is attentive and careful. Does the speaker ask for additional information? Does the speaker confirms/checks the message he/she receives?” If it matches, then label the code “CAU”.

Table 4: 23 codes expressing dominance attributes

Feature	Code	Type of coding instrument	Purpose/meaning of the code
Argumentative	ARG	Attribute-based	The speaker expresses divergent or opposing views. Does the dispatcher and LEO agree?
Assertive	ASR	Attribute-based	Sounds decisive, positive and insistent.
Aggressive	AGV	Attribute-based	Shows signs of uncooperation, sounds confrontational and hostile in conversations. Look for signs of quarrel or disagreements
Authoritative	ATT	Attribute-based	Speakers sounds assured. The speaker confirms the information he/she passes being factual and accurate
Confident	CNF	Attribute-based	Speaker is calm, composed and self-assured
Responsive	RSP	Attribute-based	Responds calmly and positively to a question posed. Shows readiness to provide more information
Energetic	ENR	Attribute-based	Speaker shows great deal of zeal and enthusiasm in the conversation. Ask onself if the speaker is lively and fully engaged in the conversation, and his mind on the task and job.
Forceful	FRC	Attribute-based	Besides being self-assured, does the speaker sound pushy/bossy?
Loud	LOD	Attribute-based	Strongly audible. Show signs of exceptional volume or intensity
Expressive	EXP	Attribute-based	
Cautious	CAU	Attribute-based	The speaker is attentive and careful. Does the speaker asks for additional information? Does the speaker confirms/checks the message he/she receives?
Hesitant	HST	Attribute-based	The speaker is uncertain and reluctant. He/she stalls the conversations. He/she sounds diffident
Timid	TMD	Attribute-based	The speaker is nervous and reticent. He/she sounds modest and diffident.
Mild	MLD	Attribute-based	The speaker talks in a gentle tone. The voice is light and feeble. The speaker soounds calm.
Passive	PSV	Attribute-based	the speaker is compliant and unassertive. He/she is docile and shows lack of interest in the conversation.
Quiet	QIT	Attribute-based	The speaker is inaudible or indistinct. He/she talks in muffled and faint voice, during any part of the conversation. The trail end of the conversation fades off
The person does more talking than listening	TLK	Behaviour-based	
The person stops to think what to say in conversat	STP	Behaviour-based	The speaker assertively asks for time before responding
The person is relaxed and at ease in conversation	RLX	Behaviour-based	
The person is nervous in conversations	NRV	Behaviour-based	
The person is task oriented in conversations	TSK	Behaviour-based	The speaker gives clear instructions/information in a tone that is audible and comprehensible
The person shows poise in conversations	PSE	Behaviour-based	
The person acts impatient during conversations	IMP	Behaviour-based	The speaker shows impatience while talking. Or the speaker talks fast and is not comprehensible

In some cases, the utterance may sound like a particular feature, and may only partially satisfy the description. In that case, if you more than 50% (reasonably) confident, the feature is emoted in the utterance, go ahead and label them.

Confidence in the annotation may vary within an utterance. In those cases, simply follow the conventions outlined above

- Identify the role of the speaker and gender

The audio files contain conversations between the dispatcher and the LEO.Label “D” for dispatchers and “P” for LEOs. Similarly, for labeling gender, use “M” for the Male and “F” for Female. Finally, the labeling will be done in the following order and enclosed within square brackets:

[“Role”, “Gender”, “Code 1”, “Code 2”,…,”Code n”].

For example, if an utterance satisfies the conditions for being “ASSERTIVE” and “The person is relaxed and at ease in conversations”, and if you identify the speaker as a dispatcher and male, then label **[D, M, ASR, RLX]** .

In cases where you are not able to identify the role or the gender, denote that with a “?”. In such cases, the label will look like **[D, ?, ASR, RLX]** or **[?, M, ASR, RLX]** or **[?, ?, ASR, RLX]**

The Notes Section

After you complete your annotation, it is important to relay any necessary information about the utterance to us through the notes section of the label. There are a few things that you must include in the notes section if you encounter them:

- If you are reasonably confident that an utterance shows signs of a particular feature/emotion, but the description is ambiguous or does not capture the essence of the feature.
- If you think an utterance show strong signs of dominance, but lies outside the scope of the 23 codes enlisted in the codebook
- Major audio quality issues that debilitated your understanding of the utterance.
- If you changed your annotation due to receiving clarity from context in a later utterance.
- If you used any audacity tools to help you understand the audio better (i.e., the speed tool).

We encourage you to take any other notes that you think of while transcribing. These can be thoughts on the content of the utterance, parts of your annotation you want to clarify, things that you may research that are not on the resources we provided you that helped you make your annotation, and any other uncertainties that you may encounter along the way. This is not an exhaustive list, nor is it required for you to include everything. The notes section is a way that you can engage with the transcription process directly and communicate important information to us. In the end, you decide what information you think we should know.

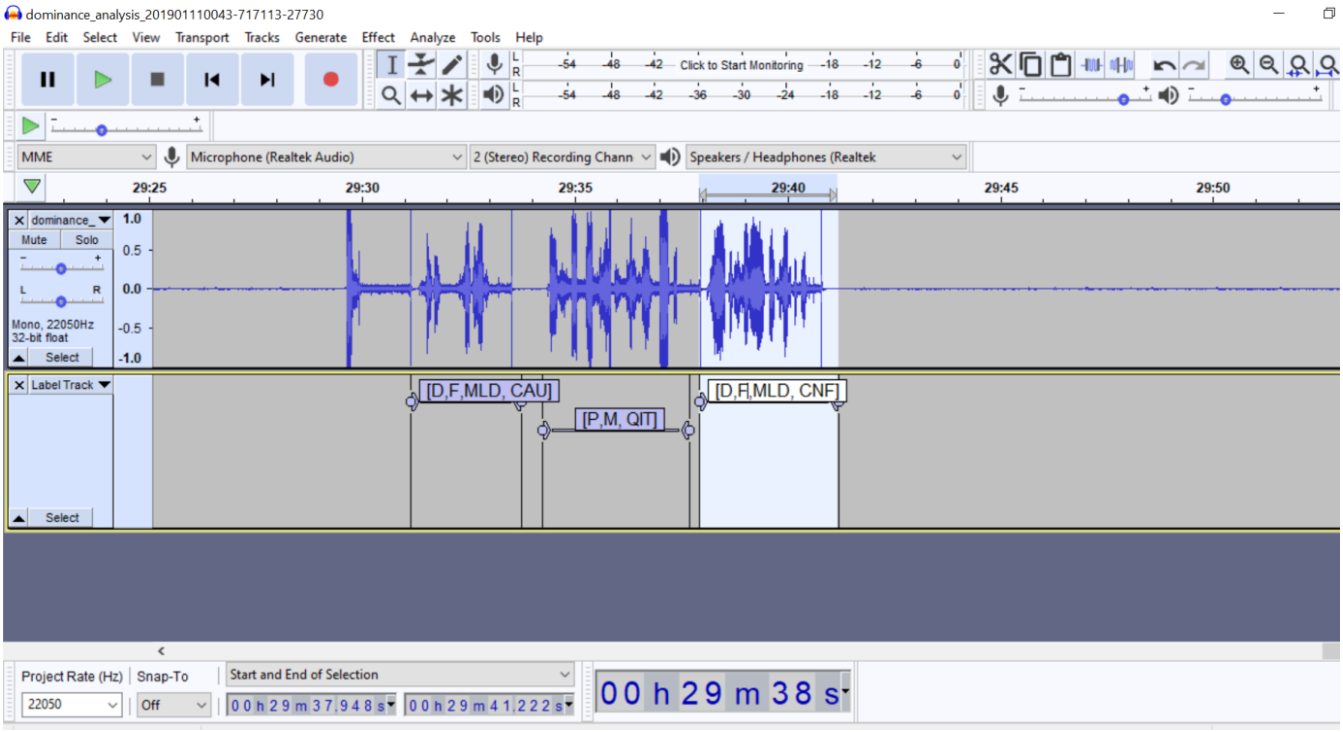
- Complete the annotation

The goal here is to balance speed and accuracy, with a bit more emphasis on the latter than the former. It is hard to give concrete stopping conditions since annotation will involve a great deal of listening and re listening to utterances, but here are some heuristics to consider using:

- You could quickly and easily explain why you labeled each utterance as you did.
- Your annotation process is up to your discretion and should fit well with the schedule that you make for yourself. The suggestions made within the document are only included to help you trouble shoot specific situations and give you ways to optimize your workflow if you haven't already found a way to do that. Your transcriptions in the end only need to look like the model provided in this section.
- You will have to make a lot of judgement calls that where you may need to sacrifice time over accuracy or vice versa. In the end, it is your responsibility to annotate every utterance and relay necessary information to your Team Leader. Your target for annotating speed should be about 1 hour of annotating for 20 minutes of broadcast audio. Once you get familiar with the codes, you can target to finish labeling an entire audio file (30 minutes) in less than 45 minutes.

Model of completed annotations:

Figure 6: A completed label will look like [P,M,TSK,CNF]. The figure shows the labels as seen in audacity.



- **Export the label**

Finish the annotation process by saving the labels to your "completed" folder by using the audacity menu **File>Export>Export Labels.** Save with the same name as your project file as .txt file.

8. References

Balko, Radley. *Opinion |A Day with 'Killology' Police Trainer Dave Grossman.* February 14, 2017. https://www.washingtonpost.com/news/the-watch/wp/2017/02/14/a-day-with-killology-police-trainer-dave-grossman/ (accessed July 28, 2022).

Bernstein, Irwin S. "Dominance: The baby and the bathwater." *Behavioral and brain sciences*, 1981: 419-429.

Brunson, Rod K. "Police don't like black people": African-American young men's accumulated police experiences." *Criminology & public policy*, 2007: 71-101.

Burgoon, Judee K, Michelle L Johnson, and Pamela T Koch. "The nature and measurement of interpersonal dominance." *Communications Monographs*, 1998: 308-335.

Carlson, Jennifer. "guardian constructs show a commitment to masculinized performances with roots in heterosexuality, white supremacy, and patriarchal structures." *Social Problems*, 2019: 399-417.

Chalmers, NR, and TE Rowell. "Behaviour and female reproductive cycles in a captive group of mangabeys." *Folia Primatologica*, 1971: 1-14.

Cheng, Joey T, Jessica L Tracy, Simon Ho, and Joseph Henrich. "Listen, follow me: Dynamic vocal signals of dominance predict emergent social rank in humans." *Journal of Experimental Psychology: General*, 2016: 536.

Chicago Police Department. *Use 9-1-1 to Report Emergencies.* 2022. https://home.chicagopolice.org/about/contact-us/use-9-1-1-to-report-emergencies/#:~:text=To%20make%20an%20emergency%20call,in%20more%20than%20140%20languages. (accessed February 24, 2022).

Gough, Harrison G, Herbert McClosky, and Paul E Meehl. "A personality scale for dominance." *The Journal of Abnormal and Social Psychology*, 1951: 360.

Hopper, Marianne. "Becoming a Policeman: Socialization of Cadets in a Police Academy." *Urban Life*, 1977: 149-70.

Immelmann, K. "Ecological significance of imprinting and early learning." *Annual Review of Ecology and Systematics*, 1975: 15-37.

Kaplan, Jay Ross. *PATTERNS OF INTERFERENCE AND THE CONTROL OF AGGRESSION IN A GROUP.* Chicago: Northwestern University, 1976.

Karunakaran, Arvind. "Status--authority asymmetry between professions: The case of 911 dispatchers and police officers." *Administrative Science Quarterly*, 2022: 423-468.

Latan{\'e}, Bibb. "Dynamic social impact: The creation of culture by communication." *Journal of communication*, 1996: 13-25.

Lee, Jae-Seung, Jonathan Lee, and Larry T. Hoover. "What Conditions Affect Police Response Time? Examining Situational and Neighborhood Factors." *Police Quarterly*, 2017: 61-80.

Marenin, Otwin. "Cheapening Death: Danger, Police Street Culture, and the Use of Deadly Force." *Police Quarterly*, 2016: 461-87.

Maxim, Peter E. "Quantification of social behavior in pigtail monkeys." *Journal of experimental psychology: animal behavior processes*, 1978: 50.

Mehrabian, A. "Pleasure-arousal-dominance: a general framework for describing and measuring individual differences in temperament." *Current Psychology*, 1996: 261-292.

Morin, Rich, Kim Parker, Renee Stepler, and Andrew Mercer. *Behind the Badge.* Pew Research Center, 2017.

Moskos, Peter. *Cop in the Hood: My Year Policing Baltimore's Eastern District.* Princeton: Princeton University Press, 2009.

Muhammad, Khalil Gibran. *The condemnation of Blackness: Race, crime, and the making of modern urban America.* Harvard University Press, 2019.

Neusteter, Rebecca, Maris Mapolski, Mawia Khogali, and Megan O'Toole. *The 911 Call Processing System: A Review of the Literature as it Relates to Policing.* Chicago: Vera Institute of Justice, 2019.

Oberfield, Zachary. "Socialisation and self-selection: How Police Officers Develop Their Views about Using Force." *Administration & Society*, 2012: 702-30.

Pernet, Cyril R, and Pascal Belin. "The role of pitch and timbre in voice gender categorization." *Frontiers in psychology*, 2012: 23.

Pratto, Felicia, Jim Sidanius, and Shana Levin. "Social dominance theory and the dynamics of intergroup relations: Taking stock and looking forward." *European review of social psychology*, 2006: 271-320.

Puts, DA, CR Hodges, RA Cardenas, and SJC Gaulin. "Men's voices as dominance signals: vocal fundamental and formant frequencies influence dominance attributions among men." *Evolution and Human Behavior*, 2007: 340-344.

Sellin, Thorsten. "The negro criminal a statistical note." *The Annals of the American Academy of Political and Social Science*, 1928: 52-64.

Shapira, Harel,, and Samantha J. Simon. "Learning to Need a Gun." *Qualitative Sociology*, 2018: 1-20.

Sierra-Arevalo, Michael. "American Policing and the Danger Imperative." *Law & Society Review*, 2021: 70-103.

Simon, Samantha J. "Training for War: Academy Socialization and Warrior Policing." *Social Problems*, 2021.

Simpson, Rylan. "Calling the police: Dispatchers as important interpreters and manufacturers of calls for service data." *Policing: A Journal of Policy and Practice*, 2021: 1537-1545.

Simpson, Rylan. "Calling the Police: Dispatchers as Important Interpreters and Manufacturers of Calls for Service Data." *Policing*, 2020: 1-9.

Smith, Erin C, Lisa Holmes, and Frederick M Burkle. "Exploring the physical and mental health challenges associated with emergency service call-taking and dispatching." *Prehospital and disaster medicine*, 2019: 619-624.

Taylor, Paul. "Dispatch Priming and the Police Decision to Use Deadly Force." *Police Quarterly*, 2020: 311-332.

Thayer, Robert E. "Measurement of activation through self-report." *Psychological reports*, 1967: 663-678.

Tusing, Kyle James, and James Price Dillard. "The sounds of dominance. Vocal precursors of perceived dominance during interpersonal influence." *Human Communication Research*, 2000: 148-171.

Van Maanen, John Eastin, and Edgar Henry Schein. *Toward a theory of organizational socialization.* MIT Alfred P. Sloan School of Management, 1977.

Vargas, Robert, Kayla Preito-Hodge, and Jeremy Christofferson. "Digital vulnerability: the unequal risk of e-contact with the criminal justice system." *RSF: The Russell Sage Foundation Journal of the Social Sciences*, 2019: 71-88.

Vargas, Robert, Kayla Preito-Hodge, and Jeremy Christofferson. "This fundamental understanding of dispatcher responsibilities has opened up research into the importance of dispatchers' judgment of calls, how they influence police officer judgments, and, most crucially, their impact on callers." *Russell Sage Foundation Journal of the Social Sciences*, 2019: 71-88.

Wells, Edward, and David Falcone. "Research on police pursuits: advantages of multiple data collection strategies." *Policing:An International journal of police strategy and management*, 1997: 729-748.

Yandell, Karina. *Telecom Reseller.* October 21, 2010.

Young, Iris Marion. "The Logic of Masculinist Protection: Reflections on the Current Security State." *Signs: Journal of Women in Culture and Society*, 2003: 1-25.