

Social Media for Safety: Characterizing Online Interactions between Citizens and Police

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Social media has emerged as a promising resource for police to connect with citizens for collective action. However the attributes of police citizen interactions on social media remain under-explored. In this paper, we utilise official and public Facebook pages of several police departments in India to study the patterns of engagement, emotions, and social processes between citizens and police in the context of day-to-day policing. We examine two prominent discussion threads: police initiated and citizen initiated. We find that topics exchanged in police initiated discussions are more focussed than citizen initiated threads; police focused on topics concerning safety awareness programs, action reports, and information regarding policing activities. Compared to police initiated discussions, citizen initiated discussions show lower engagement. Further, discussions involving both police and citizens show higher negative emotions, anger and arousal than citizen only discussions; these interventions involving both reveal a stronger notion of a collective identity. We discuss the implications of our work in designing technological support for improved policing and to help understand citizen opinions, safety concerns and well-being via social media.

Social media, police, citizens, interactions, behavioural measures

1. INTRODUCTION

Safety and law & order issues bear detrimental effects on the psychological well-being of the citizens and society at large (Lewis and Salem (1981)). Police organisations being the nodal entity for Safety and law & order issues, having positive interactions (e.g. addressing citizen's complaints) with them will help increase trust and generates a feeling of safety among the citizens; whereas negative interaction (e.g., misconduct by police) may increase insecurity among citizens (Stephens et al. (2011); Lewis and Salem (1981)). Increased interactions between police and citizens in day-to-day life may lead to improved citizen awareness, collective action, and social change (Stephens et al. (2011)). Police-citizen communication in day-to-day policing can make citizens feel that the police is available to help and hold itself accountable to citizens; as shown in research feelings of accountability are known to help reduce negative affect (Dekmar (2015)). Therefore, studying day-to-day communication between police and citizen community accounts for both social determination and social change through collective efforts in multiple ways (Drury and Reicher (2000)).

Social media, due to its massive and pervasive reach, has emerged as a prominent medium to support online interaction between citizen and government organisations such as police (Denef et al. (2013); Hughes et al. (2014)). Prior work has investigated the effectiveness of social media in a variety of scenarios - e.g., crisis (hurricanes and fires) and socio-political upheavals (Cobb et al. (2014); Palen, L. and Vieweg, S. (2008); Semaan and Mark (2012)). Interactions between citizens, first responders, and organizations for effective collaboration have also been explored (Shklovski et al. (2008); Volda et al. (2012)). These studies demonstrate the role of social media in collective action and in providing social support during crises (Choudhury et al. (2014); Denef et al. (2013); Hughes et al. (2014); López and Butler (2013)). However, it remains under explored whether the richness of such social media data can be helpful to improve and understand citizen perceptions in day-to-day policing. Such online interactions between police and citizens can help change citizen perceptions about community safety, police efforts, and the relationship between them (Welch and Fulla (2005)).

Keeping the prior literature in mind, this paper examines the communication between police and citizens in the emergent yet non-conventional setting: social media. To the best of our knowledge, this is the first work that empirically explores the role of social media interactions in: 1) characterising behaviour of and engagement between police and citizens to address crime and safety concerns in day-to-day life, and in 2) investigating if social media platforms can be a way for law enforcement agencies to assess, record and sense public safety in a macro or community-sense. Our specific study goals include:

- Exploring the feasibility of social media in quantifying attributes of police and citizen interaction around issues of day-to-day policing, such as crime and safety;
- Identifying behavioural attributes like affective expression, engagement and social and cognitive response processes of police and citizens as they interact on social media.

Our findings contribute in understanding how citizens and police interact on Facebook. Our results bear implications on the role of social media in improving collective action, and reducing the effects of fear and anxiety among citizens. Our work shows that it is possible to operationalise and measure social interactions between police-citizens in a fine-grained manner through three dimensions: engagement, affective expression and intensity, and linguistic attributes of cognitive and social processes. We find that discussions involving citizens and residents significantly reduce negative sentiment such as anxiety among citizens experiencing safety concerns exhibiting opportunity for improved emotional support through social media. Finally, our work also substantiates the focused approach to use social media for discussing limited topics in comparison to vast topics discussed. We envision that our work can help build technologies to sense and record changes in citizen's behaviour and emotions to improve policing and safety landscape in urban communities.

2. BACKGROUND & RESEARCH QUESTIONS

2.1. Safety, Collective Action, Police

Citizen-police interaction is well-studied in psychology, criminology and other social science literature (Denef et al. (2013); Heverin and Zach (2010); Lewis and Lewis (2012)). A key observation in this body of work is that collective action involving citizen and police both can successfully help reduce anxiety and fear related to crime (Lewis and Salem (1981)). However, getting citizens involved and getting them to share their experiences with police is often difficult task, considering police image of "coercive arm of the

state" (Denef et al. (2013)). Lack of information about citizen's experience with police and crime incidents, gives little opportunity to police for changing the crime landscape and explain their actions; this also prohibits involving citizens in crime prevention and civic engagement activities.

Research work has also explored developing technological solutions for interactions between police and citizens. Such research efforts focus on technologies to satisfy requirements of the police such as - management of law enforcement content and use of video surveillance (Chen et al. (2003); Tullio et al. (2010)). These technologies often ignore the citizens' needs for maintenance of law and order. On the other end, there are technologies that focus on citizens for personal safety, report unsafe locations, wearable gadgets and mechanisms to take decision based on community consensus to reduce fear (Blom et al. (2010); McGray and Thomas (2016)). Few studies focus on the technology that promote discourse between police and citizens to address safety concerns (Heverin and Zach (2010); Lewis and Salem (1981)). Existing investigations in this space are limited to understanding types of information exchanged in discussions between police and citizens (Sachdeva and Kumaraguru (2015b)). They provide little insights about behavioural attributes of these discussions: such as emotional, social and cognitive processes induced by the adoption of technologies. These attributes are important elements of successful collaboration between organisations and individuals striving to achieve societal safety (Lewis and Lewis (2012); Xu et al. (2012)). Hence, prior research has suggested to analyse citizens' and the community behaviour for societal change and social determination (Drury and Reicher (2000)). Our work explores the use of social media as a source of crowd generated data, and a means to understand the social relations and nuances of interaction between citizens and police.

2.2. Social Media & Collective Action

Social media provides government an instrument for collective action involving both government authorities and citizens (Mergel (2014); Wigand (2010)). This in turn can improve relationship with citizens as well as the trust citizens place in the government organisations such as police (Kavanaugh et al. (2011)). Research shows that social media offers two fundamental advantages to police organisation: a) it can assist in the policing jobs such as crime investigations, intelligence and prevention, and b) it can provide an instant communication platform with the public (Heverin and Zach (2010)). In spite of its advantages, social media presence may be challenging for police as

its adoption may leave them off-guard to continuous citizen scrutiny (Deneff et al. (2013)).

Prior studies also explore social media use in collective action and studying crowd behaviour during critical events (Mendoza, M., Poblete, B. and Castillo, C. (2010); Vieweg, S., Hughes, A., Starbird, K., and Palen, L. (2010)). Specifically, research shows that police organisations need communication and interaction strategies to provide timely information and understand citizens' response during crises (Deneff et al. (2013)). However, the use of social media to support interaction between police and citizens in the context of day-to-day policing remains under explored (Sachdeva and Kumaraguru (2015a,b)). Our work investigates these interactions as they play a crucial role in understanding effects of safety concerns on citizens and in bringing transparency to police accountability.

2.3. Law Enforcement & Social Media in India

The police organisation in India have only 130 personnel per 100,000 citizens whereas United Nations Guidelines recommend 270 --- 280 police personnel per 100,000 citizens (Express News Service (2013)). This lack of personnel in police in India results in many under-policed areas and increase in crime. Consequently, the police have felt the need of citizens' support to address these issues (crime and safety concerns) (Sachdeva and Kumaraguru (2015b)). Recently, Indian police have taken to social media to interact with citizens (Stephens et al. (2011)). Like in other parts of the world, Indian police departments are exhibiting fast adoption of social media to increase their online presence. India has the second largest Facebook user-base, and recently, citizens have also been found to increasingly adopt Facebook for interacting with police to address safety concerns (Nayak (2014)). We investigate the attributes of this novel interaction modality between citizens and police in this paper.

2.4. Online Interactivity & Organisations

Recent studies recognise that emotional and social processes may unfold through simplistic online interactions between government organisations and citizens (Calcara et al. (2015)). Studies have also explored multiple dimensions of these interactions such as the direction of communication, sense of place, time flexibility, timely feedback and responsiveness (Downes and McMillan (2000); McMillan and Hwang (2002)). Specifically, researchers operationalised interactions between citizen and government as a measure of individuals' perceptions, communication process and features such as user control in the context of websites and emails (Welch and Fulla (2005)).

However, little is known about measures that can be used to quantify mass interactions between police and citizens through social media communication useful in understanding effects of crime and safety concerns among citizens. We address gaps in prior work by studying attributes of social media discussions between police and citizens to address safety concerns and improve day-to-day policing. For the purpose, we adopt a quantitative approach and build on recent observations that measure engagement, emotions, and linguistic attributes in social media to reveal nuances of community behaviour.

2.5. Research Questions

In view of the above literature and our objective to explore the feasibility of a framework to characterise interaction between police and citizens, we address the following research questions:

- *RQ 1: Topical Characteristics* - What is the nature of content and topics that characterise social media discussion threads from citizens and police on safety issues?
- *RQ 2: Engagement Characteristics* - How do citizens and police engage in social media discussion threads?
- *RQ 3: Emotional Exchanges* - What is the nature of emotions and affective expression that manifest on social media during citizen-police interactions?
- *RQ 4: Cognitive and Social Orientation* - What are the linguistic attributes that characterise cognitive and social response processes during citizen and police interactions on social media?

3. DATA AND METHODS

3.1. Collection Methodology

Our study utilised data from 85 public and official Facebook pages of police departments in India. We employed a variety of mechanisms to identify these pages and then to filter posts and comments for analysis. We referred to a government website¹ that provides a list of all police departments to identify various Indian police organisation on Facebook. We found that police departments exist at different levels: city, state, and the district. Using our initial list, we were able to recognise 100 police departments on Facebook. Next, we verified these department Facebook pages for their authenticity and credibility. We manually checked if these pages were linked to the official government website of the police department, or had stated on their web page that these were the official government organisation representative. After this cleaning, we were left with

¹<http://arunpol.nic.in/>

85 police departments' pages on Facebook. At the time of writing this paper, most of these pages had an average age of 3 years.

We then collected data using the Facebook Graph API² from the day these pages were created through April 20, 2015. We obtained all wall posts (content posted by citizens); and status updates (content posted by police) from these pages. This gave us 47,474 wall posts and 85,408 status updates. Further, to understand discussions on these pages, we collected all 'comments' and 'likes' associated with the posts, including their time of creation. Since we wanted to study interaction characteristics between police & citizens and among citizens, we considered posts that had at least one comment (reply). Our dataset had 46,845 police posts and 24,984 citizen posts where there was at least one comment. Note that our data did not include private messages that people might have sent to police using Facebook, or other forms of "spill-over" activity that may be present in citizens' profile such as private discussions with friends.

3.2. Terminology and Data Categorisation

We now explain the terminology and notations used in the paper to categorise different types of *discussion threads* (posts and associated comments) prevalent in our dataset. We consider discussion threads initiated by both police and citizens. We categorise these threads into four classes based on the CMC literature including initiator and responders:

- (a) Police initiated discussion threads where both police (P) and citizens (C) had left comments and were part of discussion ($P_{P\&C}$);
- (b) Police initiated discussion threads where only citizens left comments (P_C);
- (c) Citizen initiated discussion threads where police and citizens both left comments ($C_{P\&C}$); and
- (d) Citizen initiated discussion threads where only citizens left comment and were part of discussion (C_C).

Table 1: Number of discussion threads (DT), threads with at least one comment, DTs where police and citizens comment (P&C) and those where only citizens comment (C).

	Total DT	DT w/ ≥ 1 Comment	P&C	C
Police	85,408	46,845	5,519 ($P_{P\&C}$)	41,326 (P_C)
Citizens	47,474	24,984	17,196 ($C_{P\&C}$)	7,788 (C_C)

²<https://developers.facebook.com/docs/graph-api>

Table 1 shows number of discussion threads in each category where there was at least one comment.

3.3. Measures

We now identify and propose broad measures to quantify the interactions between police and citizens in social media and also to address our various research questions. These measures are discussed below:

Topic Characterisation: Generating intelligence from the content shared on social media requires capacity to cluster and link related concepts (Gill (2012)). Our first analysis employs n-gram (uni-grams) analysis on the content of the discussion threads. Thereafter, we adopt a clustering approach in an unsupervised manner based on the k-means algorithm to examine the nature of topics discussed.

Engagement: In the context of policing, engaging with citizens is an important aspect of the problem-solving process (Peak and Glensor (2002)). We measure engagement of police and citizens in terms of their activity patterns in the different discussion threads: $P_{P\&C}$, P_C , $C_{P\&C}$, C_C . Two specific measures of engagement include number of content generators and amount of content generated during these interaction. We consider the following attributes to measure the *volume of content generators (content generation)*: 1) number of police and citizens who comment on police and citizen initiated discussion threads; 2) number of citizens who comment on police and citizen discussion threads; 3) entropy (Shannon's Wiener Diversity index) or the diversity in the number of unique citizens involved in initiating different discussion threads. We also consider two attributes to measure the *volume of content generated during interactions (content interaction)*: 4) average number of comments and 5) 'likes' on all citizen and police initiated discussion threads.

Emotional Expression: Awareness of emotion helps in building effective partnerships (required for community policing) between police officers and community members (Spalek (2013)). In order to measure emotions in our discussion thread categories, we consider two measures: a) emotional valence and b) emotional intensity. Emotional valence is measured in terms of "Positive Affect (PA)", "Negative Affect (NA)", "anger", "anxiety", and "sadness". We make use of the popular and well-validated psycholinguistic tool LIWC.³ Next, we measure emotional intensity based on the psychological arousal measures of words given in the ANEW dictionary (Affective Norms for English

³<http://liwc.wpengine.com/>

Words).⁴ This measure has been employed in prior social media analytics work and is this validated on social media data (Choudhury et al. (2014); De Choudhury et al. (2013); Xu et al. (2012)).

Cognitive, Personal and Social Orientation: Citizens often rely on cognitive and social orientation that consists of perceptions about the law, neighbourhood, and police while making decisions whether to engage in collective actions (Cullen et al. (2015)). Hence we study linguistic attributes relating to cognitive and social orientation as manifested in the different discussion thread categories. We utilise LIWC and focus on the following categories: 1) measures of *interpersonal focus* given by pronoun use, such as 1st person singular, 1st person plural, 2nd person, 3rd person singular, 3rd person plural, and impersonal pronouns; 2) measures of *cognition* given by "cognitive mech", "tentativeness" and "discrepancy"; and 3) measures of *social orientation* obtained based on the categories "friends", "family", and "humans".

4. RQ 1: TOPIC CHARACTERISTICS

For RQ 1, we begin by characterising the topics expressed in police and citizen discussion threads.

4.1. Unigram Analysis

Police Initiated Discussion Threads. First, we analyse the nature of content shared in discussion threads initiated by the police: we discuss both the posts and the associated comments in these threads. Through unigram analysis, we observe that the top words in the police posts are *safety*, *citizens*, *people*, *notice*, *issued*. In essence, these posts include advisories, the status of different cases being investigated, *notice* or "*challans*" (local word for fine) issued by the police.

In $P_{P\&C}$ discussions, we find that posts broadly span general safety of public. Top words included in these posts were *rules*, *safety*, *violations* ($P_{P\&C}$ in Table 2) e.g., in a post, police remarked:

"Good Morning to all BTP Friends.. Follow traffic rules for your safety and congestion free.."

In posts of P_C discussion threads (Table 2), we find that the posts are largely about actions taken or developments made by police. Top unigrams in these threads are *safety*, *following*, *prosecuted*, *notices*. For example, in a post, police informed the citizens that:

"29584 persons were prosecuted by Delhi Traffic Police for drunken driving during the year 2014. These drivers are requested not to drink & drive."

Table 2: Unigram Analysis: strength of normalised most frequent words across our four discussion thread categories.

$P_{P\&C}$		P_C		$C_{P\&C}$		C_C	
Unigram	Freq.	Unigram	Freq.	Unigram	Freq.	Unigram	Freq.
rules	0.015	safety	0.012	please	0.026	people	0.022
safety	0.014	following	0.011	take	0.021	please	0.02
violations	0.014	notice	0.010	action	0.019	one	0.019
challans	0.011	prosecuted	0.009	people	0.019	take	0.016
please	0.011	shall	0.009	one	0.019	action	0.015
citizens	0.010	bus	0.009	time	0.017	time	0.015
one	0.010	movement	0.008	near	0.017	number	0.013
people	0.010	complaint	0.008	car	0.017	driving	0.012
public	0.010	near	0.008	sir	0.016	sir	0.011
special	0.010	advisory	0.008	also	0.016	public	0.011
due	0.009	commissioner	0.008	number	0.015	even	0.011
side	0.009	avoid	0.008	vehicles	0.015	rules	0.010
various	0.009	public	0.007	parking	0.015	parking	0.010
drunken	0.008	heavy	0.007	taxi	0.014	see	0.010
marg	0.008	side	0.007	vehicle	0.014	near	0.009
number	0.008	taken	0.007	bus	0.012	side	0.009
parking	0.008	take	0.007	station	0.011	know	0.009
places	0.008	right	0.007	driver	0.011	driver	0.009
requested	0.008	please	0.007	today	0.011	signal	0.009
shall	0.008	action	0.007	even	0.010	get	0.009

On comparing the two police initiated discussion threads, we find that the posts of $P_{P\&C}$ discussion threads are observed to be 57.14% higher in use of the word *please*, 16.68% more in *safety*, and 149.99% in *rules*, than posts in P_C discussions; indicating that $P_{P\&C}$ posts comprise advisories requesting citizens for specific actions or respecting rules. On comparing posts, we find statistically significant difference in the most frequent unigrams ($N = 50$) of $P_{P\&C}$ and P_C discussion threads ($U = 700, p < .05, z = -3.57$) based on Mann-Whitney U tests. We find the most frequent unigrams in comments of $P_{P\&C}$ discussion threads to include: *good*, *please*, *job*, *great*, *thanks*, and *work*, indicating citizen appreciation of police work; e.g., "Great job."

Citizen Initiated Discussion Threads. Secondly, in the posts initiated by citizens, most posts tend to request police to take action on their complaints. The unigram analysis shows a high occurrence of words such as *please*, *take*, *action*, *sir* (Table 2).

On comparing the posts in the $C_{P\&C}$ and C_C threads, we find that the C_C category involves a higher reference to people (15% higher), and eyewitness experience of citizens (14.94% higher) than the $C_{P\&C}$ category. For instance, a citizen said:

"Sir, I wanted to report an incident were people were fighting (fist cuffs) on the road and some girls were being harassed in Kalyananagara. No response on either 100 or 103... Been trying these numbers for the past 20 minutes now and there's no response!"

We find statistically significant difference in frequent unigrams ($N = 50$) of $C_{P\&C}$ and C_C posts ($U = 961, p < .05, z = -1.99$), as well as among the frequent unigrams ($N = 50$) in the comments of

⁴<http://www.csc.ncsu.edu/faculty/healey/maa-16/text/>

these two discussion threads ($U = 957, p < .05, z = -2.02$). Top unigrams in $C_{P\&C}$ comments include *action, thanks, please, dear, and complaint*.

4.2. Analyzing Themes in Discussion Threads

Next, to identify broad themes, we calculate the *tf-idf*⁵ vectors for all the posts in each of the four discussion thread categories (ref. Table 1). We perform *k*-means clustering on these vectors. Specifically, we use *k*-means++ seeding method that has been proved to perform better than random seeding (Arthur and Vassilvitskii (2007)). This method has been used in previous studies to clustering tasks on social media (Arnaboldi et al. (2012)). We iteratively apply this method with different values of *k*, chosen in an empirical data-driven manner using elbow method, and then obtain silhouette score ($[0, 1]$) for each iteration (Milligan and Cooper (1985)). We obtain optimal value of *k* via maximising silhouette score, which is found to be 3 and 5 for police and citizen initiated threads respectively.

Next, adopting a qualitative approach, two researchers independently engaged to annotate the clusters from *k*-means, using a semi-open codebook. We summarise these clusters in Table 3 and present a qualitative analysis on them below. The annotators referred to existing literature in criminology to develop the codebook (Research commissioned by LexisNexis (2012); Sachdeva and Kumaraguru (2015b)).

Police Initiated Discussion Threads contain three prime clusters:

(1) *Awareness drive / safety campaigns*: This cluster includes words such as *drive, rules, safety, vehicles, city, follow, aware*. For instance, one such post in this cluster said

“Road sense is the offspring of courtesy and the parent of safety”

(2) *Prosecuted / action taken reports*: This cluster is characterised by words such as --- *notice, issuing, served, prosecuted, Facebook basis complaint, photographs, following, action, dated*. Precisely, this cluster includes posts that inform citizens that police has sent *challans* to violators or has prosecuted the violators appropriately.

“Action taken by [Withheld], Reg your tweet petition, @[withheld]; 33 parking tag & 6 no parking, 1 foot path parking. Cases booked on hospital road.”

(3) *Advisories on situations*: Here we find manifestation of specific words such as *traffic, slow, heavy,*

Table 3: Extracted topics for police and citizen initiated discussion threads.

Topics	Top Words / Tokens
<i>Police Initiated Discussion Threads</i>	
Awareness drive	drive, rules, safety, vehicles, follow, aware
Prosecuted / action taken	notice, issuing, served, prosecuted facebook basis complaint, photographs, action following, dated
Advisories	traffic, slow, heavy, movement, safety, flyover bus, road, avoid, near, delhi
<i>Citizen Initiated Discussion Threads</i>	
Appreciation	great, job, doing, police, good, nice, work initiative, gr8, congratulations, commendable
News articles	articleshow, indiatimes, timesofindia bangaloremirror
Citizen tips and complaints	people, driving, rules, traffic wrong, bus, way, lane, right, drivers, vehicles, stop
Traffic problems	jam, traffic, bridge, heavy, problem, area, huge evening hours, route
Neighbourhood	parked, road, traffic, near parking, black, tinted
Missing people	help, missing, son, contact, plz, kindly, identify

movement, safety flyover, bus, road. Thus, this cluster is characterized by posts where police informed citizens of areas where they could expect heavy or slow traffic. For instance,

“Good -- Morning to all the Commuters of Shillong City, there is heavy movement over NH - 40 - 44 and Madanrting down side, Lumdiengjri area stretch. Please do not overtake.”

Citizen Initiated Discussion Threads consist of five clusters:

(1) *Appreciation*: This cluster shows manifestation of appreciation for police departments: *great, job, doing, police, good, nice, work, initiative, gr8, congratulations*.

“Heartiest congratulations to [withheld] police for nabbing [withheld] agent within 24hrs. wow!!! kudos and respect”

(2) *Newspaper articles*: We find this cluster to show a practice of posting newspaper articles: *indiatimes, timesofindia, bangaloremirror*. On qualitative analysis we find that these articles include news about crime reported in different parts of the cities, that the citizens wanted to bring in the notice of police.

“Please ACT:
<http://timesofindia.indiatimes.com/videos/news/...>”

(3) *Citizen tips and complaints*: We identify following top tokens in this cluster: *people, driving, rules, wrong, vehicles, stop*. They indicate that citizens complain to police about others not following rules, or breaking a law.

“4th Nov 2014 [withheld]: Driving in wrong side at Teghoria U Turn”

(4) *Neighbourhood problems*: This cluster shows discussions on neighbourhood problems such as inappropriate parking areas, cars with dark tinted glasses (prohibited by law). This is indicated by words such as: *parked, road, parking, black, tinted*.

⁵Approach to convert text into numbers for analytical purpose <http://www.tfidf.com/>

“Learn from the Delhi incident and ensure that no buses in Kolkata have tinted glasses. One such bus was spotted on Gariahat road Regn. #. [Withheld]. Kindly take appropriate action. Thank you.”

(5) *Missing people*: We find evidence of citizens asking for help to identify missing people. This cluster is marked by tokens such as *help, missing, son, contact, plz, kindly*.

“Sir plz help find my nephew, he is missing since today morning, he is from kodagu, contact [withheld]”

5. RQ 2: ENGAGEMENT CHARACTERISTICS

Moving on to RQ 2, we now present observations on the measures of engagement.

Content Generation. First, based on Table 4, in the police initiated discussion threads, we find that number of individuals who participate in the P_C (i.e. citizens participants only) discussions are higher than those in $P_{P\&C}$ (both police and citizens participants). Qualitative analysis shows that the posts corresponding to the former are mainly action taken reports and people prosecuted by police departments:

“ [withheld] this is to inform you that both the vehicles were prosecuted under provision of law and removed to concerned P.S. for further action. Now the said area is free from illegal parking. And we are keeping sharp look on the area.”

Further, we find that number of individuals who participate in citizen initiated discussion threads where only citizens comment (C_C) is almost 26% lower than the $C_{P\&C}$ category where both police and citizens participate in discussion (Table 4). As we discussed in the previous section, these are mostly citizens' posts that include individual complaints; they may not relate to a larger audience on police pages. It could, therefore, explain the lower number of citizens participating in this category of citizen posts. Prior work shows that more people contributing to content generation increases social capital of an organisation (Gil de Zúñiga et al. (2012)). We conjecture that $C_{P\&C}$ discussion threads might be contributing more towards social capital building ⁶ (due to engaging both police and citizens) than those involving citizen commentary only (Table 4).

Next, to understand the contribution of individual citizens towards content generation process, we focus on discussion threads initiated by the police. In Table 4, we report the entropy (variation) in the number of comments per citizen. We find that

⁶It is a resource that individuals derive from their social structures for accomplishing their interests. These are shaped by transformations in the relationship among individuals.

Table 4: Number of individuals involved in commentary in different discussion thread categories, and entropy of comments shared by each user.

	$P_{P\&C}$	P_C	$C_{P\&C}$	C_C
Police + Citizens	55,028	1,79,176	17,124	12,630
Citizens Only	54,982	1,79,176	17,081	12,630
Entropy	4.39	4.96	3.23	3.60

entropy is 12.98% higher in P_C discussion threads, as compared to $P_{P\&C}$. Lower entropy in the latter discussions shows that there is less volatility among those who engage in content generation, and police and citizen participation is likely more balanced in them. Similarly, in the discussion threads initiated by the citizens, entropy or variation in the number of comments by each citizen is found to be 10.28% lower in $C_{P\&C}$ discussion threads as compared to C_C discussions. Here lower entropy value signifies that a large number of comments are posted by a small number of citizens and police in the $C_{P\&C}$ threads. Thus, we conjecture that these threads may contribute less towards police endeavours to obtain mass public participation in community policing.

Content Interaction. Next, we analyze the number of comments and 'likes' on posts to understand which category of discussion threads gets maximum interest and support.

In citizen initiated threads, we find that $C_{P\&C}$ gets fewer 'likes' (9.49% lower) and 'comments' (29.75% lower) per post compared to C_C (Table 5). We observe that these posts are regarding specific issues such as lost vehicle or mobile phone, some problem regarding FIR (First Information Report) filed, complaints, and so on. In most of such posts, police suggests an appropriate action and the discussion tends to close early, resulting in lower interaction in the form of comments and 'likes' by others:

Citizen post: “My family and I are getting the unwanted calls from the given number [withheld]. Especially he is misbehaving with a female member. My Number is - [withheld]”
Police reply: “Dear [withheld], Please visit at your nearest Police Station and lodge a complaint with details and they will assist you in this regard... Thank you”

In contrast, in police initiated discussion threads, the ($P_{P\&C}$) category gets more 'likes' (30.28% higher) and 'comments' (99.19% higher) per post than ones where only citizens comment (P_C). As posts in $P_{P\&C}$ discussions are mainly advisories where police requests citizens for some action or shares information with them, these may generate more engagement in the form of 'likes' and

Table 5: Mean, median and standard dev. of comments and 'likes' on posts of different discussion threads. ** $p < .01$ and * $p < .05$, per Mann Whitney U tests.

	Comments			'Likes'		
	Avg	Std dev.	Med	Avg	Std dev.	Med
$P_{P\&C}$	19.68	86.17	7	114.71	805.55	22
P_C	9.88	74.92	3	88.05	1025.53	22
<i>z</i> -score	-48.25**			-1.19		
$C_{P\&C}$	3.34	19.19	2	9.4	253.85	2
C_C	3.69	13.79	2	13.38	201.57	3
<i>z</i> -score	-2.275*			-19.54**		

commentary among police and citizens. However, in P_C discussions, posts largely include topics like notice issued or people prosecuted, which may result in lesser commentary in individual posts.

6. RQ 3: EMOTIONAL EXPRESSION

In addressing RQ 3, we now discuss our observation on the two measures of emotional expression --- *emotional valence and emotional intensity* expressed by citizens and police on the different discussion thread categories.

Emotional valence analysis shows citizens to generally express negative emotions both in $C_{P\&C}$ and C_C threads (Table 6). However, Negative Affect (NA) is 16.67% higher in $C_{P\&C}$ than C_C discussions. We further analyse the distribution of "anger", "anxiety", and "sadness" expressed in comments on citizen posts. We find that in both $C_{P\&C}$ and C_C discussion threads, dominant emotion is "anger" followed by "sadness" and "anxiety". However, we find that "anxiety" is significantly higher (200%) in the C_C threads than $C_{P\&C}$. This may indicate that discussions where only citizens comment, manifest higher levels nervousness and worry (expressions of anxiety) than the citizen discussions where police also participates in commentary:

"I am just **worried** if Hyderabad Traffic Police [HTP] makes things worse like always and create more chaos. Frankly speaking... it's the lower income group or the people who are not aware using high beams. Try to educate people on road."

Table 6: Emotional valence averaged across citizen initiated discussion threads and Mann Whitney U Test for statistical testing. ** $p = .01$. PA = Positive Affect, NA = Negative Affect, Anx= Anxiety.

	$C_{P\&C}$			C_C			<i>z</i>
	Avg	Std	Median	Avg	Std	Median	
PA**	0.08	0.11	0.05	0.06	0.12	0.02	-37.46
NA**	0.021	0.03	0.01	0.018	0.04	0.00	-14.41
Anx**	0.001	0.01	0.00	0.003	0.02	0.00	-10.29
Anger**	0.006	0.02	0.00	0.005	0.02	0.00	-3.52
Sad**	0.001	0.01	0.00	0.002	0.01	0.00	-8.03

Table 7: Emotional valence averaged across discussion threads initiated by the police. ** $p < .01$.

	$P_{P\&C}$			P_C			<i>z</i>
	Avg	Std	Median	Avg	Std	Median	
PA**	0.0668	0.07	0.04	0.0702	0.12	0.018	-12.99
NA**	0.0157	0.02	0.01	0.0157	0.03	0.019	-9.43
Anx**	0.0019	0.005	0.00	0.0021	0.008	0.015	-6.64
Anger**	0.0050	0.009	0.00	0.0049	.018	0.012	-11.40
Sad**	0.0016	0.005	0.00	0.0021	0.014	0.009	-4.71

Table 8: Emotional intensity averaged across the four different categories of discussion threads. ** $p < .01$.

	$C_{P\&C}$			C_C			<i>z</i>
	Avg	Std	Median	Avg	Std	Median	
Arousal**	4.40	1.74	5.01	3.90	2.16	4.66	-11.74
	$P_{P\&C}$			P_C			<i>z</i>
	Avg	Std	Median	Avg	Std	Median	
Arousal**	4.19	1.23	4.35	3.75	2.00	4.15	-8.43

We find a similar trend of expression of "anxiety" in the police initiated discussion threads (Table 7). Anxiety is lower (9.52%) in the discussions where police also participate ($P_{P\&C}$) than P_C discussion.

On analysing positive affect (PA), we find that $C_{P\&C}$ threads are observed to share 33.34% higher positivity than in the threads where only citizens participate in commentary (C_C) -- refer Table 6. Otherwise considered as a "coercive arm of the state" (Lewis and Lewis (2012)), this finding indicates that community discussions where police also participates can be used to transfuse positive feelings and perceptions among the citizens.

Next, analysing the emotional intensity expressed in citizen initiated discussion threads, we find that $C_{P\&C}$ threads show 12.82% higher arousal than C_C (Table 8). We find similar trends in the police initiated discussion: $P_{P\&C}$ threads show higher arousal (11.74%) than those with only citizen commentary, i.e., P_C (Table 8). Previous work also recognises higher arousal and negative affect to be markers of sensitisation (Choudhury et al. (2014)); presumably in police-citizen discourse, citizens are highly sensitised due to disclosure of personal and community challenges, experience of erosion of law and order.

7. RQ 4: COGNITIVE AND SOCIAL ORIENTATION

Finally, in RQ 4 we analyse linguistic constructs of cognitive and social orientation in different discussion threads. We find that in citizen initiated threads, use of impersonal pronouns is higher (23.34%) in the C_C category than $C_{P\&C}$, whereas personal pronouns use is 37.78% higher in $C_{P\&C}$ than C_C (Table 9). Further C_C threads show a higher (75% more) use of 1st person personal singular pronouns, 3rd person personal singular pronouns and 3rd person plural pronouns than those in which both police and

citizens comment ($C_{P\&C}$). Together, this indicates that discussion threads involving just the citizens are highly self-attention focused; likely citizens mostly express their own concerns that they face with others:

“ I have lived in the UK and all the time I have never heard anyone honking. Honking is not required if you know how to drive [...] Can anyone advise me where to complain if I see anyone who don't comply ? ”

Table 9: Social and cognitive orientation measures in $C_{P\&C}$ and C_C discussion threads. $ p < .01$. p_{pron} = personal pronouns, i = 1st person singular pronouns, we = 1st person plural pronouns, you = 2nd person shehe = 3rd person singular pronouns, $they$ = 3rd person plural pronoun, i_{pron} = impersonal pronouns.**

	$C_{P\&C}$			C_C			z
	avg	std	median	avg	std	median	
Interpersonal Focus							
p_{pron}^{**}	0.062	0.059	0.053	0.045	0.056	0.033	-24.49
i^{**}	0.008	0.017	0.000	0.014	0.033	0.000	-16.02
we^{**}	0.014	0.031	0.000	0.007	0.021	0.000	-16.01
you^{**}	0.033	0.047	0.018	0.012	0.032	0.000	-45.85
$shehe^{**}$	0.002	0.010	0.000	0.003	0.016	0.000	-4.44
$they^{**}$	0.005	0.013	0.000	0.008	0.022	0.000	-14.20
i_{pron}^{**}	0.030	0.036	0.023	0.037	0.051	0.025	-6.03
Social Orientation							
$family^{**}$	0.001	0.005	0.00	0.002	0.015	0.00	-9.49
$friend^{**}$	0.0003	0.003	0.00	0.001	0.010	0.00	-8.17
$humans^{**}$	0.008	0.026	0.00	0.012	0.033	0.00	-12.91
Cognition							
$CogMech^{***}$	0.121	0.077	0.124	0.114	0.100	0.113	-8.52
$tentativeness^{**}$	0.015	0.024	0.000	0.017	0.029	0.000	-3.98
$Discrepancy^{**}$	0.009	.018	0.000	0.013	0.032	0.000	-2.69

We also find that C_C threads have more mentions of "family", "friends", and "social" words, than $C_{P\&C}$ (Table 9). However, collective identity words such as 1st person personal plural pronouns such as "we" are very few in these conversations. Next, the occurrence of 2nd person pronoun words is 63.64% lower in C_C threads than $C_{P\&C}$. Literature shows that 2nd person pronoun use is higher when people show increased focus on others (Pennebaker et al. (2003)). This could be to advise others or to hold others accountable. When police and citizens both participate in commentary, they tend to indulge in direct references to each other in the conversation. This could also be attributed to police participation in answering citizen queries, and the latter's use of gratification words toward the former.

Cognitive process words in C_C discussion threads show higher "tentativeness" (*should, would, could*) and higher "discrepancy" (*guess, maybe, perhaps*) -- refer Table 9; these are known to indicate increased awareness of one's social environment (Pennebaker et al. (2003)).

“I guess law needs to change. This needs to be restricted to law enforcement vehicles during emergency-only. In the above case, there was only the driver in the car”.

We find similar trends of pronoun use in police initiated discussion threads (Table 10). P_C threads have 92.31% higher mention of 1st person singular pronouns and less mention of 1st person plural pronouns, showing high self-focus. However, contrary to citizen initiated threads, we find that mention of "family" and "friends" is less in these posts by police.

Table 10: Social and cognitive orientation measures in $P_{P\&C}$ and P_C discussion threads. $ p < .01$.**

	$P_{P\&C}$			P_C			z
	avg	std	median	avg	std	median	
Interpersonal Focus							
p_{pron}^{**}	0.051	0.036	0.047	0.040	0.043	0.037	-20.96
i^{**}	0.013	0.016	0.009	0.014	0.025	0.006	-5.51
we^{**}	0.008	0.013	0.004	0.007	0.016	0.000	-15.35
you^{**}	0.021	0.032	0.012	0.011	0.025	0.000	-32.86
$shehe^{**}$	0.002	0.007	0.000	0.002	0.013	0.000	-8.91
$they^{**}$	0.007	0.011	0.000	0.007	0.013	0.000	-9.96
i_{pron}	0.036	0.026	0.036	0.039	0.043	0.036	-1.33
Social Orientation							
$family^{**}$	0.11	0.48	0.00	0.09	0.62	0.00	-8.77
$friend^{**}$	0.08	0.42	0.00	0.06	0.50	0.00	-10.03
$humans^{**}$	1.42	1.98	1.00	1.62	4.19	0.60	-10.42
Cognition							
$CogMech^{**}$	0.128	0.057	0.133	0.118	0.081	12.50	-8.54
$discrep^{**}$	0.014	0.015	0.012	0.013	0.019	0.72	-10.13
$tentat^{**}$	0.018	0.017	0.017	0.017	0.024	1.30	-9.94

8. DISCUSSION

Behavioural patterns reflected on social media may act as markers of the psychological state of citizens and may also help understand civic needs and general well-being of the society. Our work explores the viability of using content generated on Facebook police pages as an instrument to quantify and characterise attributes of police and citizen's interactions around day-to-day safety needs. Towards improving safety and law enforcement, we find that citizens are appropriating a public platform like Facebook to discuss collective solutions with police and members of civic society at large.

Understanding citizen reactions is a challenge for police departments as they mostly depend upon administrative and crime reports to gauge citizen reactions. Our study highlights that Facebook can be used to record and sense behavioural attributes such as engagement, emotions, and social support expressed between police and citizens. We show the four distinctive measures i.e. topics discussed, emotions, engagement characteristic and cognitive processes can be used to extract and measure these attributes from large-scale data available on social media. This understanding can help police improve policing and community sensing.

Further, social media seems to enable police and citizen community to enhance emotional support to residents experiencing safety issues. We observed that discussion threads with police and citizen

commentary showed reduced levels of anxiety, showing police interactions can be calming to citizens. Measuring emotional needs of citizens using social media may help police and other law enforcement agencies to interact with citizens in a timely manner. We also found that discussion threads where citizens and police both comment were marked by high negative affect and arousal. In fact, arousal was more strongly correlated with negative affect than positive effect; thus exhibiting the fact that citizens may increasingly try to educate others about negative incidents they counter and gain mutual sympathy of other members in the community (Smith (2010)).

Our finding also indicated high social cohesion and a healthy social exchange between police and citizens on an informal public platform like Facebook, wherein both parties might be motivated to address lawlessness and safety concerns together. The discussion threads with both police and citizen commentary indicated a stronger notion of a collective identity via the use of 1st person plural pronouns. Thus, highlighting social media role in supporting discussions on collective action among police and citizen community.

We further observed that Facebook discussion threads where only the citizens commented manifested higher self-focus (greater use of the first person pronoun singular), and cognitive processing ("cognitive mech", "tentativeness", "discrepancy") than those with both police and citizen commentary. These discussion threads likely point to how citizens are purposing a public social media platform to voice their opinion around their personal everyday challenges. In a way, these platforms are enabling them engage with others to address accountability concerns on the part of the police, as have been observed in other community platforms (crime discussion web forums) (Lewis and Lewis (2012)).

Summarily, we envisage technologies that can help communities to make consensus based decisions on support and actions they seek from police using social media content. Technologies may also be built for authorities and police that help gauge changing emotions and behaviour among citizens, including timely and early predictive analytical systems. These technologies could help police to sense and record the reactions of citizens and share these records with decision makers to help take timely measures and gain better insights about citizens' concerns.

8.1. Limitations and Future Directions

Although we see potential use of social media to develop technologies and provisions for gauging citizen well-being, we understand that these technologies

may not work as standalone solutions. Rather, we believe that these solutions may complement existing methods and become part of broader detection systems and awareness programs about citizen's psychological and social responses.

We caution while interpreting our findings. Our work leverages a variety of computational methods and measures to make sense of the interactions between police and citizens, but requires further proof through surveys and interviews. In future, we plan to interview police and citizen participating in discussions on social media to understand motivation for sharing their thoughts on a public platform.

We study users from urban areas where social media penetration is high. It is worthwhile to examine if factors such as demography, education, the cultural background could influence citizen participation in social media. Different cultural setting may result in different expectations of citizens from police, however, we believe that even then police would need general understanding of what citizens feel and what issues concern them. Our methodology in this paper can help police departments from varied cultures to use social media for understanding their citizen communities. We suggest that future work should study cultural aspects and use our suggested measures to compare police and citizen interactions in different cultural settings. Lastly, there are other social media which police is exploring like Twitter and YouTube; in future, we plan to extend our work to other platforms.

9. CONCLUSION

In this paper, we examined discussions between police and citizens on Facebook pages of 85 Indian police departments. We found that compared to citizen initiated discussions, police initiated discussions contribute more towards engaging masses on safety related topics. Discussions where both police and citizens participated were marked by higher negative emotions (such as anger) and psychological arousal. Citizen only discussions showed higher self-focus and contributed less towards collective action than discussions involving both police and citizens. Our findings bear implications in the design of social media technologies to provide timely help and support for police to gauge safety and well-being of citizens.

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