

# Spreading information or engaging the public? The German police's communication on Twitter

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## Abstract:

Police like other public organizations increasingly use social media for external communication. Due to bureaucratic organization social media poses a communication challenge for them. This study analyses the content of tweets by German police using a three-category framework. Machine-learning based classification tasks are coupled with multilevel modeling to analyze all tweets distributed in 2019. The study demonstrates that police largely use Twitter to distribute information unidirectionally focusing on core tasks, while information gathering, and public relations only play a subordinate role. There is variation between accounts. However, the model only explains parts of it, thus inviting for follow-up research.

## Keywords:

Germany, police, Twitter, machine-learning, communication

## Introduction

As with other public organizations (Mergel & Bretschneider, 2013), the police increasingly use social media as part of their communication (Meijer & Torenvlied, 2016; van de Velde, Meijer, & Homburg, 2015). The use of social media is argued to have a significant effect on public organizations as it allows them to interact with the public in a more dialogical way (Kim, Park, & Rho, 2015; Mergel & Bretschneider, 2013; van Dijck & Poell, 2013). This has the potential to create transparency of public services, increase collaboration with citizens, and lead to greater public trust. Character-limited “micro-blogging” services, like Twitter, are seen as

particularly valuable additions (Etter, 2014; Meijer & Torenvlied, 2016). However, not much is known of the police's use of Twitter. This study will investigate what German police are tweeting about and how they use Twitter in public relations.

The police are an interesting case since they are a bureaucratic organization that works with strong hierarchies, a high degree of formality, and strong legal regulations on their behavior (Dekker, van den Brink, & Meijer, 2020; Meijer & Torenvlied, 2016). This makes them especially challenged in engaging with social media logic, which is based on flexibility, speed, and interactivity (van Dijck & Poell, 2013). At the same time, the police have a special role in society as the only organization that enforces laws and uses coercive measures. This means they rely on institutional legitimacy and the public's support to fulfil their core societal tasks (Meijer & Thaens, 2013). Simultaneously, the police are under increasing public scrutiny regarding how they conduct their work. This also means they have to constantly re-establish and negotiate their legitimacy also on social media (Ralph, 2021). Twitter therefore can be an important tool for them (Walsh & O'Connor, 2019).

Studies on the police and social media point to both growing interest and expectations by the public (Hu, Rodgers, & Lovrich, 2018; Ruddell & Jones, 2013). Moreover, it is highlighted that police utilize Twitter for very different purposes, ranging from supporting core tasks to public relations (see e.g. Grimmelikhuijsen & Meijer, 2015; Heverin & Zach, 2010; Hu et al., 2018; Jungblut, Kümpel, & Steer, 2022; van de Velde et al., 2015; C. B. Williams et al., 2018). Prior research suggests that the police's use of Twitter is often focused on spreading information (Crump, 2011; Meijer & Thaens, 2013; Meijer & Torenvlied, 2016). However, other studies point to its use in emphasizing public dialogue (O'Connor, 2017; O'Connor & Zaidi, 2020; Thomas, Hatten, & Connealy, 2022; C. B. Williams et al., 2018).

Regarding the German police, literature is especially scarce and there are no encompassing studies that analyze what German police tweet about or how they use Twitter. German police offer an interesting case as they operate within a federal system without national guidelines for the use of social media (Rogus & Rüdiger, 2014). At the same time, they are operating with strong hierarchies and their social media presence uses a centralized top-down strategy (Bayerl & Rüdiger, 2017). This makes them a least-likely case for using social media to its fullest potential, namely dialogical communication with citizens. Thus, results of our study will provide insights into the use of social media by public organizations facing sub-optimal conditions while focusing on variation among local branches.

This study combines a machine-learning based classification task with multi-level modelling. It examines all tweets sent in 2019 (n=78,317) by all active Twitter accounts of German police departments, investigating variation in the content of tweets and how Twitter is used as a public relations tool.

### **The public sector, police, and social media**

The rise of social media not only affected the private sector but also public organizations, which have adopted their communication strategies in response to it (Macnamara & Zerfass, 2012; Mergel & Bretschneider, 2013; Oliveira & Welch, 2013). Historically, public organizations focused their communication on centralized and formal practices (Mergel, 2013). Social media challenged this uni-directional distribution of information (Mergel, 2012). However, the centralized, risk-averse, and hierarchical communication practices of public organizations present a hindrance to this process (Olsson & Eriksson, 2016). The fact that social media tools are cheap, easy, and fast to implement makes them an attractive addition to communication strategies (Allagui & Breslow, 2016). At the same time, how they are used in day-to-day communication is based on decisions such as the organizational tasks that will be the basis for

social media activities, or the desired level of interactivity (Bullock, 2018; Manetti, Bellucci, & Bagnoli, 2017; Walsh & O'Connor, 2019). Thus, whether public organizations capitalize on social media's new opportunities for interactive communication, or whether they approach it with a more uni-directional approach seems to vary between types of tasks and organizational contexts (Bonsón, Royo, & Ratkai, 2017; Oliveira & Welch, 2013).

Social media platforms operate with their own functional logic (van Dijck & Poell, 2013). They allow organizations to bypass traditional mass media and directly communicate with the public (Bortree & Seltzer, 2009; Rybalko & Seltzer, 2010). Various studies have highlighted the advantages of a more dialogue-oriented communication through social media. For instance, the ability to build and maintain relationships with the public, overcoming organizational crises, or maintaining organizational trust (Romenti, Murtarelli, & Valentini, 2014; Watkins & Lewis, 2014). This echoes arguments from excellence theory, which stresses that excellence in public relations can be linked to crafting quality and lasting relations with constituencies (Grunig & Grunig, 2008). Similar aspects have also been highlighted regarding reputation management of public organizations (Wæraas & Byrkjeflot, 2012).

These opportunities of social media are also advantageous for the police. The presence of police on social media is part of a general interest by public organizations in this technology (Hu et al., 2018; Meijer & Torenvlied, 2016; Mergel, 2013). Additionally, there is evidence that the public has a growing demand for a police presence on social media (Ruddell & Jones, 2013). Finally, police can draw distinct advantages from using social media. This includes fast and direct distribution of information, gathering material to help investigations, and increasing public support (see e.g. Grimmelikhuijsen & Meijer, 2015; Meijer, 2014; Meijer & Torenvlied, 2016).

Whether police can profit from these advantages depends on their use and the content they share on social media. So far there are only a few studies investigating the content of tweets by the police. Those studies either use detailed qualitative analysis of smaller samples (e.g. Akkaya, Fedorowicz, & Krcmar, 2019; Deneff, Bayerl, & Kaptein, 2013), cover a more limited geographical area (e.g. Thomas et al., 2022), or focus on specific characteristics of messages such as emotional elements (e.g. Leppert, Saliterer, & Korać, 2022). Our paper offers a more encompassing analysis of what German police departments tweet about investigating in how far environmental factors influence how specific police departments use Twitter.

We cluster communication on Twitter along two, partially overlapping, dimensions. First, we build on the argument above regarding uni-directional versus dialogue-oriented communication. On this dimension, one can distinguish between three levels of interactivity of communication, namely push, pull, and networking (Huang, Wu, Huang, & Bort, 2017; Meijer & Thaens, 2013). These three levels should not be understood in a way that one is always better than the other, they rather describe different approaches to communication whose effectiveness depends on the type of organizational task they are coupled with (Oliveira & Welch, 2013). The first (push) uses social media similarly to classical forms of communication and focuses on uni-directional spreading of information (Bortree & Seltzer, 2009; Rybalko & Seltzer, 2010). This allows the organization to circumvent mass media and share information quickly on their own terms. The second (pull) aims at gathering information from the public by inviting them to provide relevant knowledge. This also has a strong focus on sending information directly to citizens, but it differs from the first as communication includes a request to the public to respond and provide relevant information. While this does not aim at establishing a fully-fledged dialogue, it already entails a first element of inviting responses. The third way of communicating (networking) aims at establishing a fully-fledged interaction with the public leading to dialogical communication.

The second dimension focuses on the organizational task that is the basis for social media activities. The literature describes a wide array of tasks for which public organizations in general and the police in particular do use Twitter. While there is no agreed-upon list of tasks, the described usages can be clustered into two groups: a.) core organizational tasks and b.) public relations. The former builds on literature describing purposes for which public organizations use social media in support of their core societal duties, in the case of the police public safety. While there is some variation in the literature regarding the main organizational tasks for which police use social media, one can identify a common core of activities. The most frequently named activity that nearly all studies highlight is sharing information about crimes (e.g. Dekker et al., 2020; Meijer & Torenvlied, 2016; van de Velde et al., 2015). Some studies point to the importance of Twitter for communication in crisis situations such as terror attacks (e.g. Akkaya et al., 2019; Fowler, 2017). Other studies name sharing information about traffic problems as a task for which Twitter is being used (e.g. Grimmelikhuijsen & Meijer, 2015; Heverin & Zach, 2010; Huang et al., 2017). Another common core task that is mentioned is requesting information from citizens to assist solving crimes (e.g. Bullock, 2018; Crump, 2011; C. B. Williams et al., 2018) or find missing persons (e.g. Solymosi, Petcu, & Wilkinson, 2021). Some studies identify providing advice for crime prevention to the public as another activity for which social media is used (e.g. Hu et al., 2018; Lieberman, Koetzle, & Sakiyama, 2013; O'Connor & Zaidi, 2020). Finally, the provision of information about events organized by the police and general information about police departments are organizational tasks highlighted in the literature (e.g. Heverin & Zach, 2010; van de Velde et al., 2015; Walsh & O'Connor, 2019).

The second group of tasks, public relations, is not directly related to the core work of the organization but rather aims at supporting its long-term public image and through this fostering institutionalization (Selznick, 1957). Activities here have a longer time horizon, as they are not

only focusing on the day-to-day work but try to engage the public and create relations with the aim to foster trust, secure support as well as organizational resources in the future (Wæraas & Byrkjeflot, 2012). The activity that is most-commonly named in the literature on the police is the use of Twitter for improving the public image (e.g. Brainard & Edlins, 2015; Kudla & Parnaby, 2018; Ruddell & Jones, 2013; Schneider, 2016), an approach which has clear links to reputation management (Wæraas & Byrkjeflot, 2012). Another activity that is highlighted is using Twitter to promote the police as a workplace or for recruitment purposes (e.g. Bayerl & Rüdiger, 2017; Huang et al., 2017; O'Connor & Zaidi, 2020). Two other activities that are named more seldom are the use of Twitter for promoting other social media accounts (e.g. Hu et al., 2018; Lieberman et al., 2013), and using Twitter to share trivia or humorous posts (Brainard & Edlins, 2015; van de Velde et al., 2015).

Given the diversity of tasks highlighted in the literature and the lack of agreement on a core set of tasks, we build on the two, partially overlapping, dimensions described above and created three core categories that we use to analyze the content of tweets. The first category covers uni-directional communication that focuses on pushing information about core organizational tasks. The second category covers tweets that request information from the public regarding core organizational tasks.<sup>1</sup> The third category focuses on dialogical communication that aims at networking with the public and improving public relations. Table 1 provides an overview of the categories and examples of constituent police activities.

[TABLE 1 HERE]

### **Hypotheses on the use of Twitter by the German police**

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<sup>1</sup> It is important to keep in mind that we do not assess whether the request for information is successful, meaning whether the public also replies to it. We only focus on the intention of the police.

In the following, we will develop three hypotheses on the use of Twitter by German police. These will be based on the framework presented in table 1, literature on public organizations' social media use as well as characteristics of the German police.

The starting point for formulating hypotheses is the observation that social media tools are not monolithic but instead need to be adapted to particular purposes and contexts when employed by public organizations (Oliveira & Welch, 2013). Thus, how interactive and for which organizational task social media is used (see table 1) is important to understand the coupling between organizational activities and social media communication. Studies of different public sector organizations highlight that organizational and environmental factors are important sources of variation regarding the use of social media as well as the coupling between organizational tasks and communication of social media (Bonsón et al., 2017; Manetti et al., 2017; Oliveira & Welch, 2013). Thus, it is more relevant to know how public organizations use social media than simply knowing that they use it (Manetti et al., 2017; Oliveira & Welch, 2013). Due to the importance of organizational and environmental factors, it is necessary to embed the hypotheses in contextual information on the German police.

Germany, like other federal countries, has decentralized police. The German constitution gives the sixteen *Bundesländer* (federal states) the main authority to regulate the police (Frevel & Groß, 2008; Ritsert & Pekar, 2009). While there is a federal level police service, the *Bundespolizei*, it only has very limited responsibilities such as border protection or investigating certain major crimes (Ritsert & Pekar, 2009). Each *Bundesland* has its own organizational structure for police services, but the fiscal and legal authority in all *Bundesländer* lies with the respective ministry and state parliament. So, contrary to other federal countries, for example the U.S., this means that within each *Bundesland* there is a clear organizational hierarchy from the state down to the local police department with the respective state Ministry of the Interior as supervising body (Das & Palmiotto, 2004). While this



organizational hierarchy controls activities of police departments, there is no federal guideline that provides regulations for the way German police should use social media (Rogus & Rüdiger, 2014).

The relation between the public and the German police is still characterized by a picture of the German police as the authoritative arm of the state (Bayerl & Rüdiger, 2017). It follows that dialogical communication has historically not been expected from German police. This makes the use of social media especially relevant for German police, as this could be a central tool to overcome this (Bayerl & Rüdiger, 2017). However, German police only started to use social media in the early 2010s and thus are a latecomer compared to other countries (Bayerl & Rüdiger, 2017; Jungblut & Jungblut, 2021). Moreover, German police use a centralized, top-down strategy focusing on departmental instead of personal accounts of neighborhood officers, which would allow for more personal communication (Bayerl & Rüdiger, 2017; Leppert et al., 2022; Meijer & Thaens, 2013). In combination with the hierarchical organizational culture that German police have and their limited training and resources to actively engage with social media (Bayerl & Rüdiger, 2017; Rüdiger & Rogus, 2014), this makes them especially challenged in their implementation of dialogical communication. Given these challenges we expect that German police use Twitter more in line with classical communication tools focusing on uni-directional sharing of information regarding their main organizational tasks (see table 1):

- 1. Uni-directional information sharing will be the most common category for tweets by the German police.*

Police departments are responsible for policing specific areas, and their communication is geared to the population for which they are responsible. This means that characteristics of the environment can impact their communication (Jungblut & Jungblut, 2021). For example, a

study of the use of Twitter by departments of the NYPD highlights that the social media strategy is heterogeneous across departments and that Twitter is used in line with local precincts' needs and characteristics of the area that is being policed (Thomas et al., 2022). This shows that the environment can create different demands for communication. Here, the literature points to factors such as levels of urbanization or the size of the population that can cause local organizations to differ in their social media usage (Bonsón et al., 2017; Manetti et al., 2017; Oliveira & Welch, 2013). Linking this to our categories presented in table 1, we expect that a larger population would correlate with a greater need for inviting the public to provide information for investigations as more people in a police district should correlate with more crimes that demand information from citizens. Thus, we expect that:

2. *Police departments that are responsible for areas with a larger population will use Twitter more for information gathering.*

German police does not have a common guideline or strategy for social media use (Rogus & Rüdiger, 2014) and earlier studies have uncovered organizational differences in the frequency of their tweets (Jungblut & Jungblut, 2021). Moreover, social media usage differs between age and geographic groups; younger people are more active on social media<sup>2</sup>, and urban areas in Germany have a lower mean age compared to rural areas<sup>3</sup>. Given that trust in the police is especially low among the younger population (L. S. Williams & Nofziger, 2003), we would expect that the demand for the police to use Twitter for public relations purposes and to engage in networking with the public is higher in more urban areas:

3. *Police departments in urban areas and large cities will use Twitter more for public relations and networking purposes.*

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<sup>2</sup> See: [https://www.ard-zdf-onlinestudie.de/files/2020/0920\\_Beisch\\_Schaefer.pdf](https://www.ard-zdf-onlinestudie.de/files/2020/0920_Beisch_Schaefer.pdf)

<sup>3</sup> See: [https://www.iwkoeln.de/fileadmin/user\\_upload/Studien/Kurzberichte/PDF/2019/IW-Kurzbericht\\_2019\\_Alterung\\_der\\_Gesellschaft.pdf](https://www.iwkoeln.de/fileadmin/user_upload/Studien/Kurzberichte/PDF/2019/IW-Kurzbericht_2019_Alterung_der_Gesellschaft.pdf)

While the factors that our study focuses on are the main aspects raised in the literature, some studies raise additional aspects. Thomas et al. (2022), for example, point out that other characteristics of the policed area such as existence of major tourist destinations has an influence on how police use Twitter. Moreover, they argue that the existence of an overarching communication strategy can have a positive influence on the likelihood of police engaging more in dialogue through Twitter. Finally, several studies point to the need for sufficient resources and training as a prerequisite for more active use of Twitter (e.g. Bayerl & Rüdiger, 2017; Rogus & Rüdiger, 2014). We did not formulate hypotheses related to these factors due to a lack of data (e.g. regarding the level of training and available resources). We will come back to this point in the concluding section.

## **Data and methods**

### *Data*

We conducted an automated content analysis of all Twitter communication by German police in 2019. Twitter was selected because it offers an easy way to directly and immediately share information and it makes it possible to directly enter a dialogue with citizens. Consequentially, microblogging services such as Twitter have become an important tool for police communication (e.g., Meijer & Torenvlied, 2016).

In a first step, we identified all Twitter accounts by German police that in 2019 published at least one tweet.<sup>4</sup> For this, we utilized the list provided by Reuter et al. (2018) and supplemented it through searching on Twitter for the German word for police (“Polizei”). We then validated each account creating a sample of 155 unique accounts.

With the help of Facepager (Jünger & Keyling, 2019), we collected all tweets distributed in 2019 using access to the Twitter Developer application programming interface (API). This led

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<sup>4</sup> The range of tweets per account is between 43 and 2151.

to an initial sample of 137,771 tweets including retweets and replies. Since our study focuses on the content of communication by the German police, we decided to restrict the sample to original posts leaving out replies and retweets. This led to a sample of 78,317 tweets.

While retweets and replies could also be part of different forms of two-way communication, there are several analytical and conceptual reasons not to analyze them. First, replies often are very short texts that contain little semantic information. As a result, their meaning is not easily classified neither by machine learning algorithms nor by human readers. Second, replies are often hard to understand if you do not contextualize them by reading the original post. These tweets, however, partly belong to private accounts and are thus not visible in Twitter creating a potential bias in the data set. Moreover, even if the original post is visible it is an ethical question whether one wants to download and analyze private citizen's twitter communication. Third, we decided to exclude replies from our analysis as they often consist of standardized answers that do not necessarily address the initial question. As such, one could argue whether these types of replies actually qualify for two-way communication. In addition, we decided to also exclude retweets from the analysis as they rather express a form of endorsement than a dialogue. Moreover, a quick check of our data reveals that among the 100 most retweeted accounts that make up for roughly 78% of retweets, there is not a single 'ordinary' citizen. Rather, these accounts belong to other police entities, different ministries of interior, firefighters or public administration. Thus, retweets do not provide a helpful measure of two-way communication towards the general public. As a result, instead of focusing on how the police respond to the public, we focus in our coding on deliberate and strategic attempts by the police to foster dialogue in form of the pull or the networking approach.

This dataset was supplemented by creating four account-level measures. First, we extracted information on the population in each policed area. To do so, we relied on population data of each administrative district that was extracted either from the police entities' website or from

the webpage of the municipality. Second, we created a measure for the degree of urbanization of the policed area. We manually classified each policed area into one of the following five categories: (1) federal police, (2) state police, (3) police in large metropolitan areas, (4) police in cities, or (5) police in rural areas. Third, we created a measure for the police entities' level in the organizational hierarchy. More specifically, we extracted information from each police entity's website to determine its position within the police's overall organizational structure. We thereby differentiate between federal, state, regional, subregional, and local police entities (see figure 1). Since there is no available information on the budget of each individual police department, we rely on this variable as a proxy for available resources assuming that police entities placed higher in the organizational hierarchy should have more resources and personnel. We decided to integrate this variable as a control, since we believe that the available resources and the level of organizational hierarchy impact how social media can be used and what tasks are addressed.<sup>5</sup> Finally, since the main authority on police matters is with the *Bundeländer*, we included the respective *Bundesland* as a control variable.

**[FIGURE 1 HERE]**

### *Preprocessing*

To classify the content of each tweet, we trained machine learning algorithms (van Atteveldt, Trilling, & Calderon, 2022). Since prior research can be condensed to a restricted set of potential classes, i.e. the introduced core categories (see table 1), and since our corpus of tweets extends what can be classified manually, supervised machine learning offers a promising approach to gain an overview of the actual content of police communication. As each tweet can theoretically fall in multiple categories – e.g., by sharing detailed information about a crime

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<sup>5</sup> Of Germany's 16 federal states three are city-states, namely Berlin, Hamburg, and Bremen. As their spatial spread differs vastly from the other states, we decided to classify these accounts as being organized at the state level, but as police entities from a metropolitan area.

and then asking for eyewitnesses – we decided to train classifiers for each category independently.

In a first step, we conducted extensive pre-processing following the guidelines suggested by Pilny et al. (2019) as well as Maier et al. (2018). More specifically, we first transferred the text of each tweet to lower case. Hereafter, we removed all regular URLs, all Twitter short URLs, and all punctuation. Then we removed all stopwords – e.g. articles, pronouns – relying on the Marimo stopword list for the German language.<sup>6</sup> After this, we removed all numbers from the text and removed all unnecessary whitespace. After these basic preprocessing steps, we relied on the R wrapper around the Python spaCy package – `spacyr` – to tokenize and lemmatize the text. Tokenization refers to breaking down a text into individual components that are separated by spaces in the original text. Lemmatization describes the conversion of a token to its lemma form or lexeme (Manning & Schütze, 2003) in order to “make inflected words comparable to each other” (Maier et al., 2018, p. 98). We then excluded all tokens that consist of a single character as these kinds of terms do not exist in the German language and don’t carry any meaning.

After texts were preprocessed and transferred to tokenized objects, we created a document-feature-matrix (DFM) that consisted of unigrams and bigrams. In this matrix, each line represents a tweet while each column represents a token in the corpus. Each cell describes then how often the token appears in the tweet. Moreover, the columns of our DFM contained unigrams – so each individual token – as well as bigrams meaning combinations of two tokens that follow each other as incorporating bigrams in text classification increases the classifier’s performance (Tan, Wang, & Lee, 2002). Finally, we applied relative pruning to improve the performance of classifiers (see Maier et al., 2018). Here, bigrams and unigrams that either

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<sup>6</sup> <https://github.com/koheiw/marimo>

appear very frequently – in more than 99% of tweets – or that appear very rarely – in less than 1% of the tweets – were excluded from the DFM. This follows the idea that very frequent as well as very rare features do not provide helpful information for the desired automatic inferences reducing the classifiers' performance.

Finally, it is important to outline that preprocessing of tweets also has an impact on the overall sample size. Tweets with only a few characters or tweets that contain no meaningful content – e.g. that only consist of stopwords – were automatically excluded leaving a final sample of 75,487 tweets.

### *Classification & Validation*

To train our classifiers and validate their performance, we extracted a random sample of 3,000 tweets and created a codebook in which we operationalized how the three content categories can be identified in a tweet. In the codebook, each content variable could be either present or absent resulting in three binary coding decisions (see supplemental materials for the codebook). A subsample of 100 tweets was coded to measure intercoder reliability for the three variables creating overall satisfying results (Information sharing: Holsti = .99, Krippendorff's  $\alpha$  = .94; Information gathering: Holsti = .99, Krippendorff's  $\alpha$  = .96; Public Relations: Holsti = .95, Krippendorff's  $\alpha$  = .80). After discussing cases of disagreement, the remaining 2,900 tweets were coded.

Following best practice advice (e.g. Burscher, Vliegenthart, & De Vreese, 2015), we divided the manually coded data into training data (80%) and test data (20%) using random sampling. The training data (n=2,400) was used to train a series of classifiers. More specifically we trained a naïve Bayes (NB), a support vector machine (SVM) and a maximum likelihood (ML) classifier for each of the three dependent variables (see: Pilny et al., 2019). We then used these classifiers to predict the values of the dependent variables in the remaining 600 manually coded

tweets. Moreover, we used an ensemble classifier to predict the values of the dependent variables that combines the classifications of all three classifiers. Here, we decided that a content category is present in a tweet if the majority of classifiers predicts that this category is present. We then compared the manual coding of the 600 tweets to the automated classification to assess the performance of the classifiers. Table 2 provides an overview of this assessment using precision, recall and F1 scores.<sup>7</sup> Overall, while the classifiers for Information sharing and Information gathering appear to have a satisfying validity, the results for the Public Relations category must be interpreted with some caution. Even though the classification was accurate in over 86% of the cases, the algorithm has some limitations in correctly identifying positives, i.e. cases in which the content category is present. Experiences during coding as well as the low performance of the classifier point towards a category that can be rather broad and that might need to be differentiated in future research.

**[TABLE 2 HERE]**

We then chose the classifiers for the remaining tweet data. For the Information sharing category we decided to use the ensemble classifier. Here, all three classifiers appear to have a satisfying level of validity. Consequentially, we combined these valid classifications to a majority-based decision. For the Information gathering category, we used the support vector machine due to the comparatively low level of precision of the ensemble classifier. Finally, for the Public Relations category we again used the ensemble classifier as it is the most valid classifier. We

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<sup>7</sup> In this case, precision describes the number of tweets in which a classifier and a human coder both identified the presence of a content category (true positives) divided by the number of tweets in which a classifier identified the presence of a content category (true positives + false positives). Recall is the number of tweets in which a classifier and a human coder both identified the presence of a content category (true positives) divided by the number of true positives plus the number of cases where the human coder identified the presence of content category but the algorithm failed to classify this tweet correctly (false negative). The F1 score is defined as  $2 \times (\text{precision} \times \text{recall}) / (\text{precision} + \text{recall})$  (see: Pilny et al., 2019).



then classified the remaining 72,487 tweets using our three final classifiers and added the manually coded gold standard.

## **Results**

First, we examine the distribution of the three content categories across accounts using simple frequency tables (see table 3). It should be noted that each of the content categories can appear at the same time in each tweet. Overall, the data support our hypothesis as the Information sharing category is the most dominant one. The second most used category is Public Relations followed by Information gathering. As such, the police predominantly use Twitter to distribute information (push) whereas they engage less often in dialogic forms of communication (pull or networking). In this, 68% of tweets contain neither pull nor networking communication, while only 32% of tweets contain pull (13%), networking (19%) or both forms of communication (0.1%).

**[TABLE 3 HERE]**

To address our second hypothesis, we computed a multi-level model with a binary dependent variable that is 1 if a tweet contains the content category Information gathering (see Table 4). In this model, tweets (level 1) are nested in accounts (level 2) which are again nested in *Bundesländer* (level 3). To be able to compute reliable models, we used a threshold of 20 tweets for an account to be included in the analysis. We thus had to drop three Twitter accounts (polizei\_nrw\_wes, polizei\_nrw\_gm, PolizeiBayern) resulting in a subsample of 152 accounts (n=75,469). Moreover, we excluded the dummy variable for the local level of organizational hierarchy due to multicollinearity.

**[TABLE 4 HERE]**

We expected that police departments responsible for areas with a larger population would use Twitter more often for information gathering. The analysis does not support this as the

population had no significant effect. In general, the included variables only accounted for a small share of the variance in the dependent variable (marginal  $R^2 = .03$ ), whereas the hierarchical structure explained a more substantial share of variance (conditional  $R^2 = .13$ ). As indicated by the intraclass correlation coefficient (ICC), most variance is explained through the account-level (ICC = .11).

Turning to the significant predictors, the model shows that police entities in more urban jurisdictions rely more often on social media for information gathering compared to federal police, whereas they do not differ from police entities in rural areas and from state police. Overall, organizational and environmental characteristics only seem to play a minor role for this content category.

For our final hypothesis, we computed a multilevel model with the same data structure. As a dependent variable we used a binary measure that is 1 if a tweet contains the content category public relations. Again, we excluded the dummy variable for the local level of organizational hierarchy and the three above mentioned accounts. Table 5 provides an overview of the models.

**[TABLE 5 HERE]**

Our hypothesis was that police entities in urban areas and large cities will be more likely to use Twitter for public relations. The computed model does not support this – as federal accounts relied on Twitter for public relations significantly more often than all other types of accounts as indicated by the significant odds ratio values that are lower than 1. The other four degrees of urbanization do not differ significantly in their reliance on Twitter for public relations. Moreover, the model suggests that the population of the policed jurisdiction influences the usage of Twitter for public relation in a way that policing an area with a higher population leads to more posts that try to foster dialogue.

The included predictors only account for a small share of variance (marginal  $R^2=.03$ ), whereas the data structure explains a more substantial share (conditional  $R^2=.16$ ). Again, most of this variance is accounted for by the account-level as indicated by the ICC ( $ICC=.13$ ).<sup>8</sup>

## **Discussion**

Looking at the results considering our hypotheses, it becomes clear that our first hypothesis was fulfilled as uni-directional information sharing is the most common form of Twitter usage for German. This finding is in line with earlier studies on other countries that highlighted that the police mainly employ Twitter as a tool to distribute information (see e.g. Crump, 2011; Huang et al., 2017; Kudla & Parnaby, 2018; Meijer & Thaens, 2013; Meijer & Torenvlied, 2016). Moreover, similar findings exist for other public sector organizations (see e.g. Manetti et al., 2017).

Only 32% of tweets in our sample contain either aspects of information gathering or public relations. Thus, it seems German police are not (yet) using Twitter to its fullest potential as entering into more of a dialogue is often described as a prerequisite for profiting from social media's potential to increase trust public agencies (Bonsón et al., 2017; Kim et al., 2015; Oliveira & Welch, 2013). While it has already been highlighted that German police are a least-likely case for this kind of interactive communication (Bayerl & Rüdiger, 2017), they still miss out on the potential to gain more public trust through closer communicative relations with the public (Kim et al., 2015; Romenti et al., 2014; Watkins & Lewis, 2014). However, most Twitter accounts have only been created in 2014 or later (Jungblut & Jungblut, 2021). So, German police are still somewhat of a newcomer to this form of communication. Thus, the 19% of

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<sup>8</sup> Since we did not formulate a hypothesis for the impact of organizational and environmental characteristics on the category information sharing, we do not include a multilevel model for this variable in the analysis. It is however in the appendix.

tweets containing elements of public relations could also be an indicator for increased potential for future dialogue.

Regarding the second hypothesis, the results are not in line with our expectation. The model shows that organizational and environmental characteristics were only significant predictors in very few instances. It seems that the size of the policed population, the degree of urbanization, and the position in the organizational hierarchy are not strong predictors for how German police use Twitter. This somewhat contradicts earlier studies on police in Germany but also other countries that have highlighted the importance of organizational and environmental factors (see e.g. Bullock, 2018; Dekker et al., 2020; Jungblut & Jungblut, 2021; C. B. Williams et al., 2018). However, these studies have not focused specifically on pull-aspects of communication or the task of information collection, but rather communication patterns in general. We found significant results only for police entities from larger cities and metropolitan areas, which are more likely to use Twitter to gather information compared to federal police. Especially the fact that population does not have a significant effect is somewhat surprising, as we would have expected that a larger population would correlate with greater demand for asking citizens for information. At the same time, studies on other public sector organizations also point to a complex relation between environmental conditions and social media usage (Bonsón et al., 2017; Manetti et al., 2017), and authors highlight both the importance of a clear strategy (Agostino & Arnaboldi, 2016) as well as the relevance of the coupling between task and communication (Oliveira & Welch, 2013) for optimizing social media usage.

The results for the third hypothesis are more mixed. Our expectation was that the level of urbanization affects in how far police use Twitter for public relations, with departments in metropolitan areas and larger cities being more likely to use it in this way. Our model shows that federal accounts are more likely to use Twitter for these purposes, while other levels of urbanization did not show significant results. Our expectation was that more urban

environments would create more demand for dialogical communication. Maybe the way police use Twitter is less demand-driven than we expected as the relation between German police and society is characterized by an image as the authoritative arm of the state (Bayerl & Rüdiger, 2017). This would be in line with the argument that it is especially hard for public sector workers to interact on social media in their professional function as the friendly and informal tone that this type of communication demands is a contrast to the bureaucratic language of civil servants tasked with implementing regulations or laws (Olsson & Eriksson, 2016). Similar arguments exist in the literature on reputation management in public organizations, where a key point is that the public sector is especially challenged in finding the right tone for this kind of communication (Wæraas & Byrkjeflot, 2012). This is also in line with results from a study of the Dutch police, where authors highlight that in situations of conflicts between core values of the police and a dialogical approach to social media, the police show a conservative reaction: instead of engaging in participation they focus on their own accountability and limit risks to their reputation (de Graaf & Meijer, 2019). Similar arguments have also been made regarding other public organizations' use of social media (see e.g. Manetti et al., 2017).

One explanation for the significant result in the model could be that the federal police are more focused on public relations on Twitter because they are further removed from society as their tasks are limited to border security or selected major crimes (Ritsert & Pekar, 2009). Thus, they are less present in daily life and at the same time address a more diverse group of people as they communicate with the entire country. In this situation, the advantages of Twitter allowing to bridge communicative distances and build public trust with a diverse audience could be higher than they are for e.g. local police departments. We also found a positive relation between the population of a policed area and the likelihood that police use Twitter for public relations. This speaks to parts of the previous argument, namely, that a larger and thus also more diverse population might make Twitter a more attractive tool for public relations.

It is important to keep in mind when considering the transferability of our findings that German police are a latecomer to social media. Earlier studies have shown that more than 90% of Twitter accounts by German police have been created in 2014 or later (Jungblut & Jungblut, 2021). Thus, German police have much less experience in using Twitter than their colleagues in other countries (Crump, 2011; Meijer & Torenvlied, 2016; C. B. Williams et al., 2018). It could thus be that they are still learning how to use Twitter in a more dialogical manner, which would give the 19% of tweets that try to enter a dialogue with the audience greater significance.

All in all, it seems that challenges stemming from conflicts between the social media logic and established, taken-for-granted external communication patterns of the police inhibit them from using social media to its fullest potential. Conceptually speaking, it seems that to overcome these taken-for-granted practices and engage more actively with social media, police need different necessary and sufficient conditions to align. Only then, they will be able to successfully implement necessary changes.

The literature on change management highlights, among others, that change management in public organizations is complex and difficult to steer in a top-down fashion, and that generic management practices are only helpful to a limited extent (Kickert, 2014). Instead, front-line members of public organization need to be motivated to take charge of change processes. A key factor in this is their access to resources and necessary training, which can enable front-line members to act as key drivers for organizational change (Homberg, Vogel, & Weiherl, 2019). Given a.) the potential reputational risk of engaging in new external communication practices through social media, and b.) the additional workload, need for resources and skills that are demanded from front-line members, the hesitancy of public organizations, such as the police, to engage with social media's full communicative potential is not surprising. To better understand how police and other public organizations can overcome this, it is necessary to further unpack the interplay of different necessary and sufficient conditions, such as normative

support through overarching strategies, available resources, local capacity, or training, in creating an environment that motivates members of organizations to embrace new approaches to external communication practices and in turn have their organizations profit from potentially improved reputation, trust, and public relation.

## **Conclusion**

This study investigates the content of Twitter communication of German police focusing on departmental differences in how interactive the communication is and whether tweets focus on core tasks or public relations. Our analysis combined a machine-learning based classification with multi-level modelling to examine all tweets from 2019 (n=78,317) by all German police accounts. Our results show, in line with earlier findings (see e.g. Bullock, 2018; Crump, 2011; Dekker et al., 2020; Leppert et al., 2022; Meijer & Torenvlied, 2016), that the police mainly use Twitter for uni-directional communication which aims at spreading information. Only a third of tweets (~32%) also contained content that either aimed at gathering information or improve public relations.

While our results indicate that German police are not using Twitter to its fullest potential, it is important to highlight that users of Twitter are not representative of the entire population (Kim et al., 2015). Thus, Twitter presence by public organizations must be understood as one part of an overall communication approach, which needs to couple organizational tasks and communicative tools (Oliveira & Welch, 2013). Our results reiterate earlier findings that public organizations in general, and the police in particular, struggle with using social media to its fullest potential as interactivity, an informal tone, or fast-paced reactions create tensions with their bureaucratic principles of organization (Agostino & Arnaboldi, 2016; de Graaf & Meijer, 2019; Olsson & Eriksson, 2016). In the absence of an overarching social media strategy for German police, there is more room for local experimentation. While this can be helpful in

ensuring locally suitable couplings between organizational tasks and communicative tools, the lack of a strategy moves the responsibility for implementation to the local organization. Studies have shown that it is easier to move towards institutionalized social media practices in the public sector when there is an overarching strategy, as this reduces the tendency to react in a risk-averse way when comparing risks and gains associated with more interactive use of social media (Bonsón et al., 2017; de Graaf & Meijer, 2019; Oliveira & Welch, 2013). This also reflects arguments from reputation management highlighting that public organizations are especially risk-averse in their external communication (Wæraas & Byrkjeflot, 2012). Moreover, successful implementation of organizational change in public organizations often relies on the motivation of front-line members of the organization (Homberg et al., 2019). Thus, we need to better understand the interplay of different necessary and sufficient conditions to be able to further unpack processes that inhibit or support social media use in public organizations.

At the same time, our results show that German police use Twitter to some extent for public relations and more network-oriented communication. Given that they represent a least-likely case for this, the results highlight that even under adverse conditions public organizations see the added-value in this form of communication. Moreover, our results show that local organizations differ in their usage of Twitter, but it remains somewhat unclear what drives these differences. It seems that the relationship between environmental conditions of German police departments and their Twitter usage is complex, as most variance occurs on the account-level but the environmental conditions which we measure do not capture some of the variance. This echoes earlier findings on the interplay between environmental conditions and local public organizations' use of social media that highlight the complexity of this relation (see e.g. Bonsón et al., 2017; Manetti et al., 2017). As German police are a latecomer to Twitter, it might be that they are still learning how to use it effectively. Organizational research has shown that changes,



especially in public organizations with strong hierarchies and long histories, might take some time to be fully embraced (Colyvas & Jonsson, 2011). Applying the model proposed by Mergel and Bretschneider (2013), one can locate German police at the beginning of the second stage in the process of adopting social media. The use of Twitter moved beyond local experimentation and there is general awareness of the technology visible in the number of accounts and tweets. However, there is no consolidated practice of using Twitter to its full potential. Given the adverse conditions outlined above, one could argue in line with Mergel and Bretschneider (2013, p.396) that new rules and procedures from a higher-level structure are needed to enable German police departments to use Twitter to its full potential and institutionalize social media usage. A study of Chinese police's Twitter usage supports this argument, as it showed that upper-tier pressure made local police more active on the platform (Ma, 2013). As our data only cover one year, it is hard for us to assess whether German police are in a process of institutionalization of social media which will over time lead to more interactive use (Mergel & Bretschneider, 2013), or if the lack of an overarching strategy is a fundamental problem as it leaves the assessment of risk and gains to local departments that tend to be more risk-averse (de Graaf & Meijer, 2019). Moreover, Leppert et al. (2022) have shown for a sub-sample of German police Twitter accounts that tweets that push information lead to more comments compared to tweets that are interactive. This indicates that one should not underestimate the relevance of uni-directional communication for engaging citizens' reactions.

We found that tweets from departments that police a district with a larger population are more often public relations oriented. One explanation for this could be that the greater the population that a police department covers, the harder it is to get in direct contact with citizens. As police departments that police larger populations are further away from individual citizens, the advantage of communicating through social media increases, which could explain why those

departments use Twitter in a dialogical way. This dynamic seems to be somewhat different compared to findings from other contexts, e.g. North America or the U.K., where tweets of the police are more actively used for building community relations and thus are more geared to a specific local population (Crump, 2011; O'Connor, 2017; Thomas et al., 2022).

In summary, our study developed a parsimonious categorization of police Twitter content based on the degree of interactivity and organizational tasks, and tested this categorization using a large dataset and machine-learning based classification. Results indicate a limited use of Twitter for dialogical communication and some local variation in the use of Twitter. The variables included in our model only showed a few significant results. However, our models also indicated that the multi-level structure, and here especially the account level, explains additional variance. This suggests that there are other variables at the account-level that could be relevant. This demands further research especially as the literature suggests that factors such as limited training, local communication strategies or hierarchical culture might be important (see e.g. Dekker et al., 2020; C. B. Williams et al., 2018). For reasons of multicollinearity and since the necessary information was not available for the majority of accounts, these variables could not be included in our analytical model. As such, we believe that an analysis of the role of these factors would demand the use of more qualitative research methods, such as expert interviews, to unpack some of the mechanisms underpinning the differences (see e.g. Thomas et al., 2022).

Similarly, while the goal of the paper is to provide a general overview of how the police use Twitter, we believe that follow-up qualitative work is necessary to analyze how the police communicate on issues of specific organizational and societal relevance. This relates to organizational crisis communication for instance in response to accusations of police brutality or power abuse, but also to communication on external crises like terror attacks (see e.g. Deneff et al., 2013; Fowler, 2017).

Another limitation of our study is the validity of the classifier for the category public relations. Despite its satisfying accuracy of over 86%, the comparatively low precision and recall point towards difficulties in identifying positive cases. It thus might be necessary to develop this category into more fine-grained measures.

An additional limitation of our approach is the restriction to original tweets thereby excluding replies and retweets. Even though there are good reasons for this decision, especially replies might be a form of two-way communication that need further analytical attention. Future research should focus on the question of how often the police reply to ordinary citizens and how often they provide individual answers as compared to standardized statements. This might be specifically relevant for the category public relations.

Finally, our study is limited as it focuses on Twitter communication in Germany. While the least-likely nature of the case allows for some general conclusions and the results of the analysis are in line with findings from other countries, such as the Netherlands, the UK or the U.S. (Bullock, 2018; Crump, 2011; Dekker et al., 2020; C. B. Williams et al., 2018), more comparative studies that use multi-lingual approaches to machine-learning based classification would enable direct comparisons.

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## Tables

**Table 1. Core categories and their constituent activities**

Category	Activities
Information sharing (push & core tasks)	<ul style="list-style-type: none"> <li>- Sharing information about crime</li> <li>- Sharing information about traffic</li> <li>- Sharing information about ongoing threats or crisis situations</li> <li>- Sharing information about events</li> <li>- Providing crime prevention tips</li> <li>- Providing general information about the respective police department (e.g. opening hours)</li> </ul>
Information gathering (pull & core tasks)	<ul style="list-style-type: none"> <li>- Invite the public to provide intelligence regarding crimes</li> <li>- Enlist the public in investigations</li> <li>- Enlist the public in missing person cases</li> </ul>
Public relations (network & public relations)	<ul style="list-style-type: none"> <li>- Promote the police as a workplace</li> <li>- Stimulate conversation with the public</li> <li>- Correct negative images of the police</li> <li>- Using humor or sharing trivia</li> <li>- Promote other social media accounts of the police</li> </ul>

**Table 2. Validity of the used classifier**

Content Category	Algorithm	Precision	Recall	F1
Information sharing	NB	.91	.93	.92
	SVM	.89	.97	.93
	ML	.96	.74	.84
	Ensemble	.91	.92	.91
Information gathering	NB	.81	.83	.82
	SVM	.87	.80	.83
	ML	.60	.86	.71
	Ensemble	.79	.86	.82
Public Relations	NB	.66	.58	.62
	SVM	.83	.41	.55
	ML	.50	.84	.63
	Ensemble	.66	.60	.63

**Table 3. Frequencies of the three analytic categories**

	Information sharing	Information gathering	Public Relations
Present	67,340 (89%)	9,791 (13%)	14,454 (19%)
Absent	8,147 (11%)	65,696 (87%)	61,033 (81%)



**Table 4. Influence of account characteristics as well as Bundesland on whether a tweet contains the content category Information gathering**

	Odds ratio	SE	Odds ratio	SE	95%-CI [LL;UL]
Intercept	<b>0.11***</b>	<b>.01</b>	.22	.23	[.03;1.70]
<i>Account Characteristics</i>					
Urbaniz.: state police			1.23	.74	[.38;4.02]
Urbaniz.: metropolitan police			<b>2.63*</b>	<b>1.26</b>	<b>[1.03;6.74]</b>
Urbaniz.: police in larger cities			<b>2.56*</b>	<b>1.06</b>	<b>[1.14;5.75]</b>
Urbaniz.: rural police			2.00	.79	[.92;4.34]
Population in policed area (logged)			.91	.06	[.81;1.04]
Organizational Level: state			1.11	.57	[.40;3.03]
Organizational Level: regional			.84	.22	[.50;1.41]
Organizational level: sub-regional			.81	.19	[.51;1.27]
<i>Random Effects</i>					
$\sigma^2$		3.29		4.29	
$\tau_{00}$		.42 <sub>account: Bundesland</sub>		.40 <sub>account: Bundesland</sub>	
		.07 <sub>Bundesland</sub>		.00 <sub>Bundesland</sub>	
<i>Model Fit</i>					
ICC <sub>Account</sub>		.11		.11	
ICC <sub>Bundesland</sub>		.02		.00	
AIC		55105.10		55098.82	
BIC		55132.80		55200.36	
Marginal R <sup>2</sup> (theoretical)		-		.03	
Conditional R <sup>2</sup> (theoretical)		.13		.13	

Note: Logistic Multilevel Model with content category Information gathering as dependent Variable, N(tweets) = 75,469, N(accounts) = 152, N(Bundesländer) = 17, \*\*\*p<.001, \*\*p<.01, \*p<.05, Confidence intervals are centered around odds

**Table 5. Influence of Account Characteristics as well as Bundesland on whether a tweet contains the content category Public Relations**

	Odds ratio	SE	Odds ratio	SE	95%-CI [LL;UL]
Intercept	<b>.25***</b>	<b>.03</b>	<b>.03***</b>	<b>.02</b>	<b>[.01;.15]</b>
<i>Account Characteristics</i>					
Urbaniz.: state police			<b>.31*</b>	<b>.15</b>	<b>[.12;.82]</b>
Urbaniz.: metropolitan police			<b>.23***</b>	<b>.09</b>	<b>[.11;.49]</b>
Urbaniz.: police in larger cities			<b>.49*</b>	<b>.17</b>	<b>[.25;.97]</b>
Urbaniz.: rural police			<b>.45*</b>	<b>.15</b>	<b>[.23;.85]</b>
Population in policed area (logged)			<b>1.19***</b>	<b>.06</b>	<b>[1.07;1.31]</b>
Organizational Level: state			2.26	.99	[.95;5.35]
Organizational Level: regional			<b>1.73*</b>	<b>.45</b>	<b>[1.04;2.87]</b>
Organizational level: sub-regional			1.63	.40	[1.00;2.65]
<i>Random Effects</i>					
$\sigma^2$		3.29		3.29	
$\tau_{00}$	.52 <sub>account:Bundesland</sub>		.45 <sub>account:Bundesland</sub>		
	.13 <sub>Bundesland</sub>		.08 <sub>Bundesland</sub>		
<i>Model Fit</i>					
ICC <sub>Account</sub>	.13		.12		
ICC <sub>Bundesland</sub>	.03		.02		
AIC	69028.68		69020.86		
BIC	69056.37		69122.41		
Marginal R <sup>2</sup> (theoretical)	-		.03		
Conditional R <sup>2</sup> (theoretical)	.16		.17		

Note: Logistic Multilevel Model with content category Public Relations as dependent Variable, N(tweets) = 75,469, N(accounts) = 152, N(Bundesländer) = 17, \*\*\*p<.001, \*\*p<.01, \*p<.05, Confidence intervals are centered around odds