

# Exploring Sense-Making Activities in Crisis Situations

Milad Mirbabaie<sup>1</sup>, Sina Youn<sup>1</sup>

<sup>1</sup> University of Duisburg-Essen, Department of Computer Science and Applied Cognitive Science, Duisburg, Germany  
{milad.mirbabaie,sina.youn}@uni-due.de

**Abstract.** This article seeks to explore public crisis response behaviour under the premise of sense-making and assesses what enables officials to drive sense-making on Twitter. As little is known about how sense-making takes place and influences communication behaviour, we focus on sense-making activities of the crowd and analyse the behaviour of emergency agencies. We collected the communication on Twitter concerning two human-induced crises that took place in Germany in 2016: 1) A shooting in Munich, and 2) A terrorist attack in Berlin. Qualitative and quantitative analyses of tweet types and content were conducted to determine sense-making. Our findings indicate that emergency services play a crucial role within sense-making at an early stage of the crisis and lead to suggestions of how to effectively communicate in social media. Furthermore, findings suggest that people perform different sense-making activities at different stages of the crisis, leading to a model of sense-making activities.

**Keywords:** Social Media Analytics, Sense-Making, Twitter, Crisis Communication, Emergency Management

## 1 Introduction

Examination of social media communication is exceedingly promising as the pervasiveness of social media platforms, such as Twitter, Facebook, and Instagram, enable scholars to adopt new perspectives on traditional theories and concepts of psychology [1]. They are characterised by “*a technical ease of use that facilitates production, exchange and consumption of user-generated content among social media users*” [2]. In recent years, social media use has become a crucial part not only in people’s daily lives but also during crises [3]. Here, [4] revealed that users are even more active during crises in comparison to non-crisis situations, resulting in higher number of messages and higher dissemination of information.

By its definition, a crisis is a threatening, oftentimes unexpected, event that is marked by high levels of uncertainty and potential harm [5, 6]. Here, people are confronted with a sudden loss of meaning, which generates anxiety [7, 8] that, in turn, forces people to define the situation at hand [8, 9]. As a result, people perform sense-making, a process first introduced by [10] and [8], that can be defined as the process, in which people make sense of what is happening and generate their own understanding and interpretation of an ambiguous situation [11, 12].

Sense-making can be described as an ongoing process that is initiated by a cognitive gap like an ambiguous condition, in which people selectively perceive cues that they interpret based on self-perception, past experiences and the desire to make things seem rational [8]. Moreover, sense-making is primarily a social and communicative process in which the sense-maker actively interacts with others to learn about their views to compare and adjust or rationalise one's own interpretation [8]. This results in an individual interpretation of the situation for the sense-maker and a shared meaning of all participating individuals when sense-making is performed on a collective level [13–16]. This individual and collective understanding reduces ambiguity [7] and helps the sense-maker(s) to cope with the situation [16, 17] and limit the crisis' harm [6]. As crisis situations result in a strong need for communication and information, people actively turn to others, both online and offline [18, 19]. As a result, social media have emerged as a key tool for crisis communication used by all types of social units throughout different kinds of crises [3]. Here, especially Twitter proved to be highly responsive to all types of crises [20, 21].

However, recent studies do not provide a holistic picture of sense-making because little is known about when and how it takes place. Scholars revealed that social media crisis communication is predominantly characterised by collaborative information seeking, sourcing and sharing during crisis situations [22, 23]. Here, researchers identified that a key mechanism for information distribution on Twitter [15] is the retweet function, which lets people share original or commented messages of others within a user's follower network [24]. In crisis communication, shared content usually addresses the general implications of a crisis [25] and information related to evacuations and closures, whereabouts of others as well as help, health care and recover efforts [3]. These pieces of information heighten situational awareness [25], a cognitive state of understanding what is happening and comprehending the big picture during crisis situations [26]. In line with [8], who states that people must notice things first in order to make sense of them, and [11] who introduced two sequential sub-concepts of a sense-making where the first include includes actions like information seeking and sharing, dissemination of situationally relevant information that heightens situational awareness can be interpreted as the 'beginning' of sense-making in social media crisis communication [11, 15]. Moreover, "*the emergence of new lines of strong and coherent themes*" [23] marks the 'end' of sense-making and includes the adoption of cohesive symbols or unified slogans like specific hashtags [11, 23]. However, little is known about what happens in between these stages.

The remainder of this work is structured as follows: In chapter 2, the work is embedded in the context of previous research regarding sense-making. The subsequent chapter 3 specifies the research design by describing the chosen cases and giving an overview on data collection and analyses. The results are presented in chapter 4 and discussed in chapter 5. The work finishes with a conclusion and an outlook.

## **2 Background**

In their work, [7] attempted to open the 'black box' of sense-making and introduced four major communication activities of sense-making, which offers a promising

research basis to turn the process of sense-making into an observable behaviour: The authors postulate that the sense-maker continuously singles out specific cues (noticing), puts them into a frame of reference to understand the situation at hand (interpreting), decides what to do next and act accordingly (enacting), and turns to others to take into account their reactions and interpretations (interacting). The authors derived these communication activities from retrospective interviews that addressed general sense-making situations. However, they did not test their validity reversely using data from real-life crisis communication. In order to address the current knowledge gap and gain further insight of how sense-making influences crisis communication behaviours, we derive the following research question:

**RQ:** *How is crisis communication on Twitter shaped (sense-making activities) by the general public and the emergency services?*

Besides private persons, who use social media for sense-making purposes, celebrities, media [15], and emergency services are especially central to crisis communication [26, 27]. Because they engage highly in crisis management efforts, including the enhancement of public's health and security as well as the prevention of a crisis' escalation, social media accounts of emergency services usually publish relevant crisis information and advice or guidance [28, 29]. Yet, even more than a decade after the introduction of Facebook and Twitter, social media still embody a difficult communication environment for formal crisis practitioners as "*a central [...] may not be the scarcity of information but the glut*" [3] since various publishers contend for people's attention. However, research revealed opportunities for them to cut through and overcome information overload effectively. Here, the retweet mechanism seems to be key to a message's visibility and reach: Findings revealed a tweet within a higher retweet count has an increased potential audience [27, 30]. Emerging research suggests that not only the content itself, but the way it is presented wields a certain influence on its recipient [31, 32]. Following these arguments, it seems plausible that accounts presenting emergency services should publish content in a way that maximises its likelihood to be retweeted. Here, [29] revealed that style factor and sentence function affect retweetability as a clear and specific sentence style is a predictor of retweet count. Even though the crucial role of retweetability is apparent and emphasised by literature within the field of crisis communication and management, research on how emergency services can increase their reach and support public sense-making is still in its infancy. Given the significance of emergency services for crisis management and the sense-making process, this is a knowledge gap which directly affects their efficiency and lead to the risk of making crisis communication decisions based on intuition or inaccurate information [4]. In 2016, [31] proposed the interactive crisis communication (ICC) model, which incorporates 'response form', meaning the attributes dialogic, consistent, precise and timely as well as the emotional valence it discloses. The author based the theoretical model on a literature review including frameworks of traditional crisis communication strategies and social media crisis management, yet did neither specify the influence these variables wield nor reversely validated the assumption with a sample of concrete crisis communication. Following the argument of [29, 32], however, it seems plausible that they might influence a message's retweetability. As such, to contribute to the current body of knowledge, it appears promising to test the

relationships posited in the ICC in the context of retweet count and further include the variables of [29].

### 3 Research Design

#### 3.1 Case Description

**Shooting in Munich:** On 22 July 2016 at 5:52pm CET, a man opened gunfire at a restaurant close to the Olympia shopping mall (OEZ) in Munich, Germany. About 40 minutes later, the official account of Munich's police department (@polizeimuenchen) published a Tweet about a "major police operation at the mall". The hours following the shooting were characterised by high levels of uncertainty and anxiety: The police repeatedly called the situation 'ambiguous', publishing statements of uncertainty about the number of and whereabouts of the perpetrator. Additionally, several resistant rumours spread quickly, including another gunfire at Karlsplatz/Stachus in the city centre and that there were at least three perpetrators and the use of long guns, which all turned out to be false. Investigations revealed that the gunman was an 18-year-old man.

**Terrorist attack in Berlin:** On Monday, 19 December 2016, 12 people were killed and more than 50 others injured when a 40 tonnes truck was deliberately driven into a Christmas market at Breitscheidplatz in Berlin, Germany at 8:02pm CET [33]. At 8.41pm the official account of Berlin's police department (@polizeiberlin) published a 'breaking' tweet about the incident. In the hours following the incident, it was ambiguous whether the incident was an accident or a terrorist attack and many speculations circulated. Around 10pm CET, the message of a suspect's arrest hit Twitter and the police subsequently sent an all-clear signal for the crisis location. On 21 December, it was announced that investigators suspect a man, a failed asylum seeker [34], which resulted in the launch of an official Europe-wide manhunt. On 23 December, four days after the attack, he was killed in a shootout with the police near Milan, Italy. The terrorist group of Daesh claimed responsibility for the attack [34].

#### 3.2 Data Collection

To evaluate sense-making activities by the public and crisis management by officials, we investigate the communication about the two cases on Twitter, since it is the platform of major research interest in the field of crisis communication based on the following arguments: 1) It has emerged as an important communication and management platform in all crisis categories and for all types of social units, especially by emergency services, as it facilitates quick information dissemination [4, 27]. 2) Twitter response to emerging issues is fast and offers the monitoring of an independent public conversation [28]. 3) Here, the number of participating users and tweets is usually high, leading to a big data sample [35]. 4) Data acquisition is easy as the platform provides an API which enables data gathering at scale on specific issues [35].

After the crises occurred, we started the data tracking within a few hours later. As the 'search API' offers the opportunity to track data up to 1 week in the past, we could ensure to collect the data in time. For the tracking, we used a self-developed Java tool, which makes use of the library Twitter4J and connects to the Twitter API. We identified

in each case the most often used keywords related to the extreme events and the accounts from local law enforcement. **Munich** (Time period: 22-07-16, 5:00:00pm to until 23-07-2016, 11:59:59pm CET) **Keywords:** München (Munich), Prayformunich, Oez (abbreviation crisis location), Prayforgermany, Polizeimünchen (local police account). **Berlin** (Time period: 19-12-2016 at 7:00:00pm CET until 23-12-2016 at 12.59:59pm CET) **Keywords:** Terrorist attack in Berlin, Berlin, Breitscheidplatz (public open space), Gedächtniskirche (Memorial church), Anschlag (attack), Polizeiberlin (local police account), Polizeiberlin\_E (local police account). We collected the communication and saved it into a My-SQL-Database. We considered in both cases German tweets, as the incidents occurred both in Germany

### 3.3 Data Analysis

The dataset was segmented in intervals and subsequently, variables related to sense-making activities, namely tweet types and published content, were examined within each interval. In order to analyse Twitter crisis communication behaviour by the public over time, a complex time-series analysis was conducted. The data for each case was divided into 76 (Munich), respectively 360 (Berlin), 15-min intervals, in each of specific the communication behaviour was examined. This allowed us to have a dynamic perspective on the communication [24, 36]. Following the argument of [22, 37], that tweets types suggest communication behaviour, they serve as a first indicator, of how sense-making influences actual communication behaviour. Based on [24], who state that sense-making involves both one-to-one- as well as one-to-many-communication, all tweet types are included within the given study. Here, [7] sense-making communication activities are linked to Twitter's tweet types: Noticing is an internal, attentional process which includes perceptual actions based on cue extraction [7]. There is strong evidence that retweeting influences the noticing process of others as stimuli are noticed through an individual's own efforts as well as through the individual's observation of other people's communication [8] and retweeted messages are considerably more visible [27, 30]. Moreover, following the arguments of [7, 8, 38] that sense-making is an ongoing process, it is anticipated that noticing is performed continuously. As people are constantly noticing and selected cues are inevitably interpreted [8], the same is true for the sense-making activity of interpreting, which is also an internal process. In addition to that, it seems plausible to assume that the outcome of interpreting, meaning achieved sense or interpretations [11, 23], is likely be communicated through original tweets, as they contain opinions [22, 37]. This, in turn, resembles the sense-making activity of enacting, as it is performed when individuals take actions within and to influence their environment. Yet, enacting is not limited to original tweets as information sharing, the main intent behind retweets [22, 37], can also be interpreted as an enactment. As such, for this sense-making activity both retweets and original tweets are considered and further, more unambiguously indicators of communication behaviour are derived from the published content. To get insight into the published content, the ten most frequently used words within each interval were determined. All words within one tweet were extracted and converted into lower-case characters using regular expression. Furthermore, the tweets within the

datasets that included users are arranged in descending order based on their retweet count. This method is used to get additional qualitative information about the published content that gained the highest reach and thus also had a potential influence on the sense-making process by the public.

In the given study, SentiStrength was used for the sentiment analyses. The tool uses a lexical approach based on a list of sentiment-related terms and rules for negations, booster words and misspellings, as well as for ways to express sentiments like exaggerated punctuation or emoticons [39]. Sentiments are reported on a dual scale, which means that a positive sentiment score, ranging from 1 (neutral) to 5 (strongly positive), and a negative score, between -1 (neutral) to -5 (strongly negative), are reported [39]. The sentiments are then used to calculate the polarity for each tweet with the following formula:  $polarity = positive\ sentiment\ strength + negative\ sentiment\ strength$ . Therefore, polarity, which is also referred to as 'valence' and is set as an independent variable in the given study, has a score which is negative, positive or neutral [40]. A tweet's emotionality is calculated with the following formula:  $emotionality = positive\ sentiment\ strength + |negative\ sentiment\ strength|$  and used as another sentiment-related independent variable.

## 4 Findings

### 4.1 Sense-making activities by the Public

The dataset for the gunfire in Munich consists of 411,024 tweets ranging from 74 to 22,831 tweets within each interval ( $M = 5408.21$ ,  $SD = 6720.99$ ), out of which 324,042 (78.8%) are retweets, while 73,209 (17.8%) are original tweets and 13,773 (3.4%) are replies or comments, to which 126,467 unique users contributed.

The dataset for the terrorist attack in Berlin contains 475,430 tweets, ranging from 66 to 19,662 tweets within each interval ( $M = 1320.64$ ,  $SD = 2293.74$ ). Here, 140,784 unique users contributed to 334,262 (70.3%) retweets, 117,097 (24.6%) original tweets and 24,071 (5.1%) replies or comments. Here, the early hours of the crisis incorporate large amounts of tweets and engagement of a high number of users.

Analysis of the ten most frequently used words within each interval of the Munich dataset revealed that, as soon as the crisis was triggered, major unambiguously crisis-related words, such as 'schüsse' ('shots'), 'einkaufszentrum' ('mall') and 'tote' (casualties) were published on a large scale. Here, the count of 'schüsse' increased from 68 to 1,213 within 45 minutes. Up from 6:30pm until the end of the observed period, the string 'polizeimuenchen' appeared within the most frequently used words, consistently occupying a rank between 1 to 3 in all intervals. Between 8:00pm and 11:30pm, the strings 'offenetuer' and 'offenetür' (both 'open door') occurred within serial intervals. 'Entwarnung' ('all-clear signal'), along with the words 'täter' ('perpetrator') and 'gefunden' ('found'), ranked high between 1:15am and 1:30am and, 1:30am and 1:45am respectively. Between 2:15am and 3:45am, first details about the perpetrator, namely his nationality and age were used extensively. The words 'dank' ('thanks'), 'hilfsbereitschaft' ('helpfulness') were predominantly published between 3:45am and 4:15am, while 'trauern' ('mourn') was frequently published between

5:15am and 8:00am. Within the last hours of the observed period, in particular between 9:00am and 11:15am, the word ‘terror’ entered list of the ten most frequently used words and in the very last interval, the words ‘amok’ and ‘is’ were used extensively.

The examination of the most frequently used words revealed that, in both cases, words related to the crisis event hit Twitter on a large scale immediately after it was triggered. Here, early contributions were related to the crisis’ location and trigger while later, words referring to the crisis’ scope and aftermath are published extensively in both crises. Both datasets were characterised by the occurrences of strings that do not refer to factual information or personal names. Within the public communication about the crisis in Munich, the string ‘offenetür’ (‘open door’) constantly appeared on high ranks in serial intervals between 8:00pm and 11:30pm on July 22. Moreover, two strings that started in the evening on December 20 and remained on high ranks for several hours were ‘muslimegegenterror’ (‘Muslims against terror’) and ‘ichbinberlin’ (‘I am Berlin’). A major difference between the public crisis communication is that, even though both were human-induced, strings referring to the name of the perpetrator were absent within the Munich dataset, even though his nationality and age were published, while the word ‘anis’ and ‘amri’ were constantly used within the Berlin dataset up from 10:45am on December 21.

#### 4.2 Sense-making activities by the Emergency Service

In the dataset of the gunfire in Munich, the account ‘@PolizeiMuenchen’ published 36 tweets related to the crisis, which were, in total, retweeted 101,681 times ( $M = 2,824.47$ ;  $SD = 3,490.11$ ). The sentiment polarity ranges from -4 to 2 ( $M = 0.167$ ;  $SD = 1.344$ ), while the sentiment emotionality ranges from 2 to 6 ( $M = 3.056$ ;  $SD = 1.079$ ). Figure 1 gives an overview, showing that the retweet count varied significantly but was considerably higher early in the crisis.

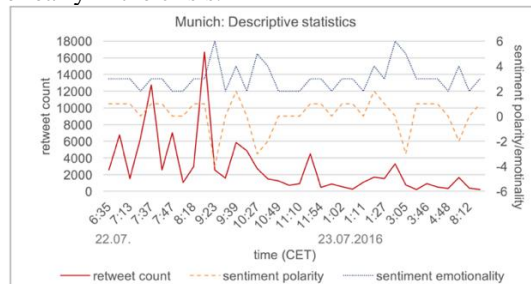
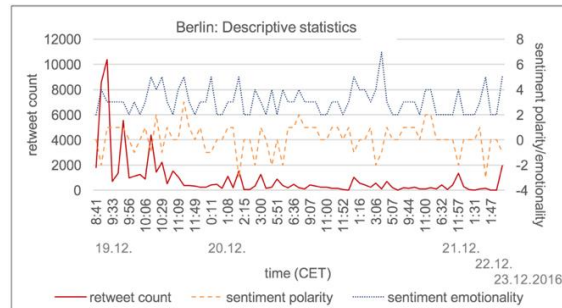


Figure 1. Retweet count, sentiment polarity and emotionality for police tweets (Munich).

In the dataset from the terrorist attack in Berlin, it is noteworthy that the account ‘@polizeiberlin’ published 7 tweets related to the crisis, which were, in sum, retweeted 65,011 times ( $M = 866.81$ ;  $SD = 1,684.47$ ), while the account ‘@PolizeiBerlin\_E’ published 68 tweets with a consolidated retweet count of 51,984 ( $M = 741.79$ ;  $SD = 1,450.59$ ). On a collective level, the sentiment polarity ranges from -3 to 3 ( $M = -0.134$ ;  $SD = 1.147$ ), while the sentiment emotionality ranges from 2 to 7 ( $M = 3.093$ ;  $SD = 1.073$ ). Also for the police accounts in Berlin were retweeted on a large scale within the early hours (Figure 2).



**Figure 2.** Retweet count, sentiment polarity and emotionality for police tweets (Berlin).

## 5 Discussion

Once sense-making is initiated by a sudden loss of meaning, people continuously perform the sense-making activity of noticing. Furthermore, as soon as they perceive cues, people start interpreting them and try to make sense of the ambiguous situation at hand. As noticing is an ongoing process, it affects interpreting, which becomes also an ongoing process. Our results indicate that enacting and interacting take place on a temporal level. Subsequently, informed users did not want to passively wait for things to happen but take actions within their environment in the form of retweeting selected tweets. As noticing and interpreting are internal processes, it was not possible to determine a specific communication behaviour performed by the sense-maker during these activities. Yet, as it is anticipated that these communication actions further influence other's noticing and interpreting processes, their impacts are outlined. According to [7, 8], individuals take actions to influence their environment within the sense-making activity of enacting to generate new information, better understand their cognitive processes and update perceptions. Our Analysis revealed that people did so by publishing original tweets and sharing retweets related to specific topics at particular periods of time. Within the Munich dataset, early intervals of heightened retweet use further contained the string 'offenetur', which refers to offer shelter for people seeking safety. This practice was used extensively in social media communication during the attacks in Paris in November 2015. Our examination revealed that the same mechanism was used between two and six hours following the crisis' trigger in Munich. A look into the top retweets revealed that in particular verified users who did not offer refuge themselves, drew the attention towards this mechanism, got high retweet counts. Following the argument of [7, 8], it seems plausible that, after people perceived cues and stimuli through various channels and interactions, they asked themselves what to do next. Results indicate that people then performed actions in the form of retweets as they feel others should know about the information they shared as they might find it useful. Thus, people enacted within their environment as information amplifiers and thereby increased the visibility of specific tweets because they shared them with their own network. It stands to reason that people enacted overwhelmingly on situationally relevant information at the very beginning of a crisis, as it contributes to situational awareness, which in turn, supports people to make sense of a situation and to reduce



uncertainty [3, 25]. Building upon [9], the expression of sympathy (and solidarity) can be interpreted as people's tendency to verbalise their thoughts and emotions to reduce anxiety and establish a sense of connection. This leads to the assumption that people enacted within their environment not only by sharing situationally relevant information but by actively spreading messages that express sympathy and builds a community spirit between remotely connected individuals in order to cope with the situation at hand [3, 24]. Even though neither [7] nor [8] specified actions linked to enactment but broadly defined that they "*bring events and structures into existence and set them into motion*" [12], latest literature suggests that only sharing situationally relevant information and achieved sense are crucial to the sense-making process [15]. As people deliberately decide to retweet messages expressing sympathy, however, we suggest that the sense-making activity of enacting is not only limited to information seeking and sharing, but serves to fulfil socio-psychological needs by publishing emotional content.

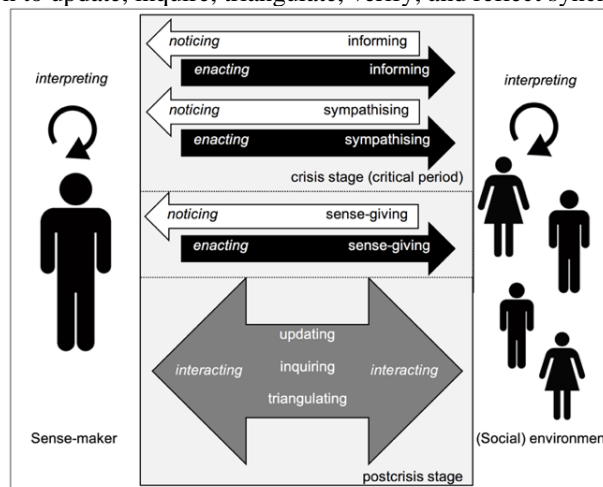
Our findings from both cases indicate that observed police accounts played a crucial role within social media crisis communication. Particularly in the Munich dataset, in which the local police account occupied the first ten ranks within the list of top retweets, yet also Berlin's police accounts dominated that list even though not taking up all ten ranks. In both cases, the tweets with the highest retweet count were published during the first hours following the crisis' trigger. Our analyses revealed that published tweets predominantly contained, partially actionable, key emergency information (e.g. advice to keep away from the crisis location) as well as requests for cooperation (e.g. that people should not publish photos). Following the argument of [8, 15] the local police account further played a crucial role within the process of sense-making and had the power to initiate it by the perception of information. The fact that the local police accounts published most of their tweets (60% in Munich and 80% in Berlin), in the early hours of the crisis, which were retweeted very often, leads to the assumption that the local police strongly engaged in crisis management efforts to limit a crisis' harm.

Our content analysis revealed that messages characterised by guidance and/or requests were predominantly stated imperatively. The police told exactly what to do, in order to maximise people's health and safety, while simultaneously supporting 'offline actions' of various related emergency service, e.g. rescue efforts by the fire brigade as well as investigations by the police, with imperative sentences, such as commands, requests or instructions. Update information and expressions of emotion, were written in declarative or exclamatory sentences. Thus, it can be assumed that imperative tweets most likely gain high retweet counts as they contain unambiguous information about what people should (not) do, in order to stay safe and support emergency services' crisis management efforts/work.

## **6 Conclusion and Further Research**

Even though both [8] and [7] state that sense-making is an ongoing and interrelated process, results strongly suggest that collective crisis communication is shaped by specific and temporary communication activities (see Figure 3), thus supporting a sequential assumption also postulated by [11]. In line with [7, 8], however, it can be assumed that people are constantly noticing and interpreting. But, in line with [11], our

findings lead to the conclusion that people perform communication activities in a sequential order: First they enact and subsequently they interact. In this context, it is noteworthy that [7], defined five sub-concepts of interacting, although neither their work nor the one of [8] specified actions related to the sense-making activity of enacting, respectively the sense-making property of enactment. We therefore propose, based on our findings, three sub-concepts of enacting of the public, in particular ‘informing’, ‘sympathising’ and ‘sense-giving’, which take place consecutively: Within the crisis stage, in particular the critical period of the crisis, people enact within their social environment by, first, sharing situationally relevant and key emergency information, while subsequently taking actions within their network by actively sharing expressions of sympathy. By doing so, people influence the noticing process of their social environment, especially their direct followers on Twitter through enactment. As such, enacting and noticing can be interpreted as a reciprocal process within sense-making in social media. At a later stage of the crisis/critical period, as well as during the early post-crisis stage, people enact through the disclosure of personal interpretations of the situation or by forwarding other’s that reflect their own opinion, possibly to influence others’ sense-making process. This suggests that sense-making and sense-giving are inevitably connected. Moreover, simultaneously with this act of sense-giving, people interact on a more personal level and use mechanics of two-way communication to update, inquire, triangulate, verify, and reflect synchronously.



**Figure 3.** Sense-making activities (adapted and extended from [7]).

Our findings suggest that emergency/rescue services, such as public health and national security agencies on federal, state, and local levels have a ‘louder voice’ than media outlets or even celebrities, and thus are able to effectively cut through chaotic Twitter communication and distribute situationally relevant information. This underlines the importance for practitioners to actively take part in social media crisis communication. Furthermore, findings lead to clear suggestions of how to effectively incorporate new technologies into crisis management to execute life safety services and support the public in sense-making activities: Emergency services should a) diffuse situationally relevant information within the first hours of the crisis and b) provide an

authoritative source of information to effectively cut through, reach target audience and support people in understanding the situation at hand.

In further research, one could examine other crises and different senders, e.g. natural crises and messages sent from the fire brigade or organisational crises and the involved organisation. Additionally, in order to further contribute to the sense-making research, future studies could differentiate sense-making activities and related communication behaviour and/or published content between the affected and unaffected public. Distinction between these actors could be based on coordinates.

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